B.E. - Civil Engineering

CURRICULUM & SYLLABI

Regulations 2020 (Amendments)

(Applicable to candidates admitted in the academic year 2022-2023 onwards)

K.S.R. College of Engineering

(Autonomous)

K.S.R. Kalvi Nagar, Tiruchengode – 637 215

Namakkal (Dt), Tamilnadu, India

Email : info@ksrce.ac.in **Website : www.ksrce.ac.ins**

K.S.R. COLLEGE OF ENGINEERING (Autonomous): TIRUCHENGODE - 637 215

DEPARTMENT OF CIVIL ENGINEERING

(REGULATIONS 2020) (Amendments)

With reference to the Centre for academic courses, Anna University, letter no. 618/CAC/TC/2023 dated 01.03.2023 two tamil language courses **"தமிழர் மரபு - HERITAGE OF TAMILS" & "தமிழரும் தொழில்நுட்பமும் - TAMILS AND TECHNOLOGY"** are introduced in the regulation 2020 and offered to the student batch 2022 – 2026 admitted in the academic year 2022–2023 during the II Semester and III Semester respectively.

The same courses are followed for student batches admitted from the academic year 2023-2024 during the I Semester and II Semester respectively.

Course Code & Course Title	Core/Elective	Semester	Credits	Applicable to candidates admitted in the academic year
Heritage of Tamils & தமிழர் மரபு	Mandatory Course	II	1	2022 – 2023
Tamils and Technology & தமிழரும் தொழில்நுட்பமும்		III	1	
Heritage of Tamils & தமிழர் மரபு		I	1	2023- 2024
Tamils and Technology & தமிழரும் தொழில்நுட்பமும்		II	1	

Chairman (BoS)

K.S.R. COLLEGE OF ENGINEERING: TIRUCHENGODE - 637 215

(Autonomous)

DEPARTMENT OF CIVIL ENIGNEERING

(REGULATIONS 2020)

Vision of the Institution

IV	We envision to achieve status as an excellent Educational Institution in the global knowledge hub, making self-learners, experts, ethical and responsible engineers, technologists, scientists, managers, administrators and entrepreneurs who will significantly contribute to research and environment friendly sustainable growth of the nation and the world.

Mission of the Institution

IM 1	To inculcate in the students self-learning abilities that enable them to become competitive and considerate engineers, technologists, scientists, managers, administrators and entrepreneurs by diligently imparting the best of education, nurturing environmental and social needs.
IM 2	To foster and maintain mutually beneficial partnership with global industries and Institutions through knowledge sharing, collaborative research and innovation.

Vision of the Department / Programme: (Civil Engineering)

DV	To impart knowledge and excellence in Civil Engineering and Technology with global perspectives to our students and to make them ethically strong engineers to create conducive environment.

Mission of the Department / Programme: (Civil Engineering)

DM 1	To promote innovative thinking in the minds of budding engineers and to make the department a centre of excellence in the field of Engineering.
DM 2	To provide knowledge base and moral autonomy to address regional, national and international needs in Civil Engineering.

Programme Educational Objectives (PEOs): (Civil Engineering)

The graduates of the programme will be able to	
PEO 1	**Successful Career:** Design and contribute to the infrastructure development project being undertaken by various sectors and evolves as a successful engineer.
PEO 2	**Lifelong Learning:** Pursue higher studies so that they can contribute to the society in terms of academic, research, sustainable development and other allied fields.
PEO 3	**Service to Society:** Work effectively and ethically in multicultural and multidisciplinary groups in accordance with technological change for the growth of Civil Engineering projects.

Programme Outcomes (POs) of B.E. –Civil Engineering

Program Outcomes (POs)	
PO1	**Engineering Graduates will be able to:** **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environmental and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
Program Specific Outcomes (PSOs)	
PSO1	**Research Culture:** Update research knowledge in Civil Engineering to solve the unknown issues that they have not encountered before.
PSO2	**Core Values:** Contribute core Universal values and social good in the community by Civil Engineering Profession.

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Department	Civil Engineering
Programme	B.E. – Civil Engineering

SEMESTER - I

Sl. No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EN151	Technical English – I (Common to all Branches)	HSC	2	0	1	3	40	60	100
2.	20MA151	Engineering Mathematics – I (Common to all Branches)	BSC	3	1	0	4	40	60	100
3.	20CH051	Engineering Chemistry (Common to all Branches)	BSC	3	0	0	3	40	60	100
4.	20EE041	Basics of Electrical and Electronics Engineering (Common to AU,CE,CS,IT,ME & SF)	ESC	3	0	0	3	40	60	100
PRACTICAL										
5.	20CH028	Chemistry Laboratory (Common to all Branches)	BSC	0	0	3	1	60	40	100
6.	20AU127	Engineering Graphics Laboratory (Common to CE,CS,EC, EE & IT)	ESC	0	0	3	1	60	40	100
7.	20GE028	Manufacturing Practices Laboratory (Common to all Branches)	ESC	0	0	3	1	60	40	100
MANDATORY COURSE										
8.	20MC151	Induction Programme* (Common to all Branches)	MC	-	-	-	-	60	40	100
Total				11	1	10	16	800		

*Induction program will be conducted for three weeks as per AICTE guidelines

SEMESTER - II

Sl. No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EN251	Technical English – II (Common to all Branches)	HSC	2	0	1	3	40	60	100
2.	20MA241	Engineering Mathematics – II (Common to AU,CE, ME, & SF)	BSC	3	1	0	4	40	60	100
3.	20PH051	Engineering physics (Common to all branches)	BSC	3	0	0	3	40	60	100
4.	20CS241	Python Programming (Common to AU,CE,EC,EE,ME & SF)	ESC	3	0	0	3	40	60	100
5.	20CE231	Engineering Mechanics	ESC	3	0	0	3	40	60	100
PRACTICAL										
6.	20PH028	Physics Laboratory (Common to all Branches)	BSC	0	0	3	1	60	40	100
7.	20CS227	Python Programming Laboratory (Common to AU,CE,EE,EC,ME & SF)	ESC	0	0	3	1	60	40	100
MANDATORY COURSE										
8.	20MC052	Environmental Science and Engineering	MC	3	0	0	0	40	60	100
9.	20GE051	Heritage of Tamils – தமிழர் மரபு	MC	1	0	0	1	40	60	100
Total				18	1	7	19	900		

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Department	Civil Engineering
Programme	B.E. – Civil Engineering

SEMESTER - III

Sl. No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20MA331	Engineering Mathematics -III	BSC	3	1	0	4	40	60	100
2.	20CE312	Engineering Geology	ESC	3	0	0	3	40	60	100
3.	20CE313	Fluid Mechanics	PCC	3	0	0	3	40	60	100
4.	20CE314	Mechanics of Solids	ESC	3	0	0	3	40	60	100
5.	20CE315	Surveying	PCC	3	0	0	3	40	60	100
6.	20CE316	Construction Materials	ESC	2	0	0	2	40	60	100
PRACTICAL										
7.	20CE321	Computer aided Building Drawing	ESC	0	0	3	1	60	40	100
8.	20CE322	Survey Practical	PCC	0	0	3	1	60	40	100
9.	20CE323	Strength of Materials Laboratory	PCC	0	0	3	1	60	40	100
10.	20HR351	Career Development Skills- I (Common to all Branches)	EEC	0	2	0	0	100	00	100
MANDATORY COURSE										
11.	20GE052	Tamils and Technology - தமிழரும் தொழில்நுட்பமும் (Common to All Branches)	MC	1	0	0	1	40	60	100
TOTAL				18	3	9	22	1100		

SEMESTER - IV

Sl. No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20MA432	Numerical Methods	BSC	3	1	0	4	40	60	100
2.	20CE412	Soil Mechanics	PCC	3	0	0	3	40	60	100
3.	20CE413	Strength of Materials	PCC	3	1	0	4	40	60	100
4.	20CE414	Applied Hydraulic and Hydraulic Machinery	PCC	3	0	0	3	40	60	100
5.	20CE415	Construction Techniques and Practices	PCC	3	0	0	3	40	60	100
6.	20CE416	Highway Engineering	PCC	3	0	0	3	40	60	100
PRACTICAL										
7.	20CE421	Fluid Mechanics and Machinery Laboratory	PCC	0	0	3	1	60	40	100
8.	20CE422	Soil Mechanics Laboratory	PCC	0	0	3	1	60	40	100
9.	20CE423	Highway Engineering Laboratory	PCC	0	0	3	1	60	40	100
10.	20HR422	Career Development Skills- II	EEC	0	2	0	0	60	40	100
Total				18	4	9	23	1000		

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Department	Civil Engineering
Programme	B.E. – Civil Engineering

SEMESTER V

Sl. No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20HS051	Universal Human Values and Understanding Harmony	HSC	3	0	0	3	40	60	100
2.	20CE511	Railways, Airport and Harbour Engineering	PCC	3	0	0	3	40	60	100
3.	20CE512	Foundation Engineering	PCC	3	0	0	3	40	60	100
4.	20CE513	Concrete Technology	PCC	3	0	0	3	40	60	100
5.	20CE514	Structural Analysis - I	PCC	3	0	0	3	40	60	100
6.	20CE515	Design of Reinforced concrete	PCC	3	0	0	3	40	60	100
7.	20CE516	Water supply Engineering	PCC	3	0	0	3	40	60	100
PRACTICAL										
8.	20CE521	Environmental Engineering Laboratory	PCC	0	0	3	1	60	40	100
9.	20CE522	Concrete Laboratory	PCC	0	0	3	1	60	40	100
10.	20HR523	Career Development Skills- III	EEC	0	2	0	0	60	40	100
TOTAL				18	3	6	23	1000		

SEMESTER –VI

Sl. No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20CE611	Irrigation Engineering	PCC	3	0	0	3	40	60	100
2.	20CE612	Structural Analysis - II	PCC	3	0	0	3	40	60	100
3.	20CE613	Design of Steel Structures	PCC	3	0	0	3	40	60	100
4.	20CE614	Waste Water Engineering	PCC	3	0	0	3	40	60	100
5.		Professional Elective – I	PEC	3	0	0	3	40	60	100
6.		Open Elective – I	OEC	3	0	0	3	40	60	100
7.		Open Elective – II	OEC	3	0	0	3	40	60	100
PRACTICAL										
8.	20CE621	Irrigation and Environmental Engineering Drawing	ESC	0	0	3	1	60	40	100
9.	20CE622	Survey Camp (2 weeks during V Sem vacation)	EEC	0	0	3	1	60	40	100
10.	20HR624	Career Development Skills- IV	EEC	0	2	0	0	60	40	100
Total				18	2	6	23	1000		

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SEMESTER VII

Sl. No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20CE712	Quantity Surveying and Estimation	PCC	3	0	0	3	40	60	100
2.		Professional Elective – II	PEC	3	0	0	3	40	60	100
3.		Professional Elective –III	PEC	3	0	0	3	40	60	100
4.		Open Elective – III	OEC	3	0	0	3	40	60	100
5.		Open Elective – IV	OEC	3	0	0	3	40	60	100
PRACTICAL										
6.	20CE721	Structural Design and Drawing Laboratory	ESC	0	0	3	1	60	40	100
7.	20CE722	Design Project	EEC	0	0	6	3	60	40	100
8.	20CE723	Industrial Training (4 weeks during VI Sem vacation)	EEC	0	0	0	2	60	40	100
MANDATORY COURSE										
9.	20MC053	Essence of Indian Traditional Knowledge (Common to all Branches)	MC	3	0	0	0	60	40	100
TOTAL				18	0	9	21	900		

SEMESTER –VIII

Sl. No.	Course Code	Course Name	Category	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20CE811	Construction Management	PCC	3	0	0	3	40	60	100
2.		Professional Elective – IV	PEC	3	0	0	3	40	60	100
3.		Professional Elective – V	PEC	3	0	0	3	40	60	100
PRACTICAL										
4.	20CE821	Project Work	EEC	0	0	12	6	60	40	100
Total				9	0	12	15	400		

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Department	Civil Engineering	
Programme	B.E. – Civil Engineering	

List of Electives

PROFESSIONAL ELECTIVE – I (SEMESTER – VI)

Sl. No.	Course Code	Course Name	Specialization	Category	Hours / Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20CE661	Prefabricated Structures	S1	PEC	3	0	0	3	40	60	100
2.	20CE662	Design of Reinforced Concrete Structures	S1	PEC	3	0	0	3	40	60	100
3.	20CE663	Maintenance and Rehabilitation of Structures	S2	PEC	3	0	0	3	40	60	100
4.	20CE664	Hydrology	S4	PEC	3	0	0	3	40	60	100
5.	20CE665	Traffic Engineering and Management	S6	PEC	3	0	0	3	40	60	100
6.	20CE666	Ground Improvement Techniques	S7	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – II (SEMESTER – VII)

Sl. No.	Course Code	Course Name	Specialization	Category	Hours / Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20CE761	Pre-stressed Concrete	S1	PEC	3	0	0	3	40	60	100
2.	20CE762	Bridge Engineering	S1	PEC	3	0	0	3	40	60	100
3.	20CE763	Construction Safety Practices	S2	PEC	3	0	0	3	40	60	100
4.	20CE764	Air Pollution Management	S3	PEC	3	0	0	3	40	60	100
5.	20CE765	Geographical Information System	S5	PEC	3	0	0	3	40	60	100
6.	20CE766	Urban Planning and Development	S6	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – III (SEMESTER – VII)

Sl. No.	Course Code	Course Name	Specialization	Category	Hours / Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20CE767	Industrial Structures	S1	PEC	3	0	0	3	40	60	100
2.	20CE768	Basics of Dynamics and Aseismic design	S1	PEC	3	0	0	3	40	60	100
3.	20CE769	Introduction to smart cities	S2	PEC	3	0	0	3	40	60	100
4.	20CE771	Environmental Impact Assessment	S3	PEC	3	0	0	3	40	60	100
5.	20CE772	Industrial Waste Management	S3	PEC	3	0	0	3	40	60	100
6.	20CE773	Geographical Informatics Application for Civil Engineering	S5	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – IV (SEMESTER – VIII)											
Sl. No.	**Course Code**	**Course Name**	**Specialization**	**Category**	**Hours / Week**			**Credit**	**Maximum Marks**		
					L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	20CE861	Earthquake Engineering	S1	PEC	3	0	0	3	40	60	100
2.	20CE862	Smart Materials and Smart Structures	S1	PEC	3	0	0	3	40	60	100
3.	20CE863	Housing, Planning and Management	S2	PEC	3	0	0	3	40	60	100
4.	20CE864	Municipal Solid Waste Management	S3	PEC	3	0	0	3	40	60	100
5.	20CE865	Pavement Engineering	S6	PEC	3	0	0	3	40	60	100
6.	20CE866	Site Investigation and Soil Exploration	S7	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – V (SEMESTER – VIII)											
Sl. No.	**Course Code**	**Course Name**	**Specialization**	**Category**	**Hours / Week**			**Credit**	**Maximum Marks**		
					L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	20CE867	Disaster Resisting Structures	S1	PEC	3	0	0	3	40	60	100
2.	20CE868	Finite Element Method in Civil Engineering	S1	PEC	3	0	0	3	40	60	100
3.	20CE869	Architectural Planning Aspects	S2	PEC	3	0	0	3	40	60	100
4.	20CE871	Green Building	S2	PEC	3	0	0	3	40	60	100
5.	20CE872	Environmental Laws and Policies	S3	PEC	3	0	0	3	40	60	100
6.	20CE873	Soil Dynamics and Machine Foundations	S7	PEC	3	0	0	3	40	60	100

S1 -Structural Engineering

S2 - Construction Engineering

S3 - Environmental Engineering

S4 - Hydrology & Water Resources

S5 - Geo informatics & Survey Engineering

S6 - Transport Engineering

S7 - Soil & Foundation Engineering

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Programme	B.E. – Civil Engineering	
List of Open Elective courses offered by other branches (SEMESTER VI to VII)		

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
Automobile Engineering											
1.	20AU901	Basics of Automobile Engineering	AE	OEC	3	0	0	3	40	60	100
2.	20AU902	Automotive Engine Technology	AE	OEC	3	0	0	3	40	60	100
3.	20AU903	Automotive Vehicle Technology	AE	OEC	3	0	0	3	40	60	100
4.	20AU904	Automotive Safety	AE	OEC	3	0	0	3	40	60	100
5.	20AU905	Hybrid Vehicles	AE	OEC	3	0	0	3	40	60	100
6.	20AU906	Off Highway Vehicles	AE	OEC	3	0	0	3	40	60	100
7.	20AU907	Modern and Intelligent Vehicle System	AE	OEC	3	0	0	3	40	60	100
8.	20AU908	Vehicle Maintenance	AE	OEC	3	0	0	3	40	60	100
Computer Science and Engineering											
9.	20CS901	Programming in Java	CSE	OEC	3	0	0	3	40	60	100
10.	20CS902	Basic concepts of Data Structure	CSE	OEC	3	0	0	3	40	60	100
11.	20CS903	Fundamentals of Database Concepts	CSE	OEC	3	0	0	3	40	60	100
12.	20CS904	Internet Programming	CSE	OEC	3	0	0	3	40	60	100
13.	20CS905	Fundamentals of Mobile Application Development	CSE	OEC	3	0	0	3	40	60	100
14.	20CS906	Principles of Ethical Hacking	CSE	OEC	3	0	0	3	40	60	100
15.	20CS907	Green Technology	CSE	OEC	3	0	0	3	40	60	100
16.	20CS908	Artificial Intelligence and Robotics	CSE	OEC	3	0	0	3	40	60	100
17.	20CS909	Big Data and Analytics	CSE	OEC	3	0	0	0	40	60	100
18.	20CS910	Hardware and Trouble Shooting	CSE	OEC	3	0	0	3	40	60	100
Electronics and Communication Engineering											
19.	20EC901	Basics of Medical Electronics	EC	OEC	3	0	0	3	40	60	100
20.	20EC902	NANO Technology	EC	OEC	3	0	0	3	40	60	100
21.	20EC903	Electronics and Microprocessor	EC	OEC	3	0	0	3	40	60	100
22.	20EC904	Analog and Digital Communication	EC	OEC	3	0	0	3	40	60	100
23.	20EC905	Principles of Communication	EC	OEC	3	0	0	3	40	60	100
24.	20EC906	Fundamentals of Robotics	EC	OEC	3	0	0	3	40	60	100
25.	20EC907	Internet of Things Sensing and Actuator Devices	EC	OEC	3	0	0	3	40	60	100
26.	20EC908	Consumer Electronics	EC	OEC	3	0	0	3	40	60	100

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
Electrical and Electronics Engineering											
27.	20EE901	Electrical Drives and Control	EE	OEC	3	0	0	3	40	60	100
28.	20EE902	Power Semiconductor Devices	EE	OEC	3	0	0	3	40	60	100
29.	20EE903	Electrical Power Generation Systems	EE	OEC	3	0	0	3	40	60	100
30.	20EE904	Control Engineering	EE	OEC	3	0	0	3	40	60	100
31.	20EE905	Industrial Automation	EE	OEC	3	0	0	3	40	60	100
32.	20EE906	Electrical Instruments and Measurements	EE	OEC	3	0	0	3	40	60	100
33.	20EE907	Energy Conservation and Management	EE	OEC	3	0	0	3	40	60	100
34.	20EE908	Electrical Wiring, Estimation and Costing	EE	OEC	3	0	0	3	40	60	100
35.	20EE909	Fundamentals of Electrical Machinery	EE	OEC	3	0	0	3	40	60	100
36.	20EE910	Principles of Soft Computing Techniques	EE	OEC	3	0	0	3	40	60	100
37.	20EE911	Embedded System Technology	EE	OEC	3	0	0	3	40	60	100
Information Technology											
38.	20IT901	Data Science using R	IT	OEC	3	0	0	3	40	60	100
39.	20IT902	Principles of Cyber Security	IT	OEC	3	0	0	3	40	60	100
40.	20IT903	Fundamentals of Business Intelligence	IT	OEC	3	0	0	3	40	60	100
41.	20IT904	Blockchain Technologies	IT	OEC	3	0	0	3	40	60	100
42.	20IT905	Internet of Things and Applications	IT	OEC	3	0	0	3	40	60	100
43.	20IT906	Principles of Software Testing	IT	OEC	3	0	0	3	40	60	100
44.	20IT907	Foundation Skills in Logic Building	IT	OEC	3	0	0	3	40	60	100
45.	20IT908	Principles of Cloud Computing	IT	OEC	3	0	0	3	40	60	100
46.	20IT909	Open Source Technologies	IT	OEC	3	0	0	3	40	60	100
47.	20IT910	Principles of Software Engineering	IT	OEC	3	0	0	3	40	60	100
Mechanical Engineering											
48.	20ME901	Basic Mechanical Engineering	ME	OEC	3	0	0	3	40	60	100
49.	20ME902	Solar Energy Utilization	ME	OEC	3	0	0	3	40	60	100
50.	20ME903	Production Technology of Agricultural Machinery	ME	OEC	3	0	0	3	40	60	100
51.	20ME904	Selection of Materials	ME	OEC	3	0	0	3	40	60	100
52.	20ME905	Marine Vehicles	ME	OEC	3	0	0	3	40	60	100
53.	20ME906	Sensors and Transducers	ME	OEC	3	0	0	3	40	60	100
54.	20ME907	Energy Auditing	ME	OEC	3	0	0	3	40	60	100
55.	20ME908	Fiber Reinforced Plastics	ME	OEC	3	0	0	3	40	60	100
56.	20ME909	Lean Manufacturing	ME	OEC	3	0	0	3	40	60	100
57.	20ME910	Surface Engineering	ME	OEC	3	0	0	3	40	60	100

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
Safety and Fire Engineering											
58.	20SF901	Occupational Health and Hygiene	SF	OEC	3	0	0	3	40	60	100
59.	20SF902	Construction Safety	SF	OEC	3	0	0	3	40	60	100
60.	20SF903	Building Fire Safety	SF	OEC	3	0	0	3	40	60	100
61.	20SF904	Safety in Electrical Engineering	SF	OEC	3	0	0	3	40	60	100
62.	20SF905	Legal Aspects of Safety	SF	OEC	3	0	0	3	40	60	100
63.	20SF906	Safety in Industries	SF	OEC	3	0	0	3	40	60	100
64.	20SF907	Food Safety	SF	OEC	3	0	0	3	40	60	100
65.	20SF908	Safety Management and its Principles	SF	OEC	3	0	0	3	40	60	100
66.	20SF909	Safety in Automobile Engineering	SF	OEC	3	0	0	3	40	60	100
67.	20SF910	Safety in Transportation	SF	OEC	3	0	0	3	40	60	100
Science and Humanities											
68.	20SH901	Applications of Statistics	FYA	OEC	3	0	0	3	40	60	100
69.	20SH902	Combinatorics and Graph Theory	FYA	OEC	3	0	0	3	40	60	100
70.	20SH903	Optimization Techniques	FYA	OEC	3	0	0	3	40	60	100
71.	20SH904	Basic Military Education and Training	FYA	OEC	3	0	0	3	40	60	100
72.	20SH905	Professional Communication	FYA	OEC	3	0	0	3	40	60	100
73.	20SH906	Fundamentals of Nanoscience and Technology	FYA	OEC	3	0	0	3	40	60	100

	K.S.R. COLLEGE OF ENGINEERING (Autonomous) (Approved by AICTE, New Delhi & Affiliated to Anna University) K.S.R. Kalvi Nagar, Tiruchengode – 637 215	CURRICULUM UG R - 2020
Department	Civil Engineering	
Programme	B.E. – Civil Engineering	
Open Elective courses offered by Civil Engineering to other branches		

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20CE901	Architectural Heritage of India	CE	OEC	3	0	0	3	40	60	100
2.	20CE902	Building Planning and Construction	CE	OEC	3	0	0	3	40	60	100
3.	20CE903	Elementary Civil Engineering	CE	OEC	3	0	0	3	40	60	100
4.	20CE904	Energy and Environment	CE	OEC	3	0	0	3	40	60	100
5.	20CE905	Environmental Laws and Policies	CE	OEC	3	0	0	3	40	60	100
6.	20CE906	Global Warming and Climate Change	CE	OEC	3	0	0	3	40	60	100
7.	20CE907	Introduction to Disaster Management and Mitigation	CE	OEC	3	0	0	3	40	60	100
8.	20CE908	Introduction to Earthquake Engineering	CE	OEC	3	0	0	3	40	60	100
9.	20CE909	Solid Waste Management	CE	OEC	3	0	0	3	40	60	100
10.	20CE910	Water and Air Pollution Management	CE	OEC	3	0	0	3	40	60	100

LIST OF VALUE ADDED COURSES

Sl. No.	Course Name	Numbers of Hours	Offered by Internal / External
1.	Contract and Tender Procedures	15	Internal/External
2.	Modern Construction Practices	15	Internal/External
3.	E-Tabs Applications	15	Internal/External
4.	REVERT	15	Internal/External
5.	BIM	15	Internal/External
6.	Drone survey	15	Internal/External
7.	Lean construction	15	Internal/External
8.	Digital construction	15	Internal/External
9.	Soil Structure Interaction	15	Internal/External
10.	Materials Management	15	Internal/External
11.	Water Harvesting &Management	15	Internal/External
12.	Energy Engineering	15	Internal/External
13.	Solid waste management	15	Internal/External
14.	Sustainable Engineering practices	15	Internal/External
15.	Intellectual Property Rights	15	Internal/External
16.	Engineering Economics & Cost analysis	15	Internal/External
17.	Value Engineering	15	Internal/External
18.	Optimization techniques	15	Internal/External
19.	Tile Laying	15	Internal/External
20.	Plumbing Services in Building	15	Internal/External
21.	Tunneling infrastructure Projects	15	Internal/External
22.	Modern flooring	15	Internal/External

COURSE COMPONENT SUMMARY

S.No	Subject Area	Credits per semester								Credits Total	% of Credits
		I	II	III	IV	V	VI	VII	VIII		
1	HSC	3	3			3				9	5.55
2	BSC	8	8	4	4					24	14.81
3	ESC	5	7	9			1	1		23	14.19
4	PCC			8	19	20	12	3	3	65	40.12
5	PEC						3	6	6	15	9.25
6	OEC						6	6		12	7.40
7	EEC						1	5	6	12	7.40
8	MC	0	1	1				0		2	1.23
Total		**16**	**19**	**22**	**23**	**23**	**23**	**21**	**15**	**162**	**100**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - I

		L	T	P	C
20EN151	**TECHNICAL ENGLISH – I** (Common to all branches)	2	0	1	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Objectives : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Comprehend and apply Grammar in context for professional communication*	*Understand*
CO2:	*Infer the gist and specific information.*	*Apply*
CO3:	*Discuss, express and interact in the society and place of study.*	*Create*
CO4:	*Critically interpret and comprehend a given text.*	*Evaluate*
CO5:	*Prioritize the listening skills for academic and professional purposes.*	*Apply*

UNIT - I **[09]**

Synonyms & Antonyms –- Use of Modal Auxiliaries – Infinitive and Gerund –-Parts of Speech -Intensive Reading – Predicting Content – Interpretation - Active Listening - Listening for the main idea - Need based Correspondence (request for joining hostel, bonafide certificate)-Self Introduction- Introducing others

UNIT - II **[09]**

British & American Terminology –- Tenses (Simple Present, Present Continuous, Present Perfect, Simple Past, and Simple Future) -Predicting Content - Drawing inferences - Listening for specific details - Listening to News – Job Application and Resume – Writing Instructions- Delivering Welcome Address

UNIT - III **[09]**

Standard Abbreviations and Acronyms -Preposition of Time, Place and Movement – Active Voice & Passive Voice – Consonant Sounds – Pronunciation guidelines related to Vowels and Consonant – Skimming & Scanning - Inference – Context Based Meaning – Recommendation Writing - Proposing Vote of Thanks.

UNIT - IV **[09]**

Vocabulary Building – Phrasal Verbs (Put, Give, Look, Take, Get, Call)- Impersonal passive -Newspaper Reading –- Note making – Listening to Dialogues – E Mail Etiquettes & E-mail Writing.- MoC – Anchoring – Role play in academic context

UNIT - V **[09]**

Homonyms - Concord (Subject & Verb Agreement)- Rearranging the jumbled sentences - Listening to Telephonic Conversation - Letter of Invitation (inviting, accepting and declining) – Paragraph writing - Letter to the Editor of a News paper – Drills using Minimal pairs – Presentation Skills.

Total (L= 40, T = 5) = 45 Periods

Text Books :

1 Meenakshi Raman, Technical Communication, Oxford University Press, New Delhi, First Edition, 2017

2 S.Sumant, Technical English – I, Vijay Nicole, Chennai, Second Edition, 2018

Reference Books :

1 Dr.P.Rathna, English Work Book – I, VRB Publishers Pvt. Ltd., Chennai, Second Edition,2018

2 Seely, The Oxford Guide to Writing and Speaking, Oxford University Press, New Delhi, First Edition, 2016

3 M Ashra Rizvi, Effective Technical Communication, Tata McGraw Hill, New Delhi, First Edition,2005

4 P.Kiranmani Dutt, A course in Communication Skills, Cambridge University Press, New Delhi, First Edition, 2014

Course Faculty ` **Module Coordinator** **Chairman BOS /S & H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20EN151 **Course Name: TECHNICAL ENGLISH – I**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Comprehend and apply Grammar in context for professional communication.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO2	*Infer the gist and specific information.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO3	*Discuss, express and interact in the society and place of study.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO4	*Critically interpret and comprehend a given text.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO5	*Prioritize the listening skills for academic and professional purposes.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
	Average	**-**	**-**	**-**	**-**	**-**		**-**	**-**	**2**	**3**	**-**	**1**	-	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty ` **Module Coordinator** **Chairman BOS /S & H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – I

		L	T	P	C
20MA151	**ENGINEERING MATHEMATICS – I** (Common to All Branches)	3	1	0	4

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes : On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Interpret the concepts of Matrix applications in the field of engineering.*	*Understand*
CO2:	*Acquire knowledge in solving ordinary differential equations.*	*Evaluate*
CO3:	*Extend and apply the concepts of differential calculus problems.*	*Apply*
CO4:	*Develop the skills in solving the functions of several variables.*	*Remember*
CO5:	*Applying the concepts and solving the Vector Calculus problems.*	*Apply*

UNIT– I **LINEAR ALGEBRA** **[12]**

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (Excluding proof) – Cayley Hamilton theorem (excluding proof) – Quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT – II **ORDINARY DIFFERENTIAL EQUATIONS** **[12]**

Linear differential equations of second and higher order with constant coefficients – Differential equations with variable coefficients – Cauchy's and Legendre's linear equations – Method of variation of parameters.

UNIT – III **DIFFERENTIAL CALCULUS** **[12]**

Curvature – Radius of curvature (Cartesian co-ordinates only) – Centre of curvature and Circle of curvature – Involutes and Evolutes.

UNIT – IV **FUNCTIONS OF SEVERAL VARIABLES** **[12]**

Partial derivatives – Total derivatives – Euler's theorem for homogenous functions – Taylor's series expansion – Maxima and Minima for functions of two variables – Method of Lagrangian multipliers.

UNIT – V **VECTOR CALCULUS** **[12]**

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Green's theorem in plane, Gauss divergence theorem and Stoke's theorem – Problems in Cube, Cuboid and Rectangular parallelopiped only.

Total (L: 45 T:15) = 60 Periods

Text Books :

1. Ravish R Singh and Mukul Bhatt, Engineering Mathematics – I, McGraw Hill Publications, Fourth Edition, New Delhi 2016.
2. Grewal B.S, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company, Forty Third Edition, New Delhi, 2015.

Reference Books :

1. Bali N. P and Manish Goyal, Textbook on Engineering Mathematics, Laxmi Publications (p) Ltd., Seventh Edition, 2016.
2. H.K. Dass, Advance Engineering Mathematics, S. Chand and company, Eleventh Edition, 2015.
3. Jain R.K. and Iyengar S.R.K., - Advanced Engineering Mathematics, Narosa Publications, Eighth Edition, 2012.
4. Narayanan.S and Manicavachagom Pillai. T.K. – Calculas vol I and Vol II, S.Chand & Co. Sixth Edition, 2014.

Course Faculty ` **Module Coordinator** **Chairman BOS /S & H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20MA151 **Course Name: ENGINEERING MATHEMATICS – I**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Interpret the concepts of Matrix applications in the field of engineering.*	3	3	3	3										
CO2	*Acquire knowledge in solving ordinary differential equations.*	3	3	3	3										
CO3	*Extend and apply the concepts of differential calculus problems.*	3	3	3	3										
CO4	*Develop the skills in solving the functions of several variables.*	3	3	3	3										
CO5	*Applying the concepts and solving the Vector Calculus problems.*	3	3	3	3										
	Average	3	3	3	**3**										

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty ` **Module Coordinator** **Chairman BOS /S & H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – I

20CH051	**ENGINEERING CHEMISTRY**	L	T	P	C
	(Common to All Branches)	3	0	0	3

Prerequisite: *-*

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Make use of the manufacture, properties and uses of advanced engineering materials.*	*Understand*
CO2:	*Explain the concept of corrosion and its control.*	*Understand*
CO3:	*Use the concept of thermodynamics in engineering applications.*	*Understand*
CO4:	*Recall the periodic properties such as ionization energy, electron affinity and electro negativity.*	*Remember*
CO5:	*Analyze the usage of various spectroscopic techniques.*	*Understand*

UNIT - I ADVANCED ENGINEERING MATERIALS [9]

Abrasives – Moh's scale of hardness – types – natural [Diamond] – synthetic [SiC]; Refractories – characteristics – classifications [Acidic, basic and neutral refractories] – properties – refractoriness – RUL – porosity – thermal spalling; Lubricants – definition – function – characteristics – properties – viscosity index, flash and fire points, cloud and pour points, oiliness; Solid lubricants – graphite and MoS_2; Nano materials – CNT– synthesis [CVD, laser evaporation, pyrolysis] – applications – medicine, electronics, biomaterials and environment.

UNIT - II ELECTROCHEMISTRY AND CORROSION [9]

Introduction – electrode potential – Nernst equation – EMF series and its significance – types of cells (Electrolytic & electrochemical); Corrosion – causes, consequences – classification – chemical corrosion – electro chemical corrosion – mechanism; Galvanic & differential aeration corrosion – factors influencing corrosion – corrosion control – corrosion inhibitors.

UNIT - III CHEMICAL THERMODYNAMICS [9]

Terminology of thermodynamics – second law; Entropy – entropy change for an ideal gas – reversible and irreversible processes – entropy of phase transition – Clausius inequality; Free energy and work function – Helmholtz and Gibb's free energy functions – criteria of spontaneity; Gibb's – Helmholtz equation (Problems); Maxwell's relations – Van't Hoff isotherm and isochore.

UNIT - IV ATOMIC STRUCTURE AND CHEMICAL BONDING [9]

Effective nuclear charge – orbitals – variations of s, p, d and f orbital – electronic configurations – ionization energy – electron affinity and electro negativity; Types of bonding – ionic, covalent and coordination bonding – hydrogen bonding and its types; Crystal field theory – the energy level diagram for transition metal complexes ($[Fe(CN)_6]^{3-}$, $[Ni(CN)_4]^{2-}$ and $[CoCl_4]^{2-}$ only); Role of transition metal ions in biological system; Band theory of solids.

UNIT - V PHOTOCHEMISTRY AND SPECTROSCOPIC TECHNIQUES [9]

Laws of photochemistry – Grotthuss Draper law – Stark-Einstein law – Beer-Lambert law – phosphorescence – fluorescence and it's applications in medicine – chemiluminescence; Colorimetry – principle – instrumentation (block diagram only) – estimation of iron by colorimetry; principles of spectroscopy – selection rules – vibrational and rotational spectroscopy – applications; Flame photometry – principle – instrumentation (block diagram only) – estimation of sodium; Atomic absorption spectroscopy – principle – instrumentation (block diagram only) – estimation of nickel.

Total = 45 Periods

Text Book :

1 Dr. A.Ravikrishnan, Engineering Chemistry, Srikrishna Hi-tech Publishing Company Private Limited, Chennai, Seventeenth Edition, 2016.

2 P.C. Jain and Monica Jain, Engineering Chemistry, Dhanpat Rai Publishing company, New Delhi, Seventeenth Edition, 2015.

Reference Books :

1 S S. Dara and S. S. Umare, A Text book of Engineering Chemistry, S.Chand &Company Limited, New Delhi, Fifth Edition, 2015.

2 N. Krishnamurthy, P. Vallinayagam and D. Madhavan, Engineering Chemistry, PHI Learning Private Limited, New Delhi, Third Edition, 2014.

3 S. Vairam, P. Kalyani and Suba Ramesh, Engineering Chemistry, Wiley India Private Limited, New Delhi, First Edition, 2013.

4 B. Sivasankar, Engineering Chemistry, Tata McGraw – Hill Education Private Limited, New Delhi, First Edition, 2008.

Course Faculty ` **Module Coordinator** **Chairman BOS /S & H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CH051 **Course Name: ENGINEERING CHEMISTRY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Make use of the manufacture, properties and uses of advanced engineering materials.*	3	3	2				2					1		
CO2	*Explain the concept of corrosion and its control.*	3	3	2				3					2		
CO3	*Use the concept of thermodynamics in engineering applications.*	3	3	2				2					2		
CO4	*Recall the periodic properties such as ionization energy, electron affinity and electro negativity.*	3	3	2				2					1		
CO5	*Analyze the usage of various spectroscopic techniques.*	3	3	2				3					1		
	Average	**3**	**3**	**2**				**2**					**1**		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty ` **Module Coordinator** **Chairman BOS /S & H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – I

		L	T	P	C
20EE041	**BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING** (Common To AU,CE,CS,IT,ME&SF)	3	0	0	3

Prerequisite: *Engineering Mathematics, Engineering Physics*

Course Outcomes : On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Solve the electric circuits by applying basic circuital laws for various combinations of circuit elements.*	*Apply*
CO2:	*Explain the construction, operating principle and application of DC motor and transformers.*	*Understand*
CO3:	*Enlighten the construction, operating principle and application of AC motors and Special Machines.*	*Understand*
CO4:	*Illustrate the function of various measuring instruments.*	*Understand*
CO5:	*Discuss the characteristics of Diodes, BJT and Digital systems.*	*Understand*

UNIT – I ELECTRICAL CIRCUITS [09]

Structural of Electrical Power System – Ohm's Law – Kirchhoff's Laws – Circuit Analysis – Introduction to AC Circuits: R, RL & RLC series circuits, Average and RMS Value – Power and Power factor for single phase Circuits – Three Phase Star and Delta Connections–Electrical safety.

UNIT –II DC MOTOR AND TRANSFORMERS [09]

Faraday's Law – Lenz's Law – Fleming's left hand and right hand rule, DC Motor: Construction –Operation-series and shunt motor Characteristics Applications. Single Phase Transformer: Construction – Operation – EMF Equation – Types – Applications.

UNIT –III AC MOTORS & SPECIAL MACHINES [09]

Single Phase Induction Motor: Construction – Operation – Split Phase Induction Motor and Capacitor Start Induction Run Motor – Applications, Three Phase Induction Motor: Construction – Operation – Types – Applications. Special Machines: Stepper Motor.

UNIT–IV MEASURING INSTRUMENTS [09]

Basic Methods of Measurements: Direct and Indirect, Functional elements of an instrument – Errors in measurements– Analog and Digital Instruments – Basic Principle of Indicating Instruments – Moving Coil and Moving Iron Ammeter and Voltmeter. Dynamometer type Wattmeter – Induction type Energy Meter – Cathode Ray Oscilloscope.

UNIT – V ANALOG AND DIGITAL ELECTRONICS [09]

Semiconductor devices: PN Junction Diode, Zener diode: Operation and Characteristics– Bipolar Junction Transistor – CE Configurations and its Characteristics. Review of number systems – Digital logic gates – Introduction to Microprocessors.

Total = 45 Periods

Text Books :

1 Smarajit Ghosh, Fundamentals of Electrical and Electronics Engineering, PHI Learning Private Limited, New Delhi, Second Edition, 2007.

2 Jegathesan, V, VinothKumar, K.,Saravanakumar, R., Basic Electrical and Electronics Engineering, Wiley India, New Delhi, First Edition, 2012.

Reference Books :

1 Muthusubramanian, R., Salivahanan, S., and Muraleedharan, K.A., Basic Electrical, Electronics and Computer Engineering, Tata Mc Graw Hill, New Delhi, Second Edition, 2006.

2 Nagsarkar, T.K., and Sukhija M.S.,Basics of Electrical Engineering, Oxford University Press, New Delhi, Ninth Edition, 2005.

3 Mehta, V.K and Rohit Mehta, Principle of Electrical Engineering, S Chand & Company, New Delhi, Second Edition, 2008.

4 Mahmood Nahvi and Joseph A. Edminister, Electric Circuits, Schaum Outline Series, McGraw Hill, New Delhi, Fifth Edition, 2002.

Course Faculty ` **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20EE041** **Course Name:** **BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Solve the electric circuits by applying basic circuital laws for various combinations of circuit elements.*	3	2	2	-	-	-	-	-	-	-	-	1	-	-
CO2:	*Explain the construction, operating principle and application of DC motor and transformers.*	3	3	2	-	-	2	1	1	-	-	-	1	-	-
CO3:	*Enlighten the construction, operating principle and application of AC motors and Special Machines.*	3	2	2	-	-	2	1	1	-	-	-	1	-	-
CO4:	*Illustrate the function of various measuring instruments.*	3	3	2	-	-	2	1	1	-	-	-	1	-	-
CO5:	*Discuss the characteristics of Diodes, BJT and Digital systems.*	3	3	2	-	-	2	1	1	-	-	-	1	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**2**	**1**	**1**		-	-	**1**	**-**	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – I

		L	T	P	C
20CH028	**CHEMISTRY LABORATORY** (Common To All Branches)	0	0	3	1

Prerequisite:-

Course Outcomes: On Completion of this course, the student will be able to

		Cognitive level
CO1:	*Apply the principle of conductometric titration.*	*Understand*
CO2:	*Relate the role of pH in quantitative analysis of a solution.*	*Understand*
CO3:	*Perceive the knowledge of the concentration of Iron by electrochemical methods.*	*Understand*
CO4:	*Analyze the application of water in various fields.*	*Understand*
CO5:	*Recall the nature of corrosion process.*	*Remember*

LIST OF EXPERIMENTS:

1. Conductometric Titration – Strong Acid Vs. Strong Base.
2. Conductometric Titration – Mixture of Weak and Strong Acids Vs. Strong Base.
3. Conductometric Titration – Precipitation, $BaCl_2$ Vs. Na_2SO_4.
4. Estimation of Ferrous ion by Potentiometry – Fe^{2+} Vs $K_2Cr_2O_7$.
5. Estimation of Hydrochloric Acid by pH metry.
6. Estimation of Iron by Spectrophotometry.
7. Estimation of hardness in water by EDTA method.
8. Estimation of chloride in water sample by Argentometry.
9. Estimation of dissolved oxygen (DO) in water by Winkler's method.
10. Determination of rate of corrosion of mild steel by weight loss method.

Total : 30 Periods

Text Book :

1. Department of Chemistry Staff members, Chemistry Laboratory Manual, K.S.R. College of Engineering, Tiruchengode, Fourth Edition, 2020.
2. I. Vogel, Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & sons, New York, Eighth Edition, 2014.

Reference Books :

1. S. K. Bhasin and Sudha Rani, Laboratory Manual of Engineering Chemistry, Dhanpat Rai Publishing Company Private Limited, New Delhi, Third Edition, 2012.
2. I. Vogel and J. Mendham, Vogel's Textbook of Quantitative Chemical Analysis, Harlow, Prentice Hall, Sixth Edition, 2000.
3. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denny, Vogel's Text book of quantitative analysis chemical analysis, Longman, Singapore publishers, Singapore, ELBS Fifth Edition, 1996.
4. B.S. Furniss, A.J, Hannaford, P.W.G. Smith and A.R.Tatchel, Vogels Textbook of Practical organic chemistry, John Wiley & sons, New York, Fifth Edition, 1989.

Course Faculty ` **Module Coordinator** **Chairman BOS /S & H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CH028 **Course Name: CHEMISTRY LABORATORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Apply the principle of conductometric titration.*	3	3	3			2		1	2			1		
CO2	*Relate the role of pH in quantitative analysis of a solution.*	3	2	3			1		1	2			1		
CO3	*Perceive the knowledge of the concentration of Iron by electrochemical methods.*	3	1	3			1		1	2			1		
CO4	*Analyze the application of water in various fields.*	3	2	2			1		1	2			1		
CO5	*Recall the nature of corrosion process.*	3	2	3			1		1	2			1		
	Average	**3**	**2**	**3**			**1**		**1**	**2**			**1**		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty ` **Module Coordinator** **Chairman BOS /S & H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - I

		L	T	P	C
20AU127	**ENGINEERING GRAPHICS LABORATORY** (Common To CE,CS,EC,EE, & IT)	0	0	3	1

Prerequisite: *-*

Course Outcomes: On Completion of this course , the student will be able to		***Cognitive level***
CO1:	*Create and modify two-dimensional drawings using AutoCAD software*	*Understand*
CO2:	*Construct various planes and do orthographic projection of lines and plane surfaces.*	*Remember*
CO3:	*Draw projections of solids and development of surfaces.*	*Understand*
CO4:	*Create the sections of solids and surfaces.*	*Understand*
CO5:	*Sketch two dimensional isometric projections of simple solids.*	*Understand*

List of Experiments:

1. Study of basic tools, commands and coordinate system (absolute, relative, polar, etc.) used in 2D software.
2. Draw the conic curves and special curves by using AutoCAD.
3. Draw the front view, top view, side view of objects from the given pictorial view.
4. Draw the projections of straight lines.
5. Draw the projections of polygonal surface.
6. Draw the projections of simple solid objects.
7. Draw the sectional view and the true shape of the given section.
8. Draw the development of surfaces like prism, pyramids, cylinders and cone.
9. Draw the isometric projections of simple solids, truncated prism and pyramids.
10. Draw the isometric projections of cylinder and cone.

Total : 45 Periods

CO PO MAPPING

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	*Create and modify two-dimensional drawings using AutoCAD software*	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO2	*Construct various planes and do orthographic projection of lines and plane surfaces.*	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO3	*Draw projections of solids and development of surfaces.*	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO4	*Create the sections of solids and surfaces.*	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO5	*Sketch two dimensional isometric projections of simple solids.*	3	3	3	2	2	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	2	2	**-**	**-**	**-**	**-**	-	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** ***Chairman BoS/AE***

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – I

		L	T	P	C
20GE028	**MANUFACTURING PRACTICES LABORATORY** (Common to All Branches)	0	0	3	1

Prerequisite: *-*

GROUP A (CIVIL & MECHANICAL)

Course Outcomes: On Completion of this course , the student will be able to ***Cognitive level***

CO1: *Prepare green sand mould for simple patterns and carpentry components with simple joints.*

CO2: *Perform welding practice to join simple structures.*

CO3: *Practice simple operations in lathe and drilling machine.*

LIST OF EXPERIMENTS

1. Study of fitting, smithy, plastic molding, and glass cutting.
2. Prepare a mould using solid/split patterns in Foundry.
3. Make Lap joint / Butt joint / T joint from the given wooden pieces using carpentry tools.
4. Make a Butt joint / Lap joint / Tee joints using arc / gas welding equipment.
5. Perform simple Facing and Turning operation using Centre Lathe.
6. Make holes as per the given dimensions using drilling machine.

LIST OF EQUIPMENT

1.	Fitting tools and its accessories	-	15 Sets
2.	Smithy tools and Open hearth furnace setup	-	2 Sets
3.	Foundry tools and its accessories	-	5 Sets
4.	Carpentry tools and its accessories	-	15 Sets
5.	Arc Welding equipments and its accessories	-	5 Sets
6.	Oxy Acetylene welding setup and its accessories	-	1 Set
7.	Centre Lathe with its accessories	-	2 Nos.
8.	Pillar type drilling machine	-	1 No.

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	*Prepare green sand mould for simple patterns and carpentry components with simple joints.*	2	-	-	3	-	-	-	3	1	-	-	3	3	1
CO2	*Perform welding practice to join simple structures.*	2	-	-	3	-	-	-	3	1	-	-	3	3	1
CO3	*Practice simple operations in lathe and drilling machine.*	2	-	-	3	-	-	-	3	1	-	-	3	3	1
	Average	**2**	**-**	**-**	**3**	**-**	**-**	**-**	**3**	**1**			**3**	**3**	**1**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty ` **Module Coordinator** ***Chairman BoS/ME***

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – I

		L	T	P	C
20GE028	**GROUP B (ELECTRICAL & ELECTRONICS)** (Common to all Branches)	0	0	3	1

Prerequisite: *-*

Course Outcomes: On Completion of this course , the student will be able to		***Cognitive level***
CO1:	*Construct different types of wiring used in house.*	*Understand*
CO2:	*Calibrate single phase Energy meter.*	*Understand*
CO3:	*Demonstrate different electronic components, logic gates and CRO.*	*Understand*

List of Experiments:

ELECTRICAL ENGINEERING

1. Fluorescent lamp wiring & Stair-case wiring.
2. Residential house wiring using switches, fuse, indicator, lamp and fan.
3. Calibration of Single phase Energy meter.

ELECTRONICS ENGINEERING

1. Study of Electronic components and Soldering practice.
2. Study of logic gates AND, OR, EX-OR, NOT, Half and Full Adder.
3. Study of CRO.

Total : 45 Periods

CO PO MAPPING

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	*Construct different types of wiring used in house.*	3	2	3	-	-	-	-	1	1	-	-	3	-	-
CO2	*Calibrate single phase Energy meter.*	3	1	2	-	-	-	-	1	1	-	-	3	-	-
CO3	*Demonstrate different electronic components, logic gates and CRO.*	3	2	3	-	-	-	-	1	1	-	-	3	-	-
	Average	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty ` **Module Coordinator** ***Chairman BoS/EEE***

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER- I

		L	T	P	C
20MC151	**INDUCTION PROGRAMME (COMMON TO ALL BRANCHES)**	0	0	0	0

Course outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Involve in physical activity, creative arts and culture and feel comfortable in the new environment.*	*Understand*
CO2:	*Build relationship between teachers and students and make familiarizing with departments.*	*Understand*
CO3:	*Concentrate on literary activities.*	*Apply*
CO4:	*Develop the required skills through lectures and workshops.*	*Remember*
CO5:	*Acquire skills in extracurricular activities.*	*Analyze*

List of activities during the three weeks Students Induction Programme (SIP): **3 weeks**

MODULE I : PHYSICAL ACTIVITY

- This would involve a daily routine of physical activity with games and sports. There would be games in the evening. These would help develop team work besides health.

MODULE II : CREATIVE ARTS & CULTURE

- Every student would chose one skill related to the arts whether visual arts or performing arts such as painting, music, dance, pottery, sculpture etc. The student would pursue it every day for the duration of the program.
- These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would help in engineering design later.

MODULE III : MENTORING AND CONNECTING THE STUDENTS WITH FACULTY

- Mentoring takes place in the context and setting of *Universal Human Values*. It gets the student to explore oneself and experience the joy of learning, prepares one to stand up to peer and take decisions with courage, be aware of relationships and be sensitive to others.
- Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program.

MODULE IV: FAMILIRIZATION WITH COLLEGE/DEPARTMENTS & BRANCHES

- They should be shown their department, and told what it means to get into the branch or department. Describe what role the technology related to their department plays in society and after graduation what role the student would play in society as an engineer in that branch. A lecture by an alumnus of the Dept. would be very helpful in this regard. They should also be shown the laboratories, workshops and other facilities.

MODULE V: LITERARY ACTIVITIES

- Literary activity would encompass reading a book, writing a summary, debating, enacting a play etc.

MODULE VI: PROFICIENCY MODULES:

- The induction program period can be used to overcome some critical lacunas that students might have difficulties in communication skills. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially.

MODULE VII: LECTURES & WORKSHOPS

- Lectures by eminent people to be organized, say, once a week. It would give the students exposure to people who are eminent, in industry or engineering, in social service, or in public life. Alumni could be invited as well.
- Motivational lectures about life, meditation, etc. by Ramakrishna Mission, Art of Living, Vivekanand Kendras, S-VYASA, etc. may be organized. (3 sessions, 9 hours).

MODULE VIII: EXTRA CURRICULAR ACTIVITIES

- The new students should be introduced to the extra-curricular activities at the college.
- They should be shown the facilities and informed about activities related to different clubs etc. This is when selected senior students involved in or leading these activities can give presentations, under faculty supervision.

MODULE IX: FEED BACK & REPORT ON THE PROGRAMMES:

- Students should be asked to give their mid-program feedback. They should be asked to write their opinions about the program at the end of the first week.
- Finally, at the end of the program, each group (of 20 students) should be asked to prepare a single report on their experiences of the program. On the second last day, each group should present their report in front of other groups. Immediately after their presentation, they should submit their written report. This will also serve as a *closure* to the program.
- Finally, a formal written or online anonymous feedback should be collected at the end of the program.

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Involve in physical activity, creative arts and culture and feel comfortable in the new environment.*	3					3	3	2	3	2		3		
CO2	*Build relationship between teachers and students and make familiarizing with departments.*	3					3	3	3	1	3		3		
CO3	*Concentrate on literary activities.*	3					2	3	3	3	3		3		
CO4	*Develop the required skills through lectures and workshops.*	3					3	3	3	2	3		3		
CO5	*Acquire skills in extracurricular activities.*	3					3	3	3	3	3		3		
	Average	**3**					**3**	**3**	**3**	**2**	**3**		**3**		

Course Faculty ` **Module Coordinator** ***Chairman/ S&H***

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - II

		L	T	P	C
20EN251	**TECHNICAL ENGLISH – II** (common to all branches)	2	0	1	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Objectives : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Infer and apply the enriched vocabulary, by knowing the basic grammatical structure, in academic and professional contexts.*	*Understand*
CO2:	*Identify and use Standard English in diverse situations.*	*Apply*
CO3:	*Interpret by reading a text and comprehend a given text.*	*Create*
CO4:	*Organize and compose business letters.*	*Evaluate*
CO5:	*Prioritize the listening skill for academic and personal development purposes.*	*Apply*

UNIT - I **[09]**

Technical Vocabulary – Changing words from one form to another - Articles – Compound Nouns - Introducing Oneself – Biased Listening- Critical reading - Need based Correspondence (In plant training & Industrial Visit) - Context based meaning - Writing short Essays.

UNIT - II **[09]**

Prefixes & Suffixes - Numerical Adjectives – If Conditionals – Making Requests – Seeking Information - Listening for main ideas –Intensive Reading - E-mail Writing– Describing Likes & Dislikes - Report Writing.

UNIT - III **[09]**

Types of Collocations - Framing Questions – 'Wh' Question – Yes / No Question –Cause and Effect Expression - Greetings and Introductions — Inviting People - Listening and Note taking - Critical reading- Making inference - Transcoding (Interpretation of Charts).

UNIT - IV **[09]**

Common English idioms and phrases - Expression of Purpose – Editing text for Spelling and Punctuation - Oral Presentation – Extensive Listening - Short Comprehension Passages - Business Correspondence – Calling for Quotations, Seeking Clarification, placing order and Complaint .

UNIT - V **[09]**

Confused and misused words - Discourse markers – Redundancies - Instructions – Describing – Listening to fill up forms and gapped texts - Reading Short texts from Journals and Newspapers - Telephone Etiquette - Check list – Essay Writing.

Total (L= 40, T = 5) = 45 Periods

Text Books :

1 Dr.S.Sumant, Technical English II, Tata McGraw Hill, New Delhi, Second Edition, 2016

2 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2004.

Reference Books :

1 Michael Swan, Practical English Usage, Oxford University Press, New Delhi, First Edition, 2015.

2 Dept. of Humanities and social sciences, Anna University, Chennai, English for Engineers and Technologists, Orient Longman, First Edition, 2014

3 Hory Sankar Mukerjee, Business Communication, Oxford University Press, New Delhi, First Edition, 2013.

4 Department of English, English for Technologists and Engineers, Orient Black Swan, Chennai, First Edition, 2016

Course Faculty ` **Module Coordinator** **Chairman BoS/ S & H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20EN251 **Course Name: TECHNICAL ENGLISH – II**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Infer and apply the enriched vocabulary, by knowing the basic grammatical structure, in academic and professional contexts.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO2	*Identify and use Standard English in diverse situations.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO3	*Interpret by reading a text and comprehend a given text.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO4	*Organize and compose business letters.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO5	*Prioritize the listening skill for academic and personal development purposes.*	-	-	-	-	-	-	-	-	2	3	-	1	-	-
	Average	**-**	**-**	**-**	**-**	**-**		**-**	**-**	**2**	**3**	**-**	**1**	-	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty ` **Module Coordinator** **Chairman BoS/ S & H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

		L	T	P	C
20MA241	**ENGINEERING MATHEMATICS – II** (COMMON TO AU, CE, ME& SF)	3	1	0	4

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes : On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Apply the concepts of analytic functions, conformal mapping and bilinear transformations.*	*Remember*
CO2:	*Solve the of Complex Integration problems.*	*Understand*
CO3:	*Solve the Fourier series problems.*	*Understand*
CO4:	*Analyze the partial differential equations and its applications.*	*Remember*
CO5:	*Apply Laplace transform, Inverse Laplace transform in the Engineering fields.*	*Apply*

UNIT - I ANALYTIC FUNCTIONS [12]

Functions of a complex variable – Analytic functions – Necessary and sufficient conditions: Cauchy – Riemann Equation (excluding proof) – Harmonic functions – Construction of analytic functions (Milne Thomson method) – Conformal mapping: w = z+c, cz, 1/z and bilinear transformation.

UNIT - II COMPLEX INTEGRATION [12]

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Laurent's series expansion – Singular points – Residues – Cauchy's residue theorem – Evaluation of real and definite integrals on unit circle and semi – circular contour (excluding poles on boundaries).

UNIT - III FOURIER SERIES [12]

Dirichlet's conditions – General Fourier series - Odd and Even functions – Half range sine and cosine series – Harmonic analysis.

UNIT - IV PARTIAL DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS [12]

Formation of partial differential equations – Lagrange's linear equation - Solutions of one dimensional wave equation – Problems on vibrating string with zero and non - zero initial velocity – One dimensional heat equation – Problems of steady state condition with zero and non- zero boundary values.

UNIT - V LAPLACE TRANSFORMATION [12]

Laplace transforms – Conditions for existence – Transform of elementary functions – Basic properties– Transform of Derivatives – Initial and final value theorems (excluding proof). Transform of periodic functions. Inverse Laplace transforms (partial fraction method only) – Solution of linear ordinary differential equations of second order with constant coefficients.

Total (L: 45 T:15) = 60 Periods

Text Books :

1. Ravish R Singh and Mukul Bhatt, Engineering Mathematics - II, McGraw Hill Publications, New Delhi, Third Edition,2016.
2. Grewal B.S, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company, Forty third Edition, New Delhi, 2015.

Reference Books :

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India, New Delhi, Seventh Edition, 2016.
2. Bali N.P and Manish Goyal, Engineering Mathematics, Laxmi Pub, Chennai, Seventh Edition, 2016
3. P. Anuradha and V. Sudhakar, Transforms and Partial Differential Equations, Scitech publication, Chennai, Second Edition, 2014.
4. Lan Sneddon, Elements of Partial Differential Equations, McGraw-Hill International Editions, New Delhi, Thirty Fifth edition, 2012.

Course Faculty ` **Module Coordinator** **Chairman BoS/ S & H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20MA241 **Course Name: ENGINEERING MATHEMATICS – II**

CO's	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Apply the concepts of analytic functions, conformal mapping and bilinear transformations.*	3	3	3	3										
CO2	*Solve the of Complex Integration problems.*	3	3	3	3										
CO3	*Solve the Fourier series problems.*	3	3	3	3										
CO4	*Analyze the partial differential equations and its applications.*	3	3	3	3										
CO5	*Apply Laplace transform, Inverse Laplace transform in the Engineering fields.*	3	3	3	3										
	Average	3	3	3	3										

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty ` **Module Coordinator** **Chairman BOS /S & H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

		L	T	P	C
20PH051	**ENGINEERING PHYSICS** (Common to All Branches)	3	0	0	3

Prerequisite: -

Course Outcomes: On Completion of this course , the student will be able to		***Cognitive level***
CO1:	*Describe the impact of engineering solutions in the constructional and designing environment.*	*Remember*
CO2:	*Categorize the types of laser and utilize it for specific application based on their desirable requisite.*	*Analyze*
CO3:	*Utilize the conceived concepts and techniques for synthesizing novel crystals with enhanced multifunctional properties.*	*Apply*
CO4:	*Enumerate the preambles of quantum physics and implement its concepts to tackle the cumbersome engineering problems.*	*Apply*
CO5:	*Comprehend the fundamental ideas of optoelectronic materials and to fabricate it for the potential applications*	*Understand*

UNIT – I ACOUSTICS AND ULTRASONICS [9]

Acoustics–Introduction – Classification of sound – Characteristics of musical sound – Loudness – Weber – Fechner law – Decibel – Absorption coefficient – Reverberation – Reverberation time – Sabine's formula: growth and decay (derivation) – Factors affecting acoustics of buildings and their remedies. Ultrasonics – Production –piezoelectric method – Properties – Velocity measurement: acoustical grating –Engineering applications– SONAR.

UNIT – II LASER TECHNOLOGY [9]

Introduction – Principle of Spontaneous emission and stimulated emission – Population inversion, pumping – Einstein's A and B coefficients (derivation). Types of lasers – Nd-YAG, CO_2 and Semiconductor lasers (homo-junction and hetero-junction) – Qualitative Industrial Applications: Lasers in welding, heat treatment and cutting – Medical applications – Holography (construction and reconstruction of images).

UNIT – III CRYSTAL PHYSICS [9]

Introduction to crystalline and amorphous solids – lattice and unit cell – seven crystal system and Bravais lattices – Miller indices(hkl) –d-spacing in cubic lattice – atomic radius – coordination number – packing factor calculation for sc, bcc, fcc and hcp– crystal defects – point, line and surface defects.

UNIT – IV QUANTUM PHYSICS [9]

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect - Theory and experimental verification – Matter waves – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box.

UNIT – V OPTOELECTRONIC DEVICES [9]

Photoconductive materials – Light Dependent Resistor (LDR) – Working – Applications – Photovoltaic materials – Solar cell – Construction, working and applications – Light Emitting Diode (LED) – Principle, construction and working - Liquid crystal Display (LCD) – Types and applications.

Total = 45 Periods

Text Books :

1. M.N. Avadhanulu and P.G. Kshirsagar, A text book of Engineering Physics, S. Chand and Company, New Delhi, seventh Edition, 2014.
2. R.K.Gaur&S.L.Gupta, Engineering Physics, Dhanpat Rai Publication, New Delhi, seventh Edition, 2014.

Reference Books :

1. D. Halliday, R. Resnick and J. Walker, Fundamentals of Physics, John Wiley & sons, USA, nineth Edition, 2011.
2. V. Rajendran, Engineering Physics, Tata McGraw Hill, New Delhi, first Edition, 2011.
3. R. A. Serway and J. W. Jewett, Physics for Scientists and Engineers with Modern Physics, nineth edition, Cengage Learning, USA, 2013.
4. Arthur Beiser, Concepts of Modern Physics, Tata McGraw Hill, New Delhi, sixth Edition, 2010.

Course Faculty ` **Module Coordinator** **Chairman BoS/ S & H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20PH051 **Course Name: ENGINEERING PHYSICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Describe the impact of engineering solutions in the constructional and designing environment.*	3	3			2			1		2		2		
CO2	*Categorize the types of laser and utilize it for specific application based on their desirable requisite.*	3	3			2			1		2		2		
CO3	*Utilize the conceived concepts and techniques for synthesizing novel crystals with enhanced multifunctional properties.*	3	3			2			1		2		2		
CO4	*Enumerate the preambles of quantum physics and implement its concepts to tackle the cumbersome engineering problems.*	3	3			2			1		2		2		
CO5	*Comprehend the fundamental ideas of optoelectronic materials and to fabricate it for the potential applications*	3	3			2			1		2		2		
	Average	3	3			2			1		2		2		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty ` **Module Coordinator** **Chairman BOS /S & H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

		L	T	P	C
20CS241	**PYTHON PROGRAMMING** (Common to AU, CE, EE, EC, ME & SF)	3	0	0	3

Prerequisite: *Basic knowledge of C programming.*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Illustrate basic concepts of python programming.*	*Understand*
CO2:	*Apply the necessary data structures includes list, tuple and dictionary in the required fields.*	*Apply*
CO3:	*Analyze, design and implement the problems using OOPs technology*	*Analyze*
CO4:	*Demonstrate the simple file operations*	*Evaluate*
CO5:	*Design web site using GUI.*	*Create*

UNIT – I FUNDAMENTALS OF PYTHON [9]

Introduction to Python – Advantages of Python programming – Variables and Data types – Comments – I/O function – Operators – Selection control structures – Looping control structures – Functions: Declaration – Types of arguments – Anonymous functions: Lambda.

UNIT – II DATA STRUCTURES AND PACKAGES [9]

Strings – List – Tuples – Dictionaries – Sets – Exception Handling: Built-in Exceptions – User-defined exception– Modules and Packages.

UNIT – III OBJECT ORIENTED PROGRAMMING [9]

Object Oriented Programming basics – Inheritance and Polymorphism – Operator Overloading and Overriding – Get and Set Attribute Values – Name Mangling – Duck Typing – Relationships.

UNIT – IV FILES AND DATA BASES [9]

File I/O operations – Directory Operations – Reading and Writing in Structured Files: CSV and JSON – Data manipulation using Oracle, MySQL and SQLite.

UNIT – V GUI AND WEB [9]

UI design: Tkinter – Events – Socket Programming – Sending email – CGI: Introduction to CGI Programming, GET and POST Methods, File Upload.

Total = 45 Periods

Text Books :

1 Mark Lutz, “Learning Python”, O'Reilly Media, Fifth Edition, 2013

2 Wesley J.Chun, “Core Python Programming”, Pearson Education, Second Edition, 2017

References :

1 Bill Lubanovic, "Introducing Python Modern Computing in Simple Packages", O'Reilly Media, First Edition, 2014.

2 David Beazley, Brian K. Jones, "Python Cookbook", O'Reilly Media, Third Edition, 2013

3 Mark Lutz, “Python Pocket Reference”, O'Reilly Media, Fifth Edition, 2014

4 www.python.org and www.diveintopython3.net

5 To practice: www.codeacademy.com and https://codingbat.com/python

Course Faculty ` **Module Coordinator** **Chairman BoS/CSE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CS241 **Course Name: PYTHON PROGRAMMING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Illustrate basic concepts of python programming.*	3	3	2	2	1				1			1		
CO2:	*Apply the necessary data structures includes list, tuple and dictionary in the required fields.*	3	3	3	2	2				1			1		
CO3:	*Analyze, design and implement the problems using OOPs technology*	3	3	3	2	2				1			1		
CO4:	*Demonstrate the simple file operations*	3	3	3	3	2				1			1		
CO5:	*Design web site using GUI.*	3	3	3	3	2				1			1		
	Average	**3**	**3**	**3**	**2**	**2**				**1**			**1**		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty ` **Module Coordinator** **Chairman BoS/CSE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

20CE231	**ENGINEERING MECHANICS**	L	T	P	C
		3	0	0	3

Prerequisite: *-*

Course Outcomes : On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Solve for the resultants of any force system and determine equivalent force system*	*Understand*
CO2:	*Analyze the moment acting on a body due to force and couples*	*Analyse*
CO3:	*Calculate the centroid, first moment and second moment of area*	*Understand*
CO4:	*Solve the problems on kinematics of particles and kinematics of rigid*	*Analyse*
CO5:	*Analyze the phenomenon of friction and solve problem related to the same*	*Analyse*

UNIT - I BASICS & STATICS OF PARTICLES [9]

Introduction – Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Coplanar Concurrent Forces – Resolution and Composition of forces – Equilibrium of a particle in 2D & 3D – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT - II EQUILIBRIUM OF RIGID BODIES [9]

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Equilibrium of Rigid bodies in two dimensions and three dimensions .

UNIT - III PROPERTIES OF SURFACES AND SOLIDS [9]

Centroid - parallel axis theorem and perpendicular axis theorem - First moment of area —Second moment of area –moment and Product of inertia of plane areas -Polar moment of inertia –Principal axes –Mass moment of inertia.

UNIT - IV DYNAMICS OF PARTICLES [9]

Displacements, Velocity and acceleration, their relationship –Relative motion – Curvilinear motion -Newton‟s laws of motion –Work Energy Equation – Impulse and Momentum – Impact of elastic bodies.

UNIT - V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS [9]

Static and Dynamic Friction – Types of friction- Laws of friction – Angle of repose –Translation and Rotation of Rigid Bodies — General Plane motion of simple rigid bodies.

Total (L: 45 T:15) = 60 Periods

Text Books :

1 Bhavikatti, S.S., Engineering Mechanics, New Age International Publishers, New Delhi, First Edition, 2016.

2 Natesan, S.C., Engineering Mechanics Statics and Dynamics, Umesh Publications, Naisarak, New Delhi, Third Edition, 2005.

Reference Books :

1 K. Rajasekaran, S. and Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd, New Delhi, Third Edition, 2005.

2 Hibbeller, R.C., Engineering Mechanics Statics and Dynamics, Pearson Education India, New Delhi, Fourteenth Edition, 2017.

3 Dubey, N.H., Engineering Mechanics Statics and Dynamics, Tata McGraw-Hill, New Delhi, First Edition, 2013.

4 Sinha, S.K., Engineering Mechanics Statics and Dynamics, Pearson Education India, New Delhi, First Edition, 2017.

Course Faculty ` **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE231 **Course Name: ENGINEERING MECHANICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Solve for the resultants of any force system and determine equivalent force system*	3	3	-	3	3	-	2	-	3	-	-	-	-	2
CO2	*Analyze the moment acting on a body due to force and couples*	3	3	-	2	2	-	2	-	3	-	-	-	-	2
CO3	*Calculate the centroid, first moment and second moment of area*	3	3	-	3	3	-	2	-	2	-	-	-	-	3
CO4	*Solve the problems on kinematics of particles and kinematics of rigid*	3	3	-	2	2	-	2	-	2	-	-	-	-	3
CO5	*Analyze the phenomenon of friction and solve problem related to the same*	2	3	-	3	2	-	2	-	3	-	-	-	-	3
	Average	**3**	**3**	**-**	**3**	**3**	**-**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

		L	T	P	C
20PH028	**PHYSICS LABORATORY** (Common to All Branches)	0	0	3	1

Prerequisite: *-*

Course Outcomes: On Completion of this course , the student will be able to		***Cognitive level***
CO1:	*Comprehend the different physical parameters of optics.*	*Analyse*
CO2:	*Perceive the production of ultrasonic waves through inverse piezoelectric effect and to determine the velocity of sound waves in the given liquid.*	*Remember*
CO3:	*Explore the principle of thermal conductivity thereby to calculate the thermal conductivity of various bad conductors like cardboard, mica, etc.*	*Apply*
CO4:	*Confer the experimental counterparts of materials properties such as modulus, solar cell, and energy gap.*	*Understand*
CO5:	*Imbibe the concept of capillary action in fluid dynamics and to compare the coefficient of viscosity of the given liquid.*	*Analyse*

List of Experiments in Physics Laboratory

1. Determination of wavelength of Laser using grating and the Size of the Particles.
2. Determination of thickness of the given material by Air – wedge method.
3. Determination of velocity of Ultrasonic waves and compressibility using Ultrasonic interferometer.
4. Spectrometer grating - Determination of wavelength of mercury spectrum.
5. Determination of thermal conductivity of a bad conductor by Lee's disc method.
6. Determination of Young's modulus of the material of a uniform bar by Non – Uniform bending method.
7. Determination of Band gap energy of a semiconductor.
8. Determination of Viscosity of a given liquid by Poiseuille's method.
9. Torsional pendulum - Determination of rigidity modulus of a given wire.
10. V-I Characteristics of Solar Cell .

Total : 30 Periods

Text Book :

1. Faculty Members of Physics, Physics Lab manual, Department of Physics, K.S.R. College of Engineering, Namakkal, Seventeenth Edition, 2018.
2. Dr. P. Mani, Physics Lab Manual & Observation Book, Dhanam Publications, Twelveth Edition Chennai 2017.

References :

1. Dr. G. Senthilkumar, Physics Lab manual, VRB Publications Pvt. Ltd., Chennai, Tenth Edition, 2006.
2. R Suresh & Dr. C. Kalyanasundaram, Physics Laboratory, Sri Krishna Hitech Publishing Company Pvt. Ltd., Chennai, Fifth Edition, 2017.

Course Faculty **Module Coordinator** **Chairman BoS/S & H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20PH028 **Course Name: PHYSICS LABORATORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Comprehend the different physical parameters of optics.*	3	3			2			1		2		2		
CO2	*Perceive the production of ultrasonic waves through inverse piezoelectric effect and to determine the velocity of sound waves in the given liquid*	3	3			2			1		2		2		
CO3	*Explore the principle of thermal conductivity thereby to calculate the thermal conductivity of various bad conductors like cardboard, mica, etc.*	3	3			2			1		2		2		
CO4	*Confer the experimental counterparts of materials properties such as modulus, solar cell, and energy gap.*	3	3			2			1		2		2		
CO5	*Imbibe the concept of capillary action in fluid dynamics and to compare the coefficient of viscosity of the given liquid.*	3	3			2			1		2		2		
	Average	3	3			2			1		2		2		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/S & H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

		L	T	P	C
20CS227	**PYTHON PROGRAMMING LABORATORY** (Common to AU, CE, EE, EC, ME & SF)	0	0	3	1

Prerequisite: *Basic knowledge of C programming.*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Design simple programs using conditionals and loops.*	*Apply*
CO2:	*Write functions to solve mathematical problems.*	*Understand*
CO3:	*Demonstrate the use of files in python.*	*Analyze*
CO4:	*Develop simple applications using python.*	*Create*
CO5:	*Construct GUI applications using python programming.*	*Create*

List of Experiments

1. Write a program to display the largest number among three numbers.
2. Write a program to check the prime number and to display the twin prime numbers.
3. Write a program to display the Fibonacci series and multiplication table by using looping constructs.
4. Write a program for converting decimal to octal, hexadecimals and vice versa by using functions.
5. Write a function to compute the GCD of two numbers.
6. Write a function to perform sorting list of numbers.
7. With the help of string array or list, display a simple calendar in python program without using the calendar module.
8. Demonstrate class and inheritance in python.
9. Create a text file using python file I/O. Read the content of the file and change them from lower to upper case characters. Write the updated content in another file and display it.
10. Write a program to demonstrate the user-defined exception handling mechanism in Python.
11. Design and implement a graphical user interface to perform any arithmetic operation.
12. Write a python program to insert and retrieve data using MySQL.

Total : 45 Periods

Course Faculty **Module Coordinator** **Chairman BoS/CSE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CS227** **Course Name:** **PYTHON PROGRAMMING LABORATORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Design simple programs using conditionals and loops.*	2	3	3	2	2				1			1		
CO2:	*Write functions to solve mathematical problems.*	3	3	3	2	2				1			1		
CO3:	*Demonstrate the use of files in python.*	3	3	3	2	2				1			1		
CO4:	*Develop simple applications using python.*	3	3	3	1	3				1			1		
CO5:	*Construct GUI applications using python programming.*	3	3	3	1	3				1			1		
	Average	**3**	**3**	**3**	**2**	**2**				**1**			**1**		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CSE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER –II

		L	T	P	C
20MC052	**ENVIRONMENTAL SCIENCE AND ENGINEERING** (Common to All Branches)	3	0	0	0

Prerequisite: -

	Course Outcomes: On Completion of this course , the student will be able to	***Cognitive level***
CO1:	*Interpret the importance in conservation of resources for future generation.*	*Understand*
CO2:	*Relate the importance of ecosystem and biodiversity.*	*Remember*
CO3:	*Analyze the impact of pollution and hazardous waste in a global and societal context.*	*Understand*
CO4:	*Identify the contemporary issues that result in environmental degradation that would attempt to provide solutions to overcome the problems.*	*Understand*
CO5:	*Predict the concept of Sustainability and Green Chemistry.*	*Understand*

UNIT – I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES [9]

Environment – definition – scope and importance – need for public awareness; Forest resources – use – over exploitation – deforestation; Water resources – over–utilization of surface and ground water; Mineral resources –environmental effects of extracting and using mineral resources; Food resources – overgrazing – effects of modern agriculture – fertilizer–pesticide problems – water logging – salinity; Role of an individual in conservation of natural resources. **Activity:** Slogan making event on conserving natural resources or plantation of trees.

UNIT – II ECOSYSTEM AND BIODIVERSITY [9]

Concept of an ecosystem – structure and function of an ecosystem – producers – consumers and decomposers – Food chain – food web – energy flow in the ecosystem – ecological pyramids – Ecological succession; Forest ecosystem and Aquatic ecosystems (Estuary and marine ecosystem); Biodiversity – introduction – definition – Values of biodiversity; Hot-spots of biodiversity; Endangered and Endemic Species of India. **Activity:** Arrange a trip to visit different varieties of plants.

UNIT– III ENVIRONMENTAL POLLUTION [9]

Pollution – introduction and different types of pollution; Causes – effects and control measures of air pollution and water pollution – water quality parameters – hardness – definition – types; Alkalinity – definition – types; BOD and COD (definition and significance); Noise pollution – solid waste management – hazardous waste – medical and e-wastes; Role of an individual in prevention of pollution. **Activity:** Drive for segregation of waste or cleanliness drive.

UNIT– IV SOCIAL ISSUES AND ENVIRONMENT [9]

Water conservation – rain water harvesting and watershed management; Environmental ethics – Issues and possible solutions; Climate change – global warming and its effects on flora and fauna – acid rain – ozone layer depletion; Disaster Management – earth quake – cyclone – tsunami – disaster preparedness – response and recovery from disaster. **Activity:** Poster making event on water management or Climate change.

UNIT– V SUSTAINABILITY AND GREEN CHEMISTRY [9]

Sustainable development – from unsustainable to sustainable development – Environmental Impact Assessment (EIA); Human rights; Value education; HIV/AIDS; Role of information technology in environment and human health; 12 Principles of Green Chemistry. **Activity:** Group discussion on Sustainability or Lecture from an expert on Green chemistry.

Total = 45 Periods

Text Book :

1 Dr. T. Arun Luiz, Environmental Science and Engineering, S.Chand & Company Private Limited, New Delhi, First Edition, 2016.

2 Anubha Kaushik and C. P. Kaushik, Environmental Science and Engineering, New Age International Publishers, Chennai, Fifth Edition, 2016.

Reference Books :

1 G. Tyler Miller and Scott E. Spoolman, Environmental Science, Cengage Learning India Private Limited, New Delhi, Fourteenth Edition, 2014.

2 Dr. A. Ravikrishnan, Environmental Science and Engineering, Sri Krishna Hi-tech Publishing Company Private Limited, Chennai, Tenth Edition, 2014.

3 Raman Sivakumar, Introduction to Environmental Science and Engineering, Tata McGraw Hill Education Private Limited, Fourth Edition, 2012.

4 S S. Dara, A Text book of Environmental Chemistry and pollution control, S. Chand & Company Limited, New Delhi, Tenth Edition, 2005.

Course Faculty **Module Coordinator** **Chairman BoS/S & H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20MC052** **Course Name:** **ENVIRONMENTAL SCIENCE AND ENGINEERING**

CO	Course Outcomes	Programme Outcomes												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Interpret the importance in conservation of resources for future generation.*	3	2	2			3	3	2				1		
CO2	*Relate the importance of ecosystem and biodiversity.*	3	2	2			3	3	2				1		
CO3	*Analyze the impact of pollution and hazardous waste in a global and societal context.*	3	2	2			3	3	2				1		
CO4	*Identify the contemporary issues that result in environmental degradation that would attempt to provide solutions to overcome the problems.*	3	2	2			3	3	2				1		
CO5	*Predict the concept of Sustainability and Green Chemistry.*	3	2	2			3	3	2				1		
	Average	**3**	**2**	**2**			**3**	**3**	**2**				**1**		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/ S & H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - II

		L	T	P	C
20GE051	**HERITAGE OF TAMILS** (common to all branches)	1	0	0	1

Prerequisite(s): *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Recognize the extensive literature of Tamil and its classical nature.*	*Understand*
CO2:	*Apprehend the heritage of sculpture, painting and musical instruments of ancient people.*	*Understand*
CO3:	*Review on folk and martial arts of tamil people.*	*Understand*
CO4:	*Insightthinai concepts, trade and victory of Chozha dynasty.*	*Understand*
CO5:	*Realize the contribution of Tamil in Indian freedom struggle, self-esteem movement and siddha medicine.*	*Understand*

UNIT - I LANGUAGE AND LITERATURE [03]

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT - II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE [03]

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT - III FOLK AND MARTIAL ARTS [03]

Therukoothu, Karagattam, VilluPattu, KaniyanKoothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT - IV THINAI CONCEPT OF TAMILS [03]

Flora and Fauna of Tamils &Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT - V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE [03]

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

Total (L= 15, T = 0) = 15 Periods

Text Books :

1. Social Life of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and RMRL – (in print)
2. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukarasu) (Published by : International Institute of Tamil Studies)

Reference Books :

1. Social Life of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published by: International Institute of Tamil Studies).
2. The Contribution of the Tamil to Indian Culture (Dr.M.Valarmathi) (Puplished by International Institute of Tamil Studies).
3. Keeladi – 'Sangam City Civilzation on the banks of river Vaigai; (Jointly Published by: Department of Archaeology &Tamilnadu Text Book and Educational Services Corporation, Tamilnadu)
4. Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)

CO-PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Recognize the extensive literature of Tamil and its classical nature.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO2:	*Apprehend the heritage of sculpture, painting and musical instruments of ancient people.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO3:	*Review on folk and martial arts of tamil people.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO4:	*Insight thinai concepts, trade and victory of Chozha dynasty.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO5:	*Realize the contribution of Tamil in Indian freedom struggle, self-esteem movement and siddha medicine.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
	Average	-	-	-	-	-	-	**3**	**3**	**-**	**2**	**-**	**3**	-	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / S & H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - II

		L	T	P	C
20GE051	**தமிழர்மரபு** (**அனைத்து துறைகளுக்கும் பொதுவானது**)	1	0	0	1

முன்கூட்டிய துறைசார் அறிவு : தேவை இல்லை

பாடம் கற்றத்தின் விளைவுகள் :பாடத்தை வெற்றிகரகமாக கற்று முடித்த பின்பு, மாணவர்களால் முடியும் விளைவுகள்		அறிவாற்றல் நிலை
CO1:	*தமிழ்மொழியின் செந்ததன்மை மற்றும் இலக்கியம் குறித்த தெரிதல்*	*புரிதல்*
CO2:	*தமிழர்களின் சிற்பக்கலை , ஓவியக்கலை மற்றும் இசைக் கருவிகள் குறித்த தெளிவு*	*புரிதல்*
CO3:	*தமிழர்களின் நாட்டுப் புரைக் கலைகள் மற்றும் வீரவிளையாட்டுகள் குறித்த தெளிவு*	*புரிதல்*
CO4:	*தமிழர்களின் திணைக் கோட்பாடுகள், சங்ககாலவணிகம் மற்றும் சோழர்களின் வெற்றிகள் குறித்த தகவல்கள் .*	*புரிதல்*
CO5:	*இந்திய தேசிய இயக்கம், சுயமரியாதை இயக்கம் மற்றும் சித்த மருத்தவம் பற்றிய புரிதல்.*	*புரிதல்*

அலகு – I **மொழி மற்றும் இலக்கியம்** **[03]**

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலயக்கிகியங்கள் – சங்க இலக்கியத்தின் சமயச்சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ் காப்பியங்கள், தமிழகத்தில் சமணபௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலகியங்கள் தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கியவளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு – II **மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை** **[03]**

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனியில் திருவள்ளுவர் சிலை – இசை கருவிகள் – மிருதங்கம், பறை. வீணை. யாழ். நாதஸ்வரம் – தமிழர்களின் சமூகபொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு – III **நாட்டுப் புறக் கலைகள் மற்றும் வீர விளையாட்டுக்கள்** **[03]**

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவை**க்** கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு – IV **தமிழர்களின் திணைக் கோட்பாடுகள்** **[03]**

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்கக்காலத்தில் தமிழகத்தில் எழுத்தறிவும் கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு – V **இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு** **[03]**

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறபகுதிகளில் தமிழ் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித்தமருத்துவத்தின் பங்கு கல்வெட்டுகள் கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்கள்களின் அச்சு வரலாறு.

Total (L= 15, T = 0) = 15 Periods

Text Books :

1. தமிழகவரலாறு-மக்களும்பண்பாடும்-கேகேபிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியில் பணிகள் கழகம்) ,உலகத் தமிழாராய்ச்சி நிறுவனம், சென்னை, 2002
2. கணினித்தமிழ்முனைவர் இல. சுந்தரம், விகடன் பிரசுரம், 2016

Reference Books :

1. கீழடி-வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம்.(தொல்லியல்துறைவெளியீடு)
2. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
3. Social Life of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and RMRL – (in print)
4. Social Life of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published by: International Institute of Tamil Studies).

CO-PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*தமிழ் மொழியின் செந்ததன்மை மற்றும் இலக்கியம் குறித்ததெரிதல்*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO2:	*தமிழர்களின் சிற்பக்கலை , ஓவியக்கலை மற்றும் இசைக் கருவிகள் குறித்த தெளிவு*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO3:	*தமிழர்களின் நாட்டுப்புரைக் கலைகள் மற்றும் வீரவிளையாட்டுகள் குறித்த தெளிவு*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO4:	*தமிழர்களின் திணைக் கோட்பாடுகள், சங்ககால வணிகம் மற்றும் சோழர்களின் வெற்றிகள் குறித்த தகவல்கள்.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO5:	*இந்திய தேசிய இயக்கம், சுயமரியாதை இயக்கம் மற்றும் சித்த மருத்தவம் பற்றிய புரிதல்.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
	Average	-	-	-	-	-	-	3	3	-	2	-	3	-	-

1. சிறிது (குறைந்த) 2. மிதமான (நடுத்தர) 3. கணிசமான (உயர்)

Course Faculty **Module Coordinator** **Chairman BoS / S & H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

		L	T	P	C
20MA331	**ENGINEERING MATHEMATICS - III (B.E. CIVIL ENGINEERING)**	3	1	0	4

Prerequisite: No prerequisites are needed for enrolling into the course.

Course Outcomes: On Completion of this course , the student will be able to		**Cognitive level**
CO1:	*Testing the hypothesis of the samples and get the inference of the samples obtained from the experiments.*	*Understand*
CO2:	*Solving the non-parametric data and obtain the conclusion of the test.*	*Apply*
CO3:	*Estimating the values by using Regression analysis.*	*Remember*
CO4:	*Evaluating Z-transforms and Difference equations.*	*Evaluate*
CO5:	*Solving the Fourier Transforms problems.*	*Apply*

UNIT - I **PARAMETRIC TESTS** **[12]**

Sampling distributions - Tests for single mean, proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – Chi-Square- test – Independence of attributes.

UNIT - II **NON –PARAMETRIC TESTS** **[12]**

Advantages of Non-Parametric tests – The Sign test, A rank sum test: The Mann-Whitney U test, The Kruskal-Wallis or H-test, One sample Run test- Spearman's Rank Correlation.

UNIT - III **CORRELATION AND REGRESSION ANALYSIS** **[12]**

Types of Correlation – Karl Pearson's Coefficient of Correlation – Spearman's Rank Correlation- Uses Regression Analysis- Difference between Correlation and Regression Analysis – Regression equation X on Y and Y on X.

UNIT - IV **Z TRANSFORMS AND DIFFERENCE EQUATIONS** **[12]**

Z-Transforms - Elementary properties - Inverse Z-Transforms by using Partial Fraction method and Convolution theorem (without proof) - Solutions of difference equations by using Z-Transforms.

UNIT - V **FOURIER TRANSFORMS** **[12]**

Fourier integral theorem (without proof) - Fourier Transform pair - Sine and cosine transforms - Properties - Transforms of simple functions - Convolution theorem (without proof).

Total (L: 45 T: 15) = 60 Periods

Text Books :

1 S.P. Gupta, Statistical Methods, Sultan Chand & Sons, New Delhi, Forty first edition, 2014

2 Veerarajan.T Engineering Mathematics, Tata McGraw Hill Publications, New Delhi, Third edition, 2015.

Reference Books:

1 Kreyszig. E. Advance Engineering Mathematics, John Wiley and Sons, New Delhi, Eighth edition, 2016.

2 R.S.N. Pillai and Mrs.Bagavathi, Practical Statistics , Sultan Chand, New Delhi, Thirty second edition 2015.

3 Dr. K. Vairamickam, Transforms and Partial Differential Equations , Scitech Publications, Third edition, 2015.

4 Grewal B.S, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company, New Delhi, Forty third edition, (2015).

Course Faculty **Module Coordinator** **Chairman BoS/S & H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20MA331 **Course Name: ENGINEERING MATHEMATICS - III**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Testing the hypothesis of the samples and get the inference of the samples obtained from the experiments.*	3	3	3	3										
CO2	*Solving the non-parametric data and obtain the conclusion of the test.*	3	3	3	3										
CO3	*Estimating the values by using Regression analysis.*	3	3	3	3										
CO4	*Evaluating Z-transforms and Difference equations.*	3	3	3	3										
CO5	*Solving the Fourier Transforms problems.*	3	3	3	3										
Average		**3**	**3**	**3**	**3**										

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** ***Chairman BoS S&H***

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

		L	T	P	C
20CE312	**ENGINEERING GEOLOGY**	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Get acquainted with internal structure of earth, natural dynamic processes and their actions. and their importance for civil engineering structures*	*Understand and Remembering*
CO2:	*Identify different types of minerals based on their property*	*Analyze*
CO3:	*Categorize rocks by their origin and engineering properties.*	*Analyze*
CO4:	*Evaluate geological maps, geological structures and interpret the geological exploration methods for suitable site selection.*	*Analyze and Understand*
CO5:	*Know the significance of geological investigations for civil engineering projects and site selection as well as for the preparation of feasibility reports and others.*	*Apply*

UNIT - I PHYSICAL GEOLOGY [9]

Geology in Civil Engineering – Branches of Geology – Earth Structures and Composition – Elementary Knowledge on Continental Drift and Plate Technologies. Earth Processes – Weathering – Work of Rivers, Wind and Sea and their Engineering Importance – Earthquake Belts in India. Groundwater – Mode of Occurrence – Prospecting – Importance in Civil Engineering.

UNIT - II MINERALOGY [9]

Physical Properties of minerals – Quartz group, Feldspar group, Pyroxene - Hypersthene and Augite, Amphibole – Hornblende, Mica – Muscovite and Biotite, Calcite, Gypsum and Clay minerals.

UNIT - III PETROLOGY [9]

Classification of rocks, distinction between igneous, sedimentary and metamorphic rocks. Engineering properties of rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.

UNIT - IV STRUCTURAL GEOLOGY AND GEOPHYSICAL METHOD [9]

Attitude of Beds – Outcrops – Introduction to Geological Maps – Study of Structures – Folds, Faults and Joints – Their Bearing on Engineering Construction. Seismic and Electrical Methods for Civil Engineering Investigations.

UNIT - V GEOLOGICAL INVESTIGATIONS IN CIVIL ENGINEERING [9]

Geological Conditions Necessary for Construction of Reservoirs and Dams, Tunnels, Buildings, Road Cuttings, Land Slides – Causes and Preventions. Sea Erosion and Coastal Protection.

Total (L : 45 T : 0) = 45 Periods

Text Books:

1. Parbin Singh., Engineering and General Geology, S.K. Kataria & Sons, Katson Publishing House, Ludhiana, Reprint 2013.
2. Varghee, P.C., Engineering Geology for Civil Engineers, PHI Learning Private Ltd, New Delhi, First Edition, 2012.

Reference Books:

1. Krynine, D. P. and Judd, W. R., Principles of Engineering Geology and Geotechnics, CBS Publisher, Chennai, First Edition, 2018.
2. Billings Marland. P., Structural Geology, Pearson Education, London, Third Edition, 2016.
3. Chenna Kesavulu N., Textbook of Engineering Geology, Laxmi Publications Pvt Ltd, Bengaluru, Third Edition, 2018.
4. http://nptel.ac.in/courses/105105106/.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE312 **Course Name: ENGINEERING GEOLOGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Get acquainted with internal structure of earth, natural dynamic processes and their actions. and their importance for civil engineering structures*	2	-	-	-	-	-	-	-	-	-	-	-	2	1
CO2	*Identify different types of minerals based on their property*	3	3	-	-	-	-	-	-	-	-	-	-	3	2
CO3	*Categorize rocks by their origin and engineering properties.*	3	3	1	-	-	-	1	-	-	-	-	1	3	3
CO4	*Evaluate geological maps, geological structures and interpret the geological exploration methods for suitable site selection.*	3	3	1	-	-	2	1	-	-	-	-	1	3	3
CO5	*Know the significance of geological investigations for civil engineering projects and site selection as well as for the preparation of feasibility reports and others.*	3	3	2	-	-	1	1	-	-	-	-	1	3	3
	Average	**3**	**3**	**1**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**3**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

		L	T	P	C
20CE313	**FLUID MECHANICS**	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Solve problems involving fluid properties.*	*Understand*
CO2:	*Derive and apply general governing equations for various fluid flows.*	*Apply*
CO3:	*Determine velocity and fluid flow rates, major and minor losses in pipe flow.*	*Evaluate*
CO4:	*Analyse the concept of boundary layer theory and flow separation.*	*Analyse*
CO5:	*Do the model analysis and similitude distorted models..*	*Apply*

UNIT - I FLUID PROPERTIES AND FLUID STATICS [9]

Fluid – Definition, Distinction between Solid and Fluid – Units and Dimensions – Properties of Fluids – Density, Specific Weight, Specific Volume, Specific Gravity, Temperature, Viscosity, Compressibility, Vapour Pressure, Capillarity and Surface Tension – Fluid Statics: Concept of Fluid Static Pressure, Absolute and Gauge Pressure – Pressure Measurements by Manometers and Pressure Gauges – Forces on Planes – Centre of Pressure – Buoyancy and Floatation

UNIT - II FLUID KINEMATICS AND DYNAMICS [9]

Fluid Kinematics – Flow Visualization – Lines of Flow – Velocity Field and Acceleration – Continuity Equation (1,2 & 3D forms) – Equation of Streamline – Stream Function – Velocity Potential Function – Circulation – Flow Net. Fluid Dynamics – Equations of Motion – Euler's Equation along a Streamline – Bernoulli's Equation – Application – Venturi Meter, Orifice Meter and Pitot Tube, Linear Momentum Equation and its Application.

UNIT - III FLOW THROUGH PIPES [9]

Viscous Flow – Shear Stress, Pressure Gradient Relationship – Laminar Flow between Parallel Plates – Laminar Flow Through Circular Tubes (Hagen Poiseuille's) – Hydraulic and Energy Gradient – Flow Through Pipes – Darcy – Weisbach's Equation – Pipe Roughness – Friction Factor – Moody's Diagram – Major and Minor Losses of Flow in Pipes – Pipes in Series and in Parallel.

UNIT - IV BOUNDARY LAYER [9]

Boundary Layer – Definition – Boundary Layer on a Flat Plate - Thickness and Classification – Displacement, Energy and Momentum Thickness – Boundary Layer Separation and Control - Drag in Flat Plate – Drag and Lift Coefficients.

UNIT - V DIMENSIONAL ANALYSIS AND MODEL STUDIES [9]

Fundamental Dimensions – Dimensional Homogeneity – Rayleigh's Method and Buckingham Pi-Theorem – Dimensionless Parameters – Similitude and Model studies – Distorted Models

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Bansal, R.K., A Textbook of Fluid Mechanics and Hydraulics Machines, Laxmi Publications Pvt. Ltd., New Delhi, Tenth Edition, 2018.

2 Modi, P.N and Seth, S.M., Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House, New Delhi, Twenty First Edition, 2017.

Reference Books :

1 Rajput, R.K., Fluid Mechanics and Hydraulic Machines, S Chand and Company, New Delhi, Sixth Edition, 2016.

2 Hibbeler, R.C., Fluid Mechanics in SI Units, Pearson Education, New Delhi, First Edition, 2017.

3 White, F.M., Fluid Mechanics, McGraw Hill Education India Private Limited, Bengaluru, Eighth Edition, 2017.

4 https://nptel.ac.in/courses/112/104/112104118/

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE313 **Course Name: FLUID MECHANICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Solve problems involving fluid properties.*	3	3	1	2	-	-	1	-	-	-	-	-	3	3
CO2	*Derive and apply general governing equations for various fluid flows.*	3	3	1	2	-	-	1	-	-	-	-	-	3	3
CO3	*Determine velocity and fluid flow rates, major and minor losses in pipe flow.*	3	3	1	2	-	-	1	-	-	-	-	-	3	3
CO4	*Analyse the concept of boundary layer theory and flow separation.*	3	3	1	2	-	-	1	-	-	-	-	-	3	3
CO5	*Do the model analysis and similitude distorted models.*	3	3	1	2	-	-	1	-	-	-	-	-	3	3
	Average	**3**	**3**	**1**	**2**	-	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – III

		L	T	P	C
20CE314	**MECHANICS OF SOLIDS**	3	0	0	3

Prerequisite: Engineering Mechanics

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Apply the fundamental concepts of force-deformation, and stress-strain relationships to the solid and structural mechanics problems.*	*Understand*
CO2:	*Evaluate the principal stress & strain of a stressed member and analyze the behaviour of the trusses subjected to loading.*	*Evaluate*
CO3:	*Develop shear force and bending moment diagrams of a beam and find the maximum shear/ moment and their locations, and get knowledge on theory of simple bending*	*Analyse*
CO4:	*Determine the slope and deflection of beams by using various methods.*	*Analyse*
CO5:	*Analyse shear stress distribution and the effect of torsion in solid and hollow shaft and also about stresses and deflection in springs*	*Analyse*

UNIT - I STRESS,STRAIN AND DEFORMATION OF SOLIDS [09]

Rigid Bodies and Deformable Solids – Stability, Strength, Stiffness – Tension, Compression and Shear Stresses – Strain, Elasticity, Hooke"s Law, Limit of Proportionality, Modulus of Elasticity, Stress-Strain Curve, Lateral Strain – Deformation of Simple and Compound Bars – Temperature Stresses – Shear Modulus, Bulk Modulus, Relationship between Elastic Constants – Volumetric Strain.

UNIT - II COMPLEX STRESSES AND ANALYSIS OF PLANE TRUSSES [09]

Principal Stresses and Principal Planes- Biaxial State of Stress – Stress at a Point – Stress on Inclined Plane – Mohr"s Circle of Stresses. Stability and Equilibrium of Plane Frames – Types of Trusses – Analysis of Forces in Truss Members by Method of Joints, Method of Sections and Method of Tension Coefficients.

UNIT - III TRANSVERSE LOADING ON BEAMS [09]

Beams – Types of Supports – Simple and Fixed, Types of Load – Concentrated, Uniformly Distributed, Uniformly Varying Load, Combination of Above Loading – Relationship between Bending Moment and Shear Force – Bending Moment Diagram and Shear Force Diagram for Cantilever, Simply Supported and Over Hanging Beams. Theory of Simple Bending - Section Modulus - Analysis of Stresses - Load Carrying Capacity of beams

UNIT - IV DEFLECTION OF BEAMS [09]

Slope and Deflection of Beams - Double Integration Method – Macaulay"s Method – Moment Area Method and Conjugate Beam Method

UNIT - V SHEAR STRESSES, TORSION AND SPRINGS [09]

Variation of Shear Stress – Shear Stress Distribution in Rectangular, I Sections, Solid Circular Sections, Hollow Circular Sections, Angle and Channel Sections. Stresses and Deformation in Circular (Solid and Hollow) Shafts – Stepped Shafts. Leaf Springs – Stresses in Helical Springs – Deflection of Springs.

Total (L:45 T:0) = 60 Periods

Text Books :

1 Bansal, R.K.A., Textbook of Strength of Materials, Laxmi Publications, New Delhi, Sixth Edition, 2018.

2 Rajput, R.K., Strength of Materials, S. Chand Publications, New Delhi, Sixth Edition, 2015.

Reference Books :

1 Punmia, B.C. Ashok Kumar Jain. and Arun Kumar Jain., Mechanics of Material, Laxmi Publications, New Delhi, Revised Edition, 2017.

2 Srinath, L.S., Advanced Mechanics of Solids, McGraw Hill Education, Bengaluru, 2010.

3 Egor, P. Popov., Engineering Mechanics of Solids, Pearson Education, New Delhi, Second Edition, 2015.

4 Subramanian, R., Strength of Materials, Oxford University Press, Bengaluru, Third Edition, 2016.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE314 **Course Name: MECHANICS OF SOLIDS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Apply the fundamental concepts of force-deformation, and stress-strain relationships to the solid and structural mechanics problems.*	*3*	*3*	*2*	*-*	*-*	*3*	*-*	*-*	*-*	*-*	*-*	*1*	*3*	*3*
CO2	*Evaluate the principal stress & strain of a stressed member and analyze the behaviour of the trusses subjected to loading.*	*3*	*3*	*2*	*-*	*-*	*3*	*-*	*-*	*-*	*-*	*-*	*1*	*3*	*3*
CO3	*Develop shear force and bending moment diagrams of a beam and find the maximum shear/ moment and their locations, and get knowledge on theory of simple bending*	*3*	*3*	*2*	*-*	*-*	*3*	*-*	*-*	*-*	*-*	*-*	*1*	*3*	*3*
CO4	*Determine the slope and deflection of beams by using various methods.*	*3*	*3*	*2*	*-*	*-*	*3*	*-*	*-*	*-*	*-*	*-*	*1*	*3*	*3*
CO5	*Analyse shear stress distribution and the effect of torsion in solid and hollow shaft and also about stresses and deflection in springs*	*3*	*3*	*2*	*-*	*-*	*3*	*-*	*-*	*-*	*-*	*-*	*1*	*3*	*3*
	Average	***3***	***3***	***2***	***-***	***-***	***3***	***-***	***-***	***-***	***-***	***-***	***1***	***3***	***3***

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

		L	T	P	C
20CE315	**SURVEYING**	3	0	0	3

Prerequisite: *-*

Course Outcomes: On Completion of this course, the student will be able to ***Cognitive Level***

CO1:	*Know how to use surveying instruments and how to find the height, distance of each point, and to prepare profile of the ground and contour maps for Civil Engineering projects.*	*Understand*
CO2:	*Explain the theoretical backgrounds of Theodolite surveying and plan a survey for applications such as road alignment and height of the building.*	*Understand*
CO3:	*Carry out survey for large areas using the concepts of triangulation and trigonometric leveling.*	*Apply*
CO4:	*Estimate measurement errors and apply corrections*	*Apply*
CO5:	Design numerical solutions for carrying out surveying in civil engineering field using *advanced surveying techniques such as remote sensing, GPS, photogrammetry etc.*	*Analyze*

UNIT - I INTRODUCTION TO PLANE SURVEYING AND LEVELLING [9]

Surveying, Classification of Surveys, Linear Measurements with Chain and Tapes, Field Survey by Chains/Tapes, Compass Surveying, True and Magnetic Bearings, Local Attraction, Fore and Back Bearing, Various Types of Compasses and Applications, Detail Plotting, Traverse Using Graphical Approach, Plane Table Accessories, Methods of Plane Table Survey, Contouring, Methods of Levelling, Determination of Height, Booking of Levelling Operation, Types of Levels, Guidelines for Preparation of Contour Maps, Methods of Contouring.

UNIT - II THEODOLITE SURVEY AND CURVES [9]

Theodolites, Measurements of Horizontal and Vertical Angles, Differences in Vernier and Microscopic Theodolites, Methods of Recording Angles, Principle and basic system, Subtensebar, Various Types of Tachometers, plotting with Tacheometers, Curves, Classification, Elements of Simple Circular, Compound, Reverse, Transition, Vertical Curves, Setting of Curves.

UNIT - III TRIGNOMETRICAL LEVELLING [9]

Triangulation, Purpose of Triangulation and Trilateration, Classification, Strength of Figure, Well-Conditioned Triangle, Triangulation Figures, Reconnaissance and Station Selection, Inter Visibility of Stations, Signal and Towers, Base Lining, Computation and Adjustment in Triangulation, Satellite Station, Reduction to centre, Trigonometrical leveling – Single and reciprocal observations.

UNIT - IV SURVEY ERRORS AND ADJUSTMENTS [9]

Sources of Errors, Errors in Chain, Compass and Theodolite Survey, Laws of Accidental Errors, Principles of Least Squares, Laws of Weights, Determination of Probable Error, Distribution of Error of the Field Measurements, Normal Equations, Determination of the Most Probable values, Method of Correlates, Triangulation Adjustments, Figure Adjustment, Adjustment of Geodetic Triangle, Adjustment of Chain of Triangles, Method of Equal Shift.

UNIT - V ADVANCED SURVEYING [9]

Hydrographic Surveying, Soundings, Method of Locating Sounding, EDM - Principles and Applications, Geodimeter, Tellurometer, Distomat etc., Digital Theodolites, Total Station, GPS. Introduction to Photogrammetry, Comparison of Serial Photographs and Topographic Maps, Definition of Basic Terms, Perspective of Near-Vertical Photograph, Scale and Coordinates from Photographs, Stereoscopy, Parallel Bar Measurements, Determination of Heights, Principle of Radial Line Triangulation, Assumption, Limitations and Errors.

Total (L: 45 T: 0) = 45 Periods

Text Books:

1 Punmia, B.C. Ashok Kumar Jain, and Arun Kumar Jain., Surveying and Levelling,Vol.1, and Vol.2, Laxmi Publication, New Delhi, Seventeenth Edition, 2017.
2 Gopi, Satheesh. Sathikumar, R. and Madhu, N., Advanced Surveying: Total Station, GPS, GIS & Remote Sensing, Pearson Education, New Delhi, Second Edition, 2017.

Reference Books:

1 Basak, N.N., Surveying and Levelling, Mc Graw Hill Education Pvt. Ltd, New Delhi, Second Edition, 2017.
2 Bhavikatti, S.S., Surveying and Levelling, Vol. I& II, I K International Publishing House Pvt. Ltd, New Delhi, 2019.
3 Venugopalarao, P. and Vijalakshmi Akella, Text Book of Surveying, PHI Learning, New Delhi, First Edition, 2015.
4 Duggal. S.K., Surveying, Vol. I& II, Mc Graw Hill Education Pvt. Ltd, New Delhi, Fourth Edition, 2017.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE315 **Course Name: SURVEYING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Know how to use surveying instruments and how to find the height, distance of each point, and to prepare profile of the ground and contour maps for Civil Engineering projects.*	3	2	1	2	1	2	-	-	-	-	-	2	3	-
CO2	*Explain the theoretical backgrounds of Theodolite surveying and plan a survey for applications such as road alignment and height of the building.*	3	2	1	2	1	2	-	-	-	-	-	2	3	-
CO3	*Carry out survey for large areas using the concepts of triangulation and trigonometric leveling.*	3	2	1	2	1	2	-	-	-	-	-	2	3	-
CO4	*Estimate measurement errors and apply corrections*	3	2	1	2	-	2	-	-	-	-	-	2	3	-
CO5	Design numerical solutions for carrying out surveying in civil engineering field using *advanced surveying techniques such as remote sensing, GPS, photogrammetry etc.*	3	2	1	2	2	2	-	-	-	-	-	2	3	-
	Average	**3**	**2**	**1**	**2**	**1**	2	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

20CE316	**CONSTRUCTION MATERIALS**	L	T	P	C
		2	0	0	2

Prerequisite: *-*

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Use suitable construction materials for building construction.*	*Apply*
CO2:	*Suggest the suitability of lime, cement, aggregates and mortar for building construction.*	*Apply*
CO3:	*Analyse the properties of concrete for building construction.*	*Analyse*
CO4:	*Identify suitable timber products and other materials for appropriate construction.*	*Apply*
CO5:	*Select and justify appropriate advanced and modern building materials for various construction applications*	*Evaluate*

UNIT - I STONES – BRICKS – CONCRETE BLOCKS [9]

Stone as Building Material – Criteria for Selection – Tests on Stones – Deterioration and Preservation of Stone Work – Bricks – Classification – Manufacturing of Clay and Fly Ash Bricks – Tests on Bricks – Compressive Strength – Water Absorption – Efflorescence – Bricks for Special Use – Refractory Bricks – Cement, Concrete Blocks – Lightweight Concrete Blocks.

UNIT - II LIME – CEMENT – AGGREGATES – MORTAR [9]

Lime: Characteristics, Classification, Manufacturing Process – Cement: Ingredients, Types and Grades, Properties, Manufacturing process, Testing of Cement– Industrial By-products: Fly ash – Aggregates: Natural Stone Aggregates, Classification Characteristics of Aggregates, Testing of Aggregates - Cement Mortar: Functions, Uses of Mortar, Types of Mortar, Ingredients of Mortar, Tests

UNIT - III CONCRETE [9]

Introduction – Characteristics of Good Concrete – Advantages and Disadvantages of Concrete – Application – Classification – Plain Cement Concrete – Ingredients – Bulking of Sand - Water Cement Ratio – Grading of Aggregates – Methods of Proportioning – Mixes Used in Concrete Works – Workability - Preparation of Plain Cement Concrete – Properties – Water Proof Concrete – Concepts of Precast, Reinforced &Prestressed Concrete

UNIT - IV TIMBER AND OTHER MATERIALS [9]

Timber – Market Forms – Industrial Timber– Plywood – Veneer – Thermacole – Panels of Laminates – Steel – Aluminum and Other Metallic Materials – Composition – Aluminium composite panel – Uses – Market forms – Mechanical treatment – Paints – Varnishes – Distempers.

UNIT - V MODERN MATERIALS [9]

Glass – Ceramics – Sealants for Joints – Fibre Glass Reinforced Plastic – Clay Products – Refractories – Composite Materials – Types – Applications of Laminar Composites – Fibre Textiles – Geomembranes and Geotextiles for Earth Reinforcement.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1 Varghese, P.C., Building Materials, Prentice Hall India Learning Private Limited, Delhi, Second Edition, 2015.
2 Rajput. R.K., Engineering Materials, S Chand & Company, Coimbatore, Third Edition, 2006.

Reference Books :

1 Jagadish.K.S., Venktarama Reddy., B.V. and Nanjunda Rao, K.S., Alternative Building Materials Technology, New Age International Private Limited, Bengaluru, Second Edition, 2017.
2 Gambhir, M.L. and Neha Jamwal., Building Materials, Products, Properties and Systems, McGraw Hill Education, Bengaluru, First Edition, 2017.
3 Bhavikatti, S.S., Building Materials, Vikas Publishing House, Noida, First Edition, 2012.
4 http://nptel.ac.in/courses/105102088/.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE316 **Course Name: CONSTRUCTION MATERIALS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Use suitable construction materials for building construction.*	3	2	-	1	-	1	-	-	-	-	-	2	2	2
CO2	*Suggest the suitability of lime, cement, aggregates and mortar for building construction.*	3	-	-	-	-	-	-	-	-	-	-	2	2	2
CO3	*Analyse the properties of concrete for building construction.*	3	2	2	-	-	1	-	-	-	-	-	2	2	2
CO4	*Identify suitable timber products and other materials for appropriate construction.*	3	-	-	-	-	1	-	-	-	-	-	2	2	2
CO5	*Select and justify appropriate advanced and modern building materials for various construction applications*	2	-	-	1	-	1	-	-	-	-	-	1	2	2
Average		**3**	**2**	2	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

20CE321	**COMPUTER AIDED BUILDING DRAWING**	L	T	P	C
		0	0	3	1

Prerequisite: *-*

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Apply the principles of planning and bye-laws used in building planning.*	*Apply*
CO2:	*Prepare comprehensive planning and draw layout, plan, elevation & sectional elevation of different types of building.*	*Understand Apply*
CO3:	*Draw plan, elevation and section of RCC framed structures.*	*Create*
CO4:	*Draw plan, elevation and section of factory buildings.*	*Create*
CO5:	*Develop 2D and 3D model of building*	*Create*

List of Experiments:

1. Classification of buildings - Principles of Planning - Dimensions of Buildings - Building Bye-Laws for Floor Area Ratio, Open Spaces - Orientation of Buildings - Lighting and Ventilation
2. Planning and Preparing Sketches and Detailed Drawings of Residential Buildings (Flat and Sloping Roof), Schools, Hostels, Hospitals Including Details of Doors and Windows
3. Detailed Drawings of RCC Framed Structures
4. Detailed Drawings of Single Storey Factory Buildings with Trusses.
5. Perspective View of One and Two Storey Buildings

Total : 45 Periods

CO PO MAPPING

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	*Apply the principles of planning and bye-laws used in building planning.*	*3*	-	3	2	3	-	-	-	2	3	-	3	2	2
CO2	*Prepare comprehensive planning and draw layout, plan, elevation & sectional elevation of different types of building.*	*3*	-	2	3	3	-	-	-	2	3	-	3	2	1
CO3	*Draw plan, elevation and section of RCC framed structures.*	*3*	-	2	2	3	3	-	-	2	2	-	3	-	1
CO4	*Draw plan, elevation and section of factory buildings.*	*3*	-	3	3	2	3	3	-	3	3	-	3	2	1
CO5	*Develop 2D and 3D model of building*	*-*	-	3	-	3	-	-	-	-	-	2	3	-	1
	Average	***3***	**-**	**3**	**2**	**3**	**3**	**3**	**-**	**2**	**3**	**2**	**3**	**2**	**1**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

20CE322	**SURVEY PRACTICAL**	L	T	P	C
		0	0	3	1

Prerequisite: *-*

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Handle survey instruments like theodolite, tacheometery and total station in field.*	*Understand*
CO2:	*Determine the elevation of points using levelling instrument.*	*Evaluate*
CO3:	*Calculate the height and distance of various objects.*	*Evaluate*
CO4:	*Carryout triangulation surveying including general field marking for various engineering projects and curves setting.*	*Analyse*
CO5:	*Use total station for various engineering project*	*Understand*

List of Experiments:

CHAIN SURVEYING & COMPASS SURVEYING & PLANE TABLE SURVEYING

1. Study of Chain, Compass, Plane Table Surveying and its Accessories

LEVELLING AND ITS APPLICATIONS

2. Study of Levels and Leveling Staff
3. Fly Leveling and Check Leveling using Dumpy Level

THEODOLITE SURVEYING AND ITS APPLICATIONS

4. Study of Theodolite and its Accessories
5. Measurement of Horizontal and Vertical Angle
6. Theodolite Traversing
7. Tachometric Constants
8. Heights and Distances using Stadia Tachometric Principles
9. Heights and Distances using Tangential Tachometric Principles
10. Heights and Distances using Triangulation – Single and Double plane Method
11. Setting out Simple Curve & Transition Curve
12. Field Work using Total Station

Total : 45 Periods

CO PO MAPPING

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	*Handle survey instruments like theodolite, tacheometery and total station in field.*	3	3	-	-	3	-	-	-	2	1	-	1	2	2
CO2	*Determine the elevation of points using levelling instrument.*	3	3	-	-	-	1	-	-	2	1	-	1	-	2
CO3	*Calculate the height and distance of various objects.*	3	3	-	-	-	1	-	-	2	1	-	1	-	2
CO4	*Carryout triangulation surveying including general field marking for various engineering projects and curves setting.*	3	3	-	-	-	1	-	-	2	1	-	1	-	2
CO5	*Use total station for various engineering project*	3	3	-	-	3	1	-	-	2	1	-	2	2	2
	Average	**3**	**3**	**-**	-	3	**1**	-	**-**	**2**	**1**	**-**	**2**	**2**	**2**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

20CE323	**STRENGTH OF MATERIALS LABORATORY**	L	T	P	C
		0	0	3	1

Prerequisite: -

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Elaborate the behaviour of materials upon normal external loads.*	*Understand*
CO2:	*Apply the linear laws of elasticity as related to stress and strain.*	*Apply*
CO3:	*Measure the deflection of different sections.*	*Evaluate*
CO4:	*Predict the behaviour of the material under impact conditions.*	*Analyse*
CO5:	*Estimate the physical and mechanical behaviour and properties of construction materials.*	*Evaluate*

List of Experiments:

1. Axial Compression Test to Obtain the Stress – Strain Curve
2. Axial Tension Test to Obtain the Stress – Strain Curve and the Strength
3. Torsion Test to Obtain the Torque vs. Angle of Twist and the Stiffness
4. Flexural test to obtain the Load Deflection Curve and the Stiffness
5. Compression and tension spring test to obtain the Load Deflection Curve and the Stiffness
6. Rockwell and Brinell hardness tests to obtain the hardness number
7. Shear test obtain the maximum shear strength
8. Charpy and Izod impact test to obtain the impact resistance
9. Tests on Brick
   i) Compressive strength
   ii) Efflorescence
   iii) Water absorption
10. Tests on Cement
    i) Standard consistency
    ii) Setting time
    iii) Soundness
    iv) Compressive strength

Total : 45 Periods

CO PO MAPPING

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	*Elaborate the behaviour of materials upon normal external loads.*	3	2	-	3	-	2	-	-	2	-	-	2	3	3
CO2	*Apply the linear laws of elasticity as related to stress and strain.*	3	2	-	3	-	2	-	-	2	-	-	2	3	3
CO3	*Measure the deflection of different sections.*	3	2	-	3	-	2	-	-	2	-	-	2	3	3
CO4	*Predict the behaviour of the material under impact conditions.*	3	2	-	3	-	2	-	-	2	-	-	2	3	3
CO5	*Estimate the physical and mechanical behaviour and properties of construction materials.*	3	2	-	3	-	2	-	-	2	-	-	2	3	3
	Average	**3**	**2**	**-**	**3**	**-**	**2**	**-**	**-**	**2**	**-**	**-**	**2**	**3**	**3**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

		L	T	P	C
20HR351	**CAREER DEVELOPMENT SKILLS – I**				
	(Common to all branches)	0	2	0	0

Prerequisite: *-*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Have competent knowledge on grammar with an understanding of its basic rules.*	*Understand*
CO2:	*Communicate effectively and enhance interpersonal skills with renewed self – confidence*	*Apply*
CO3:	*Construct sentence in English and make correction*	*Apply*
CO4:	*Perform oral communication in any formal situation*	*Create*
CO5:	*Develop their LSRW skills.*	*Understand*

UNIT - I **EFFECTIVE ENGLISH – SPOKEN ENGLISH** **[06]**

Basic Rules of Grammar – Parts of Speech – Tenses – Verbs – Sentences construction - Vocabulary – idioms & phrases – Synonyms – Antonyms – Dialogues and conversation – Exercise(Speaking).

UNIT - II **ESSENTIAL COMMUNICATION** **[06]**

Verbal communication – Effective communication – Active Listening – Paraphrasing – Feedback, Non Verbal Communication – Body language of self and Others, Important of feelings in communication – Dealing with feelings in communication practice – Exercise.

UNIT - III **WRITTEN COMMUNICATION – PART 1** **[06]**

Usage of noun, pronoun, adjective (Comparative Forms), Verb, Adjectives, Adverb, Tenses, Articles and Preposition – Change of Voice – Change of Speech – One word Substitution – Using the same word as different parts of speech – Odd Man Out – Spelling & Punctuation (Editing).

UNIT - IV **WRITTEN COMMUNICATION – PART – 2** **[06]**

Analogies – Sentences Formation – Sentence Completion – Sentence Correction – idioms & Phrases – Jumbled Sentences, Letter Drafting (Formal Letters) – Reading Comprehension (Level 1) – Contextual Usage – Foreign Languages Words used in English – Exercise.

UNIT - V **ORAL COMMUNICATION – PART – 1** **[06]**

Self-introduction – Situational Dialogues / Role Play (Telephonic Skills) – Oral Presentations – Prepared –'Just A Minute' Sessions (JAM) – Presentation Skills – Exercise.

Total (L= 0, T = 30) = 30 Periods

Text Books :

1 Anne Laws, Writing Skills, Orient Black Swan., Hyderabad, 2011.

2 Sarah Freeman, Written Communication in English, Orient Black Swan, Hyderabad, First Edition, 2015

Reference Books :

1 Raj N Bakshmi, English Grammar Practice, Orient Black Swan, Hyderabad, First Edition, 2009.

2 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005.

3 Thakur K B Sinha, Enrich Your English, Vijay Nicole, Chennai, First Edition, 2005.

4 Norman Lewis. W.R., "Word Power Made Easy", Goyal Publications.

Course Faculty **Module Coordinator** **Chairman BoS S&H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20HR351 **Course Name: CAREER DEVELOPMENT SKILLS - I**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Have competent knowledge on grammar with an understanding of its basic rules.*	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO2	*Communicate effectively and enhance interpersonal skills with renewed self – confidence*	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO3	*Construct sentence in English and make correction*	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO4	*Perform oral communication in any formal situation*	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO5	*Develop their LSRW skills.*	-	-	-	-	1	-	-	-	3	3	-	3	-	-
	Average	-	-	-	-	1	-	-	-	**3**	**3**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS S&H**

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SEMESTER - III

		L	T	P	C
20GE052	**TAMILS AND TECHNOLOGY** (Common to All Branches)	1	0	0	1

Prerequisite(s): *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Understand the weaving and ceramic technology of ancient Tamil People nature.*	*Understand*
CO2:	*Comprehend the construction technology, building materials in sangam Period and case studies.*	*Understand*
CO3:	*Infer the metal process, coin and beads manufacturing with relevant archeological evidence*	*Understand*
CO4:	*Realize the agriculture methods, irrigation technology and pearl diving.*	*Understand*
CO5:	*Apply the knowledge of scientific Tamil and Tamil computing.*	*Apply*

UNIT - I **WEAVING AND CERAMIC TECHNOLOGY** **[03]**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT - II **DESIGN AND CONSTRUCTION TECHNOLOGY** **[03]**

Designing and Structural construction House & Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram– Sculptures and Temples of Mamallapuram– Great Temples of Cholas and other worship places – Temples of Nayaka Period – Type study (Madurai Meenakshi Temple) – ThirumalaiNayakar Mahal –Chetti Nadu Houses, Indo –Saracenic architecture at Madras during British Period.

UNIT - III **MANUFACTURING TECHNOLOGY** **[03]**

Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel – Copper and gold – Coins as source of history – Minting of Coins – Beads making – industries Stone beads – Glass beads –Terracotta beads –Shell beads/ bone beats – Archeological evidences – Gem stone types described in Silappathikaram.

UNIT - IV **AGRICULTURE AND IRRIGATION TECHNOLOGY** **[03]**

Dam, Tank, ponds, Sluice, Significance of KumizhiThoompu of Chola Period, Animal Husbandry – Wells designed for cattle use – Agriculture and Agro Processing – Knowledge of Sea – Fisheries – Pearl – Conche diving – Ancient Knowledge of Ocean – Knowledge Specific Society.

UNIT - V **SCIENTIFIC TAMIL & TAMIL COMPUTING** **[03]**

Development of Scientific Tamil – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

Total (L= 15, T = 0) = 15 Periods

Text Books :

1. Social Life of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published by: International Institute of Tamil Studies).

Reference Books :

1. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukarasu) (Published by : International Institute of Tamil Studies)
2. The Contribution of the Tamils to Indian Culture (Dr.M.Valarmathi)(Puplished by International Institute of Tamil Studies).
3. Keeladi – 'Sangam City Civilzation on the banks of river Vaigai; (Jointly Published by: Department of Archaeology &Tamilnadu Text Book and Educational Services Corporation, Tamilnadu)
4. Studies in the History of India with Special Reference to Tamilnadu (dr.K.K.Pillay) (Published by : The Author)

CO-PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Understand the weaving and ceramic technology of ancient Tamil People nature.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO2:	*Comprehend the construction technology, building materials in sangam Period and case studies.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO3:	*Infer the metal process, coin and beads manufacturing with relevant archeological evidence*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO4:	*Realize the agriculture methods, irrigation technology and pearl diving.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO5:	*Apply the knowledge of scientific Tamil and Tamil computing.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
	Average	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / S & H**

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SEMESTER - III

		L	T	P	C
20GE052	**தமிழரும் தொழில் நுட்பமும்** (**அனைத்து துறைகளுக்கும் பொதுவானது**)	1	0	0	1

முன் கூட்டிய துறைசார் அறிவு : தேவை இல்லை

பாடம் கற்றத்தின் விளைவுகள் : பாடத்தை வெற்றிகரகமாக கற்று முடித்த பின்பு, மாணவர்களால் முடியும் விளைவுகள்	அறிவாற்றல் நிலை
CO1: சங்ககாலத் தமிழிர்களின் நெசவு மற்றும் பானைவனைதல் தொழில் நுட்பம் குறித்து கற்றுணர்தல்	*புரிதல்*
CO2: சங்ககாலத் தமிழிர்களின் கட்டிட தொழில் நுட்பம் கட்டுமான பொருட்கள் மற்றும் அவற்றை விளகும் தளங்கள் குறித்து அறிவு	*புரிதல்*
CO3: சங்ககாலத் தமிழிர்களின் உலோகத் தொழில், நாணயங்கள் மற்றும் மணிகள் சார்ந்த தொல்லியல் சான்றுகள் பற்றிய அறிவு	*புரிதல்*
CO4: சங்ககாலத் தமிழிர்களின் வேளாண்மை, நீர்ப்பாசன முறைகள் மற்றும் முத்து குளித்தல் குறித்த தெளிவு	*புரிதல்*
CO5: நவீன அறிவியல் தமிழ் மற்றும் கன்னி தமிழ் குறித்த புரிந்துகொள்ளலும் மற்றும் பயன்படுத்தலும்	*பகுப்பாய்வு*

அலகு – I **நெசவு மற்றும் பானைத் தொழில்நுட்பம்** **[03]**

சங்ககாலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் கருப்பு சிவப்பு பாண்டங்கள்–பாண்டகளில் கீறல் குறியீடுகள்

அலகு – II **வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்** **[03]**

சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு – சங்க காலத்தில் கட்டுமானப் பொருட்களும் நடுகல்லும்–சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள்–மாமல்லபுரச் சிற்பங்களும், கோவில்களும்–சோழர்காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள்–நாயக்கர் காலக்கோயில்கள்–மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன்ஆலயம் மற்றும் திருமலைநாயக்கர்மஹால் – செட்டிநாட்டுவீடுகள்–பிரிட்டிஷ்காலத்தில் சென்னை இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு – III **உற்பத்தித் தொழில்நுட்பம்** **[03]**

கப்பல் கட்டும் கலை–உலோகவியல்–இரும்புத்தொழிற்சாலை–இரும்பை உருக்குதல், எஃகு–வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்கநாணயங்கள்–நாணயங்கள் அச்சடித்தல்–மணி உருவாக்கும் தொழிற்சாலைகள்–கல் மணிகள்–கண்ணாடி மணிகள்–சுடு மண்மணிகள்–சங்குமணிகள்–எலும்புத்துண்டுகள்–தொல்லியல் சான்றுகள்–சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு – IV **வேளாண்மை மற்றும் நீர்ப் பாசனத் தொழில்நுட்பம்** **[03]**

அணை,ஏரி,குளங்கள்,மதகு–சோழர்காலகுமிழித்தூம்பின் முக்கியத்துவம்–கால்நடை பராமரிப்பு–கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள்–வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள்–கடல்சார் அறிவு – மீன் வளம்–முத்து மற்றும் முத்துக் குளித்தல்–பெருங்கடல் குறித்த பண்டைய அறிவு–அறிவுசார் சமூகம்.

அலகு – V **அறிவியல் தமிழ் மற்றும்** கணினித்தமிழ் **[03]**

அறிவியல் தமிழின் வளர்ச்சி– கணினித்தமிழ் வளர்ச்சி–தமிழ் நூல்களை மின்பதிப்பு செய்தல்–தமிழ் மென் பொருட்கள் உருவாக்கம்–தமிழ் இணையக்கல்விக் கழகம்–தமிழ் மின்நூலகம்–இணையத்தில் தமிழ் அகராதிகள் சொற்குவைத் திட்டம்.

Total (L= 15, T = 0) = 15 Periods

Text Books :

1. தமிழகவரலாறு- மக்களும் பண்பாடும்- கேகேபிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியில் பணிகள் கழகம்)
2. கணினித்தமிழ் - முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)

Reference Books :

1. கீழடி- வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம்.(தொல்லியல் துறை வெளியீடு)
2. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
3. Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by : The Author)
4. Porunai Civilization (Jointly Published by: Department of Archaeology &Tamilnadu Textbook and Educational Services Corporation, Tamilnadu)

CO-PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*சங்ககாலத் தமிழிர்களின் நெசவு மற்றும் பானைவனைதல் தொழில்நுட்பம் குறித்து கற்றுணர்தல்*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO2:	*சங்ககாலத் தமிழிர்களின் கட்டிட தொழில்நுட்பம் கட்டுமான பொருட்கள் மற்றும் அவற்றை விளகும் தளங்கள் குறித்து அறிவு*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO3:	*சங்ககாலத் தமிழிர்களின் உலோகத் தொழில், நாணயங்கள் மற்றும் மணிகள் சார்ந்த தொல்லியல் சான்றுகள் பற்றிய அறிவு*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO4:	*சங்ககாலத் தமிழிர்களின் வேளாண்மை, நீர்ப்பாசன முறைகள் மற்றும் முத்து குளித்தல் குறித்த தெளிவு*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO5:	*நவீன அறிவியல் தமிழ் மற்றும் கன்னி தமிழ் குறித்த புரிந்து கொள்ளலும் மற்றும் பயன்படுத்தலும்*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
	Average	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**-**	**3**	**-**	**-**

1. சிறிது (குறைந்த) 2. மிதமான (நடுத்தர) 3. கணிசமான (உயர்)

Course Faculty **Module Coordinator** **Chairman BoS / S & H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20MA432	**NUMERICAL METHODS (B.E CIVIL ENGINEERING)**	3	1	0	4

***Prerequisite*: -**

Course Outcomes : On successful completion of the course , the student will be able to		**Cognitive Level**
CO1:	*Solve the polynomial, transcendental equations and simultaneous linear equations numerically.*	*Apply*
CO2:	*Interpreting, the Interpolation techniques.*	*Understand*
CO3:	*Developing their skills in numerical differentiation and integration.*	*Remember*
CO4:	*Solve ordinary differential equations numerically.*	*Apply*
CO5:	*Able to apply the concepts of numerical solutions to boundary value problems.*	*Apply*

UNIT - I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS [12]

Solutions to polynomials and transcendental equations - Newton's method, Regula-falsi method - Solutions to simultaneous linear equations - Gauss Elimination method - Gauss-Seidel method - Eigen value of a matrix by Power method.

UNIT - II INTERPOLATION AND APPROXIMATION [12]

Newton's forward and backward difference interpolation techniques (equal intervals) - Lagrange's interpolation - Inverse Lagrange's interpolation and Divided difference method (for unequal intervals).

UNIT - III NUMERICAL DIFFERENTIATION AND INTEGRATION [12]

Numerical differentiation using Newton's forward and backward interpolation methods - Numerical integration by trapezoidal and Simpson's 1/3rd and 3/8th rules - Double integrals using trapezoidal rule and Simpson's rule.

UNIT - IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS [12]

Solving first order Ordinary Differential Equations by Taylor series **-** Euler's and Modified Euler's Method - Fourth order Runge-Kutta Method - Milne's predictor and corrector method.

UNIT - V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS [12]

Solution of one dimensional heat equation by Bender - Schmidt and Crank - Nicolson method - Solution of One dimensional wave equation - Solution of two dimensional Poisson equations.

Total (L: 45 T:15) = 60 Periods

Text Books :

1 Dr. B. S. Grewal, Numerical Methods in Engineering and Science, Khanna Publishers, New Delhi, Twelfth Edition, 2015.

2 Dr. M.K. Venkataraman, Numerical Methods in Science and Engineering, National Publishing Company, New Delhi, Fourth Edition, 2014.

Reference Books:

1 Sukhendu Dey and Shishir Gupta, Numerical Methods, Tata Mc Graw Hill Publishing Company, New Delhi, Fifth Edition, 2016.

2 V. Gerald, Applied Numerical Analysis, Pearson Education, New Delhi, Sixth edition 2015.

3 P.Kandasamy, K.Thilagavathy and K.Gunavathy, Numerical Methods, S.Chand & Company Ltd, New Delhi Fifth Edition, 2016.

4 https://www.youtube.com/watch?v=AT7Olelic8U&https://www.youtube.com/watch?v=QTQ8bO1F-Dg

Course Faculty **Module Coordinator** **Chairman BoS/ S&H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20MA432 **Course Name: NUMERICAL METHODS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Solve the polynomial, transcendental equations and simultaneous linear equations numerically.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	*Interpreting, the Interpolation techniques.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	*Developing their skills in numerical differentiation and integration.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	*Solve ordinary differential equations numerically.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	*Able to apply the concepts of numerical solutions to boundary value problems.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**3**		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/ S&H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20CE412	**SOIL MECHANICS**	3	0	0	3

Prerequisite: *-*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Characterize and classify soils.*	*Understand*
CO2:	*Solve the problems related to effective stress, permeability and seepage.*	*Analyse*
CO3:	*Compute and analyze the consolidation settlements*	*Analyse*
CO4:	*Estimates shear strength parameters for field conditions.*	*Evaluate*
CO5:	*Explain the concept of slope stability and slope failures of cohesive soil.*	*Remember*

UNIT - I SOIL CLASSIFICATION AND COMPACTION [9]

Nature of Soil - Problems with Soil - Phase Relation - Sieve Analysis - Sedimentation Analysis – Atterberg Limits- Classification for Engineering Purposes - BIS Classification System – Soil Compaction - Factors Affecting Compaction – Laboratory Compaction Methods.

UNIT - II SOIL WATER AND PERMEABILITY [9]

Soil Water – Various Forms – Influence of Clay Minerals – Capillary Rise – Suction - Effective Stress Concepts in Soil – Total, Neutral and Effective Stress Distribution in Soil - Permeability – Darcy's Law- Permeability Measurement in the Laboratory – Quick Sand Condition - Seepage –Introduction to Flow Nets –Properties and Uses - Application to Simple Problems.

UNIT - III STRESS DISTRIBUTION, COMPRESSIBILITY AND SETTLEMENT [9]

Stress Distribution - Soil Media – Boussinesq Theory - Use of Newmark's Influence Chart –Components of Settlement — Immediate and Consolidation Settlement – Terzaghi's One Dimensional Consolidation Theory – Computation of Rate of Settlement. - √t and log t Methods– e-log p Relationship - Factors Influencing Compression Behaviour of soils.

UNIT - IV SHEAR STRENGTH [9]

Shear strength of Cohesive and Cohesionless Soils - Mohr - Coulomb Failure Theory – Saturated Soil - Strength Parameters - Measurement of Shear Strength, Direct Shear, Triaxial Compression, UCC and Vane Shear Tests –Types of Shear Tests Based on Drainage and their Applicability - Drained and Undrained Behaviour of Clay and Sand.

UNIT - V SLOPE STABILITY [9]

Slope Failure Mechanisms - Modes - Infinite Slopes - Finite Slopes – Total and Effective Stress Analysis - Stability Analysis for Purely Cohesive and C-ø Soil - Method of Slices – Modified Bishop's Method - Friction Circle Method - Stability Number – Problems – Slope Protection Measures.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1. Punmia,B.C. Ashok Kumar Jain and Arun Kumar Jain., Soil Mechanics and Foundations, Laxmi Publications, New Delhi, Sixteenth Edition, 2017.
2. Gopal Ranjan. and Rao A.S.R., Basic and Applied Soil Mechanics, New Age International, New Delhi, Third Edition, 2016.

Reference Books :

1. Arora, K.R., Soil Mechanics and Foundation Engineering, Standard Publishers Distributors, New Delhi, Seventh Edition, 2019.
2. Muni Budhu., Soil Mechanics and Foundations, Wiley, Noida, Wiley India Edition, 2016.
3. Donald. P.Coduto, Man chu Ronald Yeung and William A Kitch., Geotechnical Engineering Principles and Practices, Pearson, London, Second Edition, 2017.
4. http://nptel.ac.in/courses/105103097/.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE412 **Course Name: SOIL MECHANICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Characterize and classify soils.*	3	-	2	-	-	-	-	-	-	-	-	2	2	2
CO2	*Solve the problems related to effective stress, permeability and seepage.*	3	2	3	-	-	-	-	-	-	-	-	3	3	2
CO3	*Compute and analyze the consolidation settlements*	3	2	2	2	-	2	-	-	-	-	-	3	3	2
CO4	*Estimates shear strength parameters for field conditions.*	3	2	3	2	-	-	-	-	-	-	-	3	3	2
CO5	*Explain the concept of slope stability and slope failures of cohesive soil.*	3	-	3	2	-	2	-	-	-	-	-	3	3	2
	Average	**3**	2	3	2	-	2	-	-	-	-	-	3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

20CE413	**STRENGTH OF MATERIALS**	L	T	P	C
		3	1	0	4

Prerequisite: *Mechanics of Solids*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Apply energy principles and compute deflections of beam under the principle of virtual work method.*	*Apply*
CO2:	*Analyse propped cantilever, fixed beam and continuous beam and draw SFD & BMD.*	*Analyse*
CO3:	*Find the stresses developed due to eccentricity in short column and evaluate the buckling strength of long column*	*Evaluate*
CO4:	*Determine different stresses developed in thick and thin cylinders and apply the concept of theory of failures.*	*Analyse*
CO5:	*Determine the stresses due to unsymmetrical bending of beams analyse shear flow and curved beams.*	*Analyse*

UNIT - I ENERGY PRINCIPLES [12]

Strain Energy and Strain Energy Density – Strain Energy in Traction, Shear in Flexure and Torsion –Castigliano's Theorems – Principle of Virtual Work Application of Energy Theorems for Computing Deflections in Beams and Trusses – Maxwell's Reciprocal Theorems.

UNIT - II INDETERMINATE BEAMS [12]

Propped Cantilever and Fixed Beams-Fixed End Moments and Reactions Due to Lateral Loads Theorem of Three Moments – Analysis of Continuous Beams (limited to two unknowns.)

UNIT - III COLUMNS [12]

Eccentrically Loaded Short Columns – Middle Third Rule – Core Section – Columns of Unsymmetrical Sections – Euler's Theory of Long Columns – Critical Loads for Prismatic Columns with Different End Conditions; Rankine-Gordon Formula for Eccentrically Loaded Columns .

UNIT - IV THIN AND THICK CYLINDERS, THEORIES OF FAILURES [12]

Thin Cylinders and Shells under Internal Pressure –Deformation of Thin Cylinders and Shells. Thick Cylinders – Compound Cylinders. - Theories of Failure – Principal Stress, Dilatation, Principal Strain, Shear Stress, Strain Energy, Distortion Energy and Mohr's Theories – Application in Analysis of Stress (limited to Two Dimensional).

UNIT - V ADVANCED TOPICS IN BENDING OF BEAMS [12]

Unsymmetrical Bending of Beams of Symmetrical and Unsymmetrical Sections – Shear Flow -Shear Centre - Curved Beams – Winkler Bach Formula – Stress Concentration.

Total (L: 45 T:15) = 60 Periods

Text Books :

1 Rajput, R.K., A Textbook of Strength of Materials**,** Laxmi Publications, New Delhi**,** Sixth Edition, 2018.

2 Punmia, B.C. Ashok Kumar Jain. and Arun Kumar Jain., Mechanics of Material, Laxmi Publications, New Delhi**,** Tenth Edition, 2017.

Reference Books :

1 Nash, William.A., Theory and Problems of Strength of Materials, Schaum's Outline Series, Tata McGraw-Hill Publishing Co., New Delhi, First Edition, 2007.

2 Srinath, L.S., Advanced Mechanics of Solids, McGraw Hill Education, New York, Third Edition, 2017.

3 Popov, Egor. P., Engineering Mechanics of Solids, Pearson Education, New Delhi, Second Edition, 2015.

4 https://nptel.ac.in/courses/105/105/105105108/

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE413 **Course Name: STRENGTH OF MATERIALS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Apply energy principles and compute deflections of beam under the principle of virtual work method.*	3	3	2	-	-	-	-	-	-	-	-	1	3	3
CO2	*Analyse propped cantilever, fixed beam and continuous beam and draw SFD & BMD.*	3	3	2	-	-	-	-	-	-	-	-	2	3	3
CO3	*Find the stresses developed due to eccentricity in short column and evaluate the buckling strength of long column*	3	3	2	-	-	-	-	-	-	-	-	1	3	3
CO4	*Determine different stresses developed in thick and thin cylinders and apply the concept of theory of failures.*	3	3	2	-	-	-	-	-	-	-	-	1	3	3
CO5	*Determine the stresses due to unsymmetrical bending of beams analyze shear flow and curved beams.*	3	3	2	-	-	-	-	-	-	-	-	1	3	3
	Average	3	3	2	-	-	-	-	-	-	-	-	1	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

20CE414	**APPLIED HYDRAULIC AND HYDRAULIC MACHINERY**	L	T	P	C
		3	0	0	3

Prerequisite: *Fluid Mechanics*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Explain fluid action in open channel flow.*	*Understand*
CO2:	*Identify an effective section for flow in different cross sections and solves problems in uniform, gradually and rapidly varied flows in steady state conditions.*	*Remember*
CO3:	*Derive the concept, working applications of impact of jets with the importance of constructing velocity triangles.*	*Apply*
CO4:	*Perform characteristic study on pumps and select pumps for practical purposes.*	*Analyse*
CO5:	*Explore the design concept of turbines, perform characteristic study and select hydraulic turbines for hydropower plants.*	*Evaluate*

UNIT – I OPEN CHANNEL FLOW **[9]**

Open channel flow – Types and regimes of flow – Velocity distribution in open channel – Wide open channel – Specific energy – Critical flow and its computation – channel transition.

UNIT – II UNIFORM FLOW &NON UNIFORM FLOW **[9]**

Uniform flow – Manning's and Chezy's formula – Determination of roughness coefficients – Most economical sections – Non-erodible channels. Dynamic equations of gradually varied flow – Assumptions – Characteristics of flow profiles – Draw down and back water curves – Hydraulic jump – Types – Energy dissipation –Surges.

UNIT – III IMPACT OF JETS **[9]**

Force exerted by the jet on a stationary vertical plate(Inclined flat plate, curved plate) - Force exerted by the jet on a moving plate - Force exerted by the jet of water on unsymmetrical moving curve plate at its tip – series of vanes, radial curved vanes

UNIT – IV PUMPS **[9]**

Centrifugal Pump - Minimum Speed to Start the Pump – Multistage Pumps – Jet and Submersible Pumps - Positive Displacement Pumps - Reciprocating Pump - Negative Slip - Flow Separation Conditions - Air Vessels -Indicator Diagram and its Variation

UNIT – V TURBINES **[9]**

Turbines - Application of Momentum Principle – Turbines - Classification - Draft Tube and Cavitation - Radial Flow Turbines - Axial Flow Turbines – Impulse and Reaction

Total (L: 45 T: 0) =45Periods

Text Books :

1 Subramanya, K., Flow in Open channels, McGraw Hill Education, Noida, Fourth Edition, 2015.

2 Bansal, R.K.,A Textbook of Fluid Mechanics and Hydraulics Machines, Laxmi Publications Pvt. Ltd, New Delhi ,Tenth Edition, 2018.

Reference Books :

1 Rajput, R.K., Fluid Mechanics and Hydraulic Machines, S Chand & Company, New Delhi, Sixth Edition, 2016.

2 Modi, P.N and Seth, S.M., Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House, New Delhi, Twenty Two Edition, 2018.

3 Rattan S. S., Fluid Mechanics and Hydraulic Machines, Khanna Book Publishing, New Delhi, First Edition, 2019.

4 http://nptel.ac.in/courses/105107059/

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE414** **Course Name:** **APPLIED HYDRAULIC AND HYDRAULIC MACHINERY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain fluid action in open channel flow.*	3	3	3	2	-	-	-	-	-	-	-	2	2	3
CO2	*Identify an effective section for flow in different cross sections and solves problems in uniform, gradually and rapidly varied flows in steady state conditions.*	3	3	3	2	-	-	-	-	-	-	-	2	2	3
CO3	*Derive the concept, working applications of impact of jets with the importance of constructing velocity triangles.*	3	3	3	2	-	-	-	-	-	-	-	2	2	3
CO4	*Perform characteristic study on pumps and select pumps for practical purposes.*	3	3	3	2	-	-	-	-	-	-	-	2	2	3
CO5	*Explore the design concept of turbines, perform characteristic study and select hydraulic turbines for hydropower plants.*	3	3	3	2	-	-	-	-	-	-	-	2	2	3
	Average	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**3**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

20CE415	**CONSTRUCTION TECHNIQUES AND PRACTICES**	L	T	P	C
		3	0	0	3

Prerequisite: *-*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Plan different stages of construction techniques and identify suitable supporting structures based on the condition.*	*Remember*
CO2:	*Adopt different techniques of building construction as per requirement.*	*Apply*
CO3:	*Apply appropriate techniques used for sub structure construction.*	*Apply*
CO4:	*Identify and apply different techniques for super structure construction.*	*Analyse*
CO5:	*Use suitable equipment needed for construction of various types of structures from foundation to super structure.*	*Understand* *Apply*

UNIT - I PLANNING FOR CONSTRUCTION & SUPPORTING STRUCTURES [9]

Various Stages in the Construction of the Project – Construction Coordination - Job Planning - Technical Planning – Scheduling - Site Clearance - Marking – Setting out foundations , Earthwork job Layout – Temporary Sheds – Setting Out Works – Centering& Shuttering - Slip Forms - Scaffolding – Shoring – De-shuttering Forms.

UNIT - II CONSTRUCTION PRACTICES [9]

Masonry – Stone Masonry – Bond in Masonry - Concrete Hollow Block Masonry – Flooring – Damp Proof Courses – Construction Joints – Movement and Expansion Joints– Pre Cast Pavements – Building Foundations – Basements – Fabrication and Erection of Steel Trusses – Frames – Braced Domes – Laying Brick - Arrangement of bonds in brick masonry— Weather and Water Proof – Roof Finishes –Acoustic and Fire Protection.

UNIT - III SUB STRUCTURE CONSTRUCTION [9]

Techniques of Box Jacking – Pipe Jacking -Under Water Construction of Diaphragm Walls And Basement – Tunneling Techniques – Piling Techniques - Well and Caisson - Sinking Cofferdam – Cable Anchoring and Grouting-Driving Diaphragm Walls, Sheet Piles - Shoring for Deep Cutting – Well Points -Dewatering And Stand by Plant Equipment for Underground Open Excavation.

UNIT - IV SUPER STRUCTURE CONSTRUCTION [9]

Launching Girders, Bridge Decks, Off Shore Platforms – Special Forms for Shells - Techniques for Heavy Decks – In-Situ Pre-Stressing In High Rise Structures, Material Handling - Erecting Light Weight Components On Tall Structures - Support Structure for Heavy Equipment And Conveyors –Erection of Articulated Structures, Braced Domes and Space Decks.

UNIT - V CONSTRUCTION EQUIPMENT [9]

Selection of Equipment for Earth Work - Earth Moving Operations - Types of Earthwork Equipment -Tractors, Motor Graders, Scrapers, Front End Waders, Earth Movers – Equipment for Foundation and Pile Driving. Equipment for Compaction, Batching And Mixing and Concreting - Equipment for Material Handling and Erection of Structures - Equipment for Dredging, Trenching, Tunneling.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1. Peurifoy, R.L. Ledbetter, W.B. and Schexnayder, C., Construction Planning, Equipment and Methods, McGraw Hill Education, Noida, Seventh Edition, 2010.
2. Purushothama Raj, P., Construction Techniques, Equipments and Practices, Sri Krishna Hitech Publishing Company Pvt. Ltd, Chennai, Fifth Edition, 2015.

Reference Books :

1. Sharma, S.C., Construction Equipment and Management, Khanna Publishers, New Delhi, First Edition, 2016.
2. Arora, S.P. and Bindra, S.P., Building Construction, Planning Techniques and Method of Construction, Dhanpat Rai and Sons, New Delhi, Reprint, 2010.
3. Deodhar, S.V., Construction Equipment and Job Planning, Khanna Publishers, New Delhi, Fourth Edition, 2012.
4. https://nptel.ac.in/courses/114106035/15.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE415** **Course Name:** **CONSTRUCTION TECHNIQUES AND PRACTICES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Plan different stages of construction techniques and identify suitable supporting structures based on the condition.*	3	-	2	1	-	2	-	-	-	-	3	1	2	3
CO2	*Adopt different techniques of building construction as per requirement.*	3	-	2	1	-	2	-	-	-	-	-	1	2	3
CO3	*Apply appropriate techniques used for sub structure construction.*	3	-	2	1	2	2	-	-	-	-	-	2	2	3
CO4	*Identify and apply different techniques for super structure construction.*	3	-	2	1	2	2	-	-	-	-	-	2	2	3
CO5	*Use suitable equipment needed for construction of various types of structures from foundation to super structure.*	3	-	2	1	2	2	-	-	-	-	-	2	2	3
	Average	**3**	**-**	**2**	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**3**	**2**	**2**	**3**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

20CE416	**HIGHWAY ENGINEERING**	L	T	P	C
		3	0	0	3

Prerequisite: *-*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Acquire skills in selecting the best highway alignment and develop the highway proposal.*	*Understand*
CO2:	*Design a variety of highway cross sectional elements.*	*Create*
CO3:	*Raise knowledge on highway materials and construction practice.*	*Remember*
CO4:	*Design flexible and rigid pavements as per IRC codes.*	*Create*
CO5:	*Deduct the distress in flexible and rigid pavements and identify appropriate strengthening methods.*	*Analyse*

UNIT - I HIGHWAY PLANNING AND ALIGNMENT [9]

History of Road Construction, Highway Development in India – Jayakar Committee Recommendations and Realizations, Twenty-year Road Development Plans, Concepts of On-going Highway Development Programmes at National Level, Institutions for Highway Development at National Level - Indian Road Congress, Highway Research Board, National Highway Authority of India, Ministry of Road Transport and Highways (Morth) and Central Road Research Institute. Requirements of Ideal Alignment, Factors Controlling Highway Alignment, Engineering Surveys for Alignment - Classification and Cross Section of Urban and Rural Roads (IRC) - Principles of Highway Financing.

UNIT - II GEOMETRIC DESIGN OF HIGHWAYS [9]

Highway Cross Sectional Elements – Right of Way, Carriage Way, Camber, Kerbs, Shoulders and Footpaths [IRC Standards], Design of Horizontal Alignment – Horizontal Curves Super Elevation, Widening of Pavements on Horizontal Curves and Transition Curves, Design of Vertical Alignments – Rolling, Limiting, Exceptional and Minimum Gradients, Summit and Valley Curves-Sight Distances – Factors Affecting Sight Distances, PIEV Theory, Stopping Sight Distance (SSD), Overtaking Sight Distance (OSD), Sight Distance at Intersections, Intermediate Sight Distance and Illumination Sight Distance [Derivations and Problems in SSD and OSD] -Geometric Design of Hill Roads [IRC Standards Only].

UNIT - III HIGHWAY MATERIALS AND CONSTRUCTION PRACTICE [9]

Desirable Properties and Testing of Highway Materials: Soil – California Bearing Ratio Test, Field Density Test - Aggregate - Crushing, Abrasion, Impact Tests, Water Absorption, Flakiness and Elongation Index and Stone Polishing Value Test - Bitumen - Penetration, Ductility, Viscosity, Binder Content and Softening Point Tests. - Construction Practice - Water Bound Macadam Road, Bituminous Road And Cement Concrete Road [As Per IRC and Morth Specifications] - Highway Drainage [IRC Recommendations].

UNIT - IV FLEXIBLE AND RIGID PAVEMENTS [9]

Rigid And Flexible Pavements- Components and their Functions -Design Principles of Flexible and Rigid Pavements, Factors Affecting the Design Of Pavements - ESWL, Climate, Sub-Grade Soil And Traffic - Design Practice for Flexible Pavements [IRC Method And Recommendations- Problems] - Design Practice for Rigid Pavements – IRC Recommendations - Concepts Only.

UNIT - V HIGHWAY MAINTENANCE [9]

Types of Defects in Flexible Pavements – Surface Defects, Cracks, Deformation, Disintegration – Symptoms, Causes and Treatments. - Types of Failures in Rigid Pavements – Scaling, Shrinkage, Warping, Structural Cracks, Spalling of Joints and Mud Pumping – Special Repairs - Pavement Evaluation – Pavement Surface Conditions and Structural Evaluation, Evaluation of Pavement Failure and Strengthening - Overlay Design by Benkelman Beam Method [Procedure Only].

Total (L: 45 T: 0) = 45 Periods

Text Books :

1 Khanna, S. K.and Justo, C.E.G., Highway Engineering, Nemch and Publishers, Roorkee, Tenth Edition, 2018.

2 Subramanian, K.P., Highways, Railways, Airport and Harbour Engineering, Scitech Publications, Pvt. Ltd, Chennai, Second Edition, 2018.

Reference Books :

1 Kadiyali, L. R., Transportation Engineering, Khanna Book Publishing, New Delhi, First Edition, 2016.

2 Mallick,Rajib B. and Tahar El-Korchi., Pavement Engineering: Principles and Practice, CRC Press, Florida, Third Edition, 2017.

3 Rangwala, S.C., Highway Engineering, Charotar Publishing House Pvt. Ltd., Anand, Eleventh Edition, 2017.

4 http://nptel.ac.in/courses/105101087/

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE416 **Course Name: HIGHWAY ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Acquire skills in selecting the best highway alignment and develop the highway proposal.*	3	2	-	2	-	2	2	2	3	2	2	2	2	3
CO2	*Design a variety of highway cross sectional elements.*	3	2	3	3	-	-	2	2	3	2	2	2	2	3
CO3	*Raise knowledge on highway materials and construction practice.*	3	2	-	2	-	2	2	2	3	2	2	2	2	3
CO4	*Design flexible and rigid pavements as per IRC codes.*	3	2	3	3	-	-	2	2	3	2	2	2	2	3
CO5	*Deduct the distress in flexible and rigid pavements and identify appropriate strengthening methods.*	3	2	3	2	-	2	2	2	3	2	2	2	2	3
	Average	**3**	**2**	**3**	**2**	**-**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20CE421	**FLUID MECHANICS AND MACHINERY LABORATORY**	0	0	3	1

Prerequisite: -

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Measure discharge using various measuring devices.*	*Remember*
CO2:	*Estimate the friction and measure the frictional losses in fluid flow.*	*Analyse*
CO3:	*Determine the force exerted by jet of water on vanes.*	*Understand*
CO4:	*Estimate performance parameters of a given centrifugal and reciprocating pump.*	*Analyse*
CO5:	*Categorize and plot the performance characteristics of turbines.*	*Analyse*

1. Determination of Co-efficient of Discharge for Orifice
2. Determination of Co-efficient of Discharge for Notches
3. Determination of Co-efficient of discharge for Venturimeter
4. Determination of Co-Efficient of Discharge for Orifice Meter
5. Study of Impact of Jet on Flat Plate (Normal / Inclined)
6. Study of Friction Losses in Pipes
7. Study of Minor Losses in Pipes
8. Study on Performance Characteristics of Centrifugal Pumps (Constant Speed / Variable Speed)
9. Study on Performance Characteristics of Reciprocating Pump
10. Study on Performance Characteristics of Pelton Turbine
11. Study on Performance Characteristics of Francis Turbine
12. Study on Performance Characteristics of Kaplan Turbine

Total : 45 Periods

CO PO MAPPING

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	*Measure discharge using various measuring devices.*	3	3	2	2	-	-	-	-	1	-	-	-	3	3
CO2	*Estimate the friction and measure the frictional losses in fluid flow.*	3	3	2	2	-	-	-	-	1	-	-	-	3	3
CO3	*Determine the force exerted by jet of water on vanes.*	3	3	2	2	-	-	-	-	1	-	-	-	3	3
CO4	*Estimate performance parameters of a given centrifugal and reciprocating pump.*	3	3	2	2	-	-	-	-	1	-	-	-	3	3
CO5	*Categorize and plot the performance characteristics of turbines.*	3	3	2	3	-	-	-	-	1	-	-	-	3	3
	Average	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**3**	**3**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20CE422	**SOIL MECHANICS LABORATORY**	0	0	3	1

Prerequisite: *-*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Analyse grain size distribution using sieve analysis and by hydrometer analysis.*	*Analyse*
CO2:	*Identify and classify soils with reference to their characteristics.*	*Understand*
CO3:	*Determine and interpret different soil properties.*	*Analyse*
CO4:	*Evaluate the strength of the soil and to calculate shear strength of the soils.*	*Evaluate*
CO5:	*Estimate the consolidation properties of soil.*	*Remember*

List of Experiments:

1. Grain Size Distribution – Sieve Analysis
2. Grain Size distribution – Hydrometer Analysis
3. Specific Gravity of Soil
4. Relative density of Sands
5. Field Density by Core Cutter Method and Sand Replacement Method
6. Atterberg's Limits Test
7. Coefficient of Permeability - Variable Head Method
8. Coefficient of Permeability – Constant Head Method
9. Unconfined Compression Test
10. Direct Shear Test
11. Standard Proctor Compaction Test
12. Tri-axial compression tests in Cohesion less Soil
13. One Dimensional Consolidation Test

Total : 45 Periods

CO PO MAPPING

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	*Analyse grain size distribution using sieve analysis and by hydrometer analysis.*	3	3	-	2	-	2	-	-	-	-	-	2	2	2
CO2	*Identify and classify soils with reference to their characteristics.*	3	3	-	2	-	1	-	-	-	-	-	2	2	2
CO3	*Determine and interpret different soil properties.*	3	3	2	2	-	2	-	-	-	-	-	2	2	2
CO4	*Evaluate the strength of the soil and to calculate shear strength of the soils.*	3	3	2	2	-	2	-	-	2	-	-	2	2	2
CO5	*Estimate the consolidation properties of soil.*	3	3	2	2	-	2	-	-	2	-	-	2	2	2
	Average	3	3	2	2	-	2	-	-	2	-	-	2	2	2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20CE423	**HIGHWAY ENGINEERING LABORATORY**	0	0	3	1

Prerequisite:-

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Select the best highway materials.*	*Apply*
CO2:	*Determine different physical properties of aggregates by performing different test on road aggregates.*	*Evaluate*
CO3:	*Evaluate the strength of sub-grade soil by CBR (California Bearing Ratio) test.*	*Evaluate*
CO4:	*Estimate various properties of bitumen material and mixes by performing various tests on it.*	*Analyse*
CO5:	*Apply the concepts of properties of aggregates and binding materials for design of roads.*	*Apply*

List of Experiments:

1. Sieve Analysis of Fine and Coarse Aggregates
2. Specific Gravity &Water Absorption Test on Fine and Coarse Aggregates
3. Crushing Strength of Aggregates.
4. Impact Test on Aggregates.
5. Los Angles Abrasion Test on Aggregates
6. Flakiness Index, Elongation Index of Coarse Aggregates
7. CBR Test on Soil
8. Penetration Test on Bitumen
9. Softening Point Test
10. Viscosity Test
11. Ductility Test
12. Determination of Binder Content on Bituminous Mixes
13. Determination of Marshall Stability Value on Bituminous Mixes
14. Tests on Bituminous Emulsion

Total : 45 Periods

CO PO MAPPING

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	*Select the best highway materials.*	3	3	3	3	-	2	-	-	2	-	-	-	2	3
CO2	*Determine different physical properties of aggregates by performing different test on road aggregates.*	3	3	3	3	-	2	-	-	2	-	-	-	2	3
CO3	*Evaluate the strength of sub-grade soil by CBR (California Bearing Ratio) test.*	3	3	3	3	-	2	-	-	2	-	-	-	2	3
CO4	*Estimate various properties of bitumen material and mixes by performing various tests on it.*	3	3	3	3	-	2	-	-	2	-	-	-	2	3
CO5	*Apply the concepts of properties of aggregates and binding materials for design of roads.*	3	3	3	3	-	2	-	-	2	-	-	-	2	3
	Average	**3**	**3**	**3**	**3**	**-**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**3**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20HR422	**CAREER DEVELOPMENT SKILLS - II**	0	2	0	0

Prerequisite: *-*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Speak and write appropriately by understanding verbal and logical reasoning*	*Apply*
CO2:	*Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions*	*Apply*
CO3:	*Enhance their skills on quantitative aptitude*	*Understand*
CO4:	*Speak and write appropriately by understanding and applying the basic grammatical rules*	*Create*
CO5:	*Critically evaluate problems related to quantitative aptitude*	*Apply*

UNIT - I **VERBAL AND LOGICAL REASONING – PART 1** **[06]**

Alphabet Test – Synonyms & Antonyms – Idioms & Phrases – Analogies - Theme Detection – Odd Words – Statement & Conclusions - Family Tree – Blood Relations – Coding & Decoding – Syllogism – Odd Man Out.

UNIT - II **QUANTITATIVE APTITUDE – PART 1** **[06]**

Numbers: Number system - Squaring of Numbers – Square Roots – Cube Roots – Divisibility – HCF, LCM – Decimals.

UNIT - III **QUANTITATIVE APTITUDE – PART 2** **[06]**

Percentages – Averages – Ratio & Proportion – Mixtures and Allegations – logarithms.

UNIT - IV **READING COMPREHENSION&WRITTEN COMMUNICATION –PART 3** **[06]**

READING SKILLS : Importance of Reading – Definition of Reading – Levels of Reading – Requirements of Reading – Types of Reading – Techniques of Reading - Academic Reading Tips.

UNIT - V **QUANTITATIVE APTITUDE – PART 3** **[06]**

Profit and Loss – Simple Interest & Compound Interest – Problem on Ages – Calendar.

Total (L= 0, T = 30) = 30 Periods

Text Books :

1 Anne Laws, Writing Skills, Orient Black Swan., Hyderabad, 2011.

2 Abhijit Guha, Quantitative Aptitude, TMH, New Delhi, Third Edition,2009

Reference Books :

1 Agarwal. R.S , A.Modern Approach to Verbal and Non- verbal Reasoning, Revised Edition 2008, Reprint 2009, S.Chand & Co Ltd., New Delhi.

2 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005.

3 M.B. Lal & Goswami, Objective Instant Arithmetic, Upkar Publications, New Delhi, Second Edition, 2012.

4 Norman Lewis. W.R., “Word Power Made Easy”, Goyal Publications

Course Faculty **Module Coordinator** **Chairman BoS/ S&H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20HR422 **Course Name: CAREER DEVELOPMENT SKILLS - II**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Speak and write appropriately by understanding verbal and logical reasoning*	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO2	*Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions*	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO3	*Enhance their skills on quantitative aptitude*	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO4	*Speak and write appropriately by understanding and applying the basic grammatical rules*	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO5	*Critically evaluate problems related to quantitative aptitude*	-	-	-	-	-	-	-	-	2	3	-	3	2	2
	Average	-	-	-	-	-	-	-	-	**2**	**3**	**-**	**3**	**2**	**2**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/ S&H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20HS051	**UNIVERSAL HUMAN VALUES AND UNDERSTANDING HARMONY** (Common To All Branches)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the basic concepts of value education.*	*Understand*
CO2:	*Distinguish between the self and the body, implement the meaning of harmony in the Co–existence of Self and the Body.*	*Understand*
CO3:	*Explain the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human–human relationships.*	*Understand*
CO4:	*Describe the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.*	*Understand*
CO5:	*Explain the ethical and unethical practices in work environment.*	*Understand*

UNIT - I INTRODUCTION TO VALUE EDUCATION [09]

Need and Basic Guidelines of Value Education – Content and Process of Value Education – Self Exploration – purpose of self-Exploration – Content and Process of Self exploration – Natural Acceptance – Realization and Understanding – Basic Human Aspirations – Continuous Happiness and Prosperity – Exploring Happiness and Prosperity – Basic Requirement for Fulfillment of Human Aspirations – Relationships – Physical Facilities – Right Understanding.

UNIT - II HARMONY IN THE HUMAN BEING [09]

Human Being and Body – Understanding Myself as Co–existence of Self ('I') and Body, Needs of the Self and Body, Activities in the Self and Body, Self ('I') as the Conscious Entity, the Body as the Material Entity – Exercise – Body as an Instrument– Harmony in the Self ('I) – Understanding Myself – Harmony with Body.

UNIT - III HARMONY IN THE FAMILY AND SOCIETY [09]

Harmony in the Family – Justice – Feelings (Values) in Human Relationships – Relationship from Family to Society – Identification of Human Goal – Five dimensions of Human Endeavour.

UNIT - IV HARMONY IN NATURE AND EXISTENCE [09]

Order of Nature – Interconnectedness – Understanding the Four order – Innateness – Natural Characteristic – Basic Activity – Conformance – Introduction to Space – Co–existence of units of Space – Limited and unlimited – Active and No–activity – Existence is Co–existence.

UNIT - V PROFESSIONAL ETHICS [09]

Values in different dimensions of Human Living – Definitiveness of Ethical Human Conduct –Implications of Value based Living – Identification of Comprehensive Human Goal – Humanistic Education – Universal Human Order – Competence and Issues in Professional Ethics.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Gaur R.R., Sangal, R., Bagaria, G.P., A Foundation Course in Human Values and Professional Ethics, Excell Books Pvt. Ltd., New Delhi, First Edition, 2016.

2 Tripaty, A.N., Human Values, New Age International Publishers, New Delhi,Third Edition, 2003.

Reference Books :

1 Ivan Illich, Energy & Equity, The Trinity Press, USA, 1974.

2 Schumacher E.F., Small is Beautiful: a study of economics as if people mattered, Britain, 1973.

3 Seebauer, E.G., Robert L. Berry, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press, 2000.

4 B P Banerjee, , Foundations of Ethics and Management, Excel Books, First Edition 2005

Course Faculty **Module Coordinator** **Chairman BoS/MBA**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20HS051** **Course Name:** **UNIVERSAL HUMAN VALUES AND UNDERSTANDING HARMONY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain the basic concepts of value education.*	1	-	2	-	-	3	2	3	-	3	-	3	-	3
CO2	*Distinguish between the self and the body, implement the meaning of harmony in the Co– existence of Self and the Body.*	1	-	2	-	-	3	2	3	-	3	-	3	-	3
CO3	*Explain the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human–human relationships.*	1	-	2	-	-	3	3	3	-	3	-	3	-	3
CO4	*Describe the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.*	1	-	2	-	2	3	2	3	-	3	-	3	-	3
O5	*Explain the ethical and unethical practices in work environment.*	1	-	2	-	2	3	3	3	-	3	-	3	-	3
	Average	1	-	2	-	2	3	3	3	-	3	-	3	-	3

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/MBA**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20CE511	**RAILWAYS, AIRPORT AND HARBOUR ENGINEERING**	3	0	0	3

Prerequisite: -

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Exemplify various components and their functions of a railway track.*	Understand
CO2:	*Summarize the railway track construction, maintenance and operation.*	Understand
CO3:	*Explain the concepts of airport planning and the components with its functions.*	Understand
CO4:	*Plan, analyze and design the elements for orientation of runways and passenger facility systems.*	Create
CO5:	*Explain various features in harbours and ports, their construction, and coastal protection works and provide basic orientation in harbour structural systems.*	Understand

UNIT - I RAILWAY PLANNING AND DESIGN [9]

Role of Indian Railways in National Development - Permanent Way - Components and Functions - Rails – Types - Rail Fastenings - Concept of Gauges - Coning of Wheels - Creeps and kinks - Sleepers – Functions, Materials, Density, Ballasts – Functions – Materials - Geometric Design of Railway Tracks – Gradients and Grade Compensation – Super Elevation - Widening of Gauges in Curves - Transition Curves - Horizontal and Vertical Curves – Introduction to Metro rail

UNIT - II RAILWAY TRACK CONSTRUCTION, MAINTENANCE AND OPERATION [9]

. Points and Crossings - Design of Turnouts - Working Principle Signaling - Interlocking and Track Circuiting - Construction & Maintenance – Conventional - Modern methods and Materials - Track Drainage – Track Modernization– Automated maintenance and upgrading – Technologies - Re-laying of Track - Lay outs of Railway Stations and Yards - Rolling Stock - Tractive Power - Track Resistance - Level Crossings

UNIT - III AIRPORT PLANNING AND DESIGN [9]

Role of Air Transport - Components of Airports - Airport Planning – Air traffic potential - Site Selection - Runway – Orientation - Cross wind Component - Wind rose Diagram - Geometric Design and Corrections for Gradients (Problems) - Taxiway Design – Geometric Design Elements - Minimum Separation Distances - Design Speed - Airport Drainage - Airport Zoning –types - obstruction Clearance over Highways and Railways – Circular airport.

UNIT - IV AIRPORT LAYOUTS, VISUAL AIDS, AND AIR TRAFFIC CONTROL [9]

Airport Layouts – Apron, Terminal Building - Hangars - Motor Vehicle Parking Area and Circulation Pattern – Airport Buildings – Primary functions - Planning Concept - Principles of Passenger Flow - Passenger Facilities Visual Aids – Runway and Taxiway Markings - Wind Direction Indicators - Runway and Taxiway Lightings-Air Traffic Control – Basic Actions - Air Traffic Control Network – Helipads - Service Equipment's.

UNIT - V HARBOUR ENGINEERING [9]

Definition of terms – Harbours, ports, docks, tides and waves – Site investigation – Planning - Requirements and classification – Concept of satellite ports - Docks – Dry and Wet Docks – Dredgers and dredging – Terminal facilities – Shipping terminal facilities – Essentials of passenger terminal – Port Buildings – Warehouse, Transit sheds – Mooring accessories – Navigational aids – Piers, Breakwaters, Wharves, Jetties, Quays ,Spring fenders – Littoral drift

Total (L: 45 T: 0) = 45 Periods

Text Books :

1. Saxena, S. C. and Arora. S.P., A Text Book of Railway Engineering, DhanpatRai and Sons, Delhi, First Edition, 2010.
2. Khanna, S K. Arora, M G. and Jain S.S, Airport Planning and Design, Nemchand and Brothers, Roorkee, First Edition, 1999.

Reference Books :

1. Subramanian, K.P., Railways, Airport and Harbour Engineering ll, Scitech Publications (India) Pvt. Ltd, Chennai, Second Edition, 2018.
2. Saxena S. C., Airport Engineering Planning and Design, CBS Publisher, New Delhi, First Edition, 2020.
3. Chandra, Railway Engineering, Oxford University Press, New Delhi, Second Edition, 2013.
4. Khanna, S.K. Arora, M.G., Airport, Planning & design, Nemchand & Bros, Roorkee, Sixth Edition,2018.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE511** **Course Name:** **RAILWAYS, AIRPORT AND HARBOUR ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Describe various components and their functions in a railway track.*	3	1	-	-	-	2	-	-	3	-	-	-	2	3
CO2	*Summarize the railway track construction, maintenance and operation.*	3	1	-	-	-	2	-	-	3	-	-	-	3	3
CO3	*Explain the concepts of airport planning and the components with its functions.*	2	2	3	-	-	2	-	-	-	-	-	-	2	3
CO4	*Plan, analyze and design the elements for orientation of runways and passenger facility systems.*	2	2	2	-	-	2	-	-	-	-	-	-	3	3
O5	*Describe various features in harbours and ports, their construction, and coastal protection works and provide basic orientation in harbour structural systems.*	3	2	3	-	-	2	-	-	3	-	-	-	3	3
	Average	3	2	3	-	-	2	-	-	3	-	-	-	3	3

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

20CE512	**FOUNDATION ENGINEERING**	L	T	P	C
		3	0	0	3

Prerequisite: *- Soil Mechanics*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Explain about sampling techniques and selection of foundation based on soil condition.*	*Understand*
CO2:	*Analyze the principle types of foundation and the factors governing the choice of the most suitable type of foundation.*	*Analyze*
CO3:	*Analyze deep foundations*.	*Analyze*
CO4:	*Select suitable types of piles their function and method to find the load carrying capacity of piles.*	*Remember*
CO5:	*Estimate the earth pressure in retaining wall in arithmetic and graphical methods.*	*Evaluate*

UNIT - I SOIL EXPLORATION AND CHOICE OF FOUNDATION [9]

Scope and objectives – Methods of exploration – Auguring and boring – Water boring and rotator drilling – Depth of boring – Spacing of bore hole – Sampling – Disturbed and undisturbed sampling – Sampling techniques – Split spoon sampler, Thin tube sampler, Stationary piston sampler – Geophysical methods – Bore log report – Penetration tests (SPT and SCPT) – Choice of foundation based on soil condition.

UNIT - II SHALLOW FOUNDATION [9]

. Definition – Types, location and depth of foundation – Bearing capacity of shallow foundation – Terzaghi's formula and BIS formula – Factors affecting bearing capacity – Problems – Bearing capacity from in-situ tests (SPT, SCPT and Plate load) - Allowable bearing pressure – Settlement – Components of settlement – Determination of settlement of foundations on granular and clay deposits – Allowable settlements – Methods of minimizing settlement, differential settlement.

UNIT - III FOOTINGS, RAFTS AND MACHINE FOUNDATION [9]

Contact pressure distribution below footings and raft -Isolated and combined footings – Types and proportioning of combined footing – Raft foundation – Types, applications – Floating foundation– Introduction to machine foundation

UNIT - IV PILE FOUNDATION [9]

Types of piles and their function – Factors influencing the selection of pile – Load carrying capacity of Single pile in granular and cohesive soil – Static formula – Dynamic formula (Engineering news and Hiley's) – Capacity from in-situ tests (SPT and SCPT) – Negative skin friction – Group capacity by different methods (Feld's rule, Converse Labarra formula) – Settlement of pile groups – Interpretation of pile load test – Foundation in expansive soil – Under reamed piles.

UNIT - V EARTH PRESSURE AND RETAINING WALLS [9]

Plastic equilibrium in soils – Active and passive earth pressure – Rankine's theory – Cohesionless and cohesive soil – Coloumb's wedge theory – Earth pressure on retaining walls of simple configurations – Graphical methods (Rebhann's and Culman's) – Stability of retaining walls.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1. Punmia, B.C., Soil Mechanics and Foundations, Laxmi Publications, New Delhi, Seventeenth Edition, 2017.
2. Murthy, V.N.S., Text Book of Soil Mechanics and Foundation Engineering, CBS Publishers, New Delhi, First Edition, 2018.

Reference Books :

1. Arora, K.R., Soil Mechanics and Foundation Engineering, Standard Publishers & Distributors, Delhi, Seventh Reprint, 2019.
2. Varghese, P.C, Foundation Engineering, Prentice-hall of India Private Limited, New Delhi, Ninth Edition, 2012.
3. Bowles, J.E., Foundation analysis and design, McGraw-Hill, Fifth Edition, 2017.
4. http://nptel.ac.in/courses/105101083/

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE512 **Course Name: FOUNDATION ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Describe about sampling techniques and selection of foundation based on soil condition.*	3	3	3	-	-	3	-	-	-	-	-	2	2	3
CO2	*Analyze the principle types of foundation and the factors governing the choice of the most suitable type of foundation.*	3	2	2	-	-	-	-	-	-	-	-	2	2	3
CO3	*Analyze deep foundations*.	3	3	2	-	-		-	-	-	-	-	2	2	3
CO4	*Select suitable types of piles their function and method to find the load carrying capacity of piles.*	3	3	3	-	-	3	-	-	-	-	-	2	2	3
CO5	*Calculate the earth pressure in retaining wall in arithmetic and graphical methods.*	3	3	3	-	-	-	-	-	-	-	-	2	2	3
	Average	**3**	2	3	-	-	3	-	-	-	-	-	2	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

20CE513	**CONCRETE TECHNOLOGY**	L	T	P	C
		3	0	0	3

Prerequisite: *-*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Evaluate constituent materials of concrete, their testing procedure and requirements as per standard.*	Evaluate
CO2:	*Identify suitable chemical and mineral admixtures based on the required properties of concrete*	Apply
CO3:	*Design a concrete mix which fulfils the required properties for fresh and hardened concrete.*	Create
CO4:	*Summarize fundamental knowledge on fresh and hardened properties of concrete.*	Understand
CO5:	*Select suitable concrete depending on their specific applications and know about future trends in concrete technology.*	Evaluate

UNIT - I CONSTITUENT MATERIALS [9]

Cement-Different types-Chemical composition and Properties-Tests on cement - hydration of cement – IS Specifications-Aggregates-Classification-Mechanical properties and tests as per BIS Grading requirements – M-Sand -Water- Quality of water for use in concrete

UNIT - II CHEMICAL AND MINERAL ADMIXTURES [9]

Role of Construction Chemicals - Accelerators – Retarders - Plasticizers- Super plasticizers - Water proofers - Mineral Admixtures - Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag, Rice husk ash and Metakaolin - Their effects on concrete properties

UNIT - III PROPORTIONING OF CONCRETE MIX [9]

Principles of Mix Proportioning - Properties of concrete related to Mix Design - Physical properties of materials required for Mix Design - Design Mix and Nominal Mix - BIS and ACI Methods of Mix Design with examples

UNIT - IV FRESH AND HARDENED PROPERTIES OF CONCRETE [9]

Workability - Tests for workability of concrete - Slump Test, Flow table test, Vee Bee Test and Compaction factor Test-Segregation and Bleeding - Determination of Compressive and Flexural strength as per BIS Properties of Hardened concrete - Determination of Stress-strain curve for concrete - Determination of Young's Modulus-Durability of concrete.

UNIT - V SPECIAL CONCRETES [9]

Light weight and Heavy weight concretes- High strength concrete - Fibre reinforced concrete – Ferrocement- Ready mix concrete – SIFCON - Shotcrete- Polymer concrete - High performance concrete – Self compacting concrete - no-fine concrete - properties and applications

Total (L: 45 T: 0) = 45 Periods

Text Books :

1 Shetty, M.S, and Jain, A.K., Concrete Technology, Theory and Practice, S.Chand and Company Ltd, New Delhi, Eighth Edition, 2018.

2 Santhakumar, A.R., Concrete Technology, Oxford University Press, New Delhi, Second Edition, 2018.

Reference Books :

1 Nevill, A.M, Properties of Concrete, Pearson Education, New Delhi, Fifth Edition, 2012.

2 Gambir, M.L, Concrete Technology: Theory and Practice, Tata McGraw Hill Publishers, New Delhi, Fifth Edition, 2017.

3 IS: 10262-2009 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi.

4 http://nptel.ac.in/courses/105104030

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE513 **Course Name: CONCRETE TECHNOLOGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Evaluate constituent materials of concrete, their testing procedure and requirements as per standard.*	3	2	1	-	-	2	-	-	-	-	-	2	3	3
CO2	*Suggest suitable chemical and mineral admixtures based on the required properties of concrete*	3	1	1	-	-	2	-	-	-	-	-	-	3	3
CO3	*Design a concrete mix which fulfills the required properties for fresh and hardened concrete.*	3	3	2	1	-	3	1	-	-	-	-	2	3	3
CO4	*Get fundamental knowledge on fresh and hardened properties of concrete.*	3	1	1	-	-	2	1	-	-	-	-	2	2	2
CO5	*Select suitable concrete depending on their specific applications and know about future trends in concrete technology.*	2	2	2	-	-	2	1	-	-	-	-	-	3	2
	Average	3	2	1	1	-	2	1	-	-	-	-	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

20CE514	**STRUCTURAL ANALYSIS - I**	L	T	P	C
		3	0	0	3

Prerequisite: *- Strength of materials*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Analyse the indeterminate pin-jointed plane frame and rigid plane frame by energy and consistent deformation methods*	Analyse
CO2:	*Derive the shear and bending moments for indeterminate structures using slope deflection method and draw the shearing force and bending moment diagrams*	Create
CO3:	*Develop the shear and bending moments for indeterminate structures using moment distribution method and draw the shearing force and bending moment diagrams*	Apply
CO4:	*Evaluate and draw the influence lines for reactions, shear force, and bending moments for determinate structures due to moving load*.	Evaluate
CO5:	*Calculate and draw the influence lines for reactions, shear force and bending moments for indeterminate structures due to moving load*.	Evaluate

UNIT - I INDETERMINATE FRAMES [9]

Basics of Analysis - Degree of static and kinematic indeterminacies for plane frames - analysis of indeterminate pin-jointed frames - rigid frames (Degree of static indeterminacy up to two) - Energy and consistent deformation methods

UNIT - II SLOPE DEFLECTION METHOD [9]

Concepts and assumptions - Continuous beams and rigid frames (with and without sway) – Symmetry and ant symmetry – Yielding of supports

UNIT - III MOMENT DISTRIBUTION METHOD [9]

Concept – Stiffness, distribution and carry over factors – Analysis of continuous beams - Plane rigid frames (with and without sway) – Advantages of symmetric and ant symmetric cases

UNIT - IV INFLUENCE LINES FOR DETERMINATE STRUCTURES [9]

Influence lines for reactions in statically determinate structures – influence lines for member forces in pin-jointed frames – Focal length - Influence lines for reaction SF, BM for determinate beams - Calculation of critical stress resultants due to concentrated and distributed moving loads - Muller-Breslau principle for determinate structures

UNIT - V INFLUENCE LINES FOR INDETERMINATE STRUCTURES [9]

Influence lines for reaction SF, BM for indeterminate beams – Muller Breslau principle – propped cantilever, fixed and continuous beam (redundancy restricted to one degree) and single storey rigid frames

Total (L: 45 T: 0) = 45 Periods

Text Books :

1 Vaidyanadhan, R and Perumal, P., Comprehensive Structural Analysis – Vol.1 & Vol.2, Laxmi Publications, New Delhi,Fourth Edition, 2016.

2 Bhavaikatti, S.S., Structural Analysis – Vol. 1 & Vol. 2., Vikas Publishing Pvt Ltd., New Delhi, Fourth Edition, 2011.

Reference Books :

1 Punmia, B.C.Ashok Kumar Jain. and Arun Kumar Jain., Theory of Structures – SMTS-II, Laxmi Publications, New Delhi, Thirteenth Edition, 2017.

2 Reddy, C.S., Basic Structural Analysis, Tata McGraw-Hill Education, New Delhi, Third Edition, 2011.

3 Vazirani, V.N, Ratwani, M.M and Duggal, S.K., Analysis of Structures – Vol II, Khanna Publishers, New Delhi, Sixteenth Edition, 2011.

4 http://nptel.ac.in/courses/105101085/

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE514 **Course Name: STRUCTURAL ANALYSIS - I**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Analyse the indeterminate pin-jointed plane frame and rigid plane frame by energy and consistent deformation methods*	3	3	2	-	-	3	-	-	-	1	-	2	3	3
CO2	*Derive the shear and bending moments for indeterminate structures using slope deflection method and draw the shearing force and bending moment diagrams*	3	3	2	-	-	3	-	-	-	1		2	3	3
CO3	*Develop the shear and bending moments for indeterminate structures using moment distribution method and draw the shearing force and bending moment diagrams*	3	3	2	-	-	3	-	-	-	1		3	3	3
CO4	*Evaluate and draw the influence lines for reactions, shear force, and bending moments for determinate structures due to moving load*.	3	3	2	-	-	3	-	-	-	1		3	3	3
CO5	*Calculate and draw the influence lines for reactions, shear force and bending moments for indeterminate structures due to moving load*.	3	3	2	-	-	3	-	-	-	1		3	3	3
	Average	3	3	2	-	-	3	-	-	-	1	-	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20CE515	**DESIGN OF REINFORCED CONCRETE**	3	0	0	3

Prerequisite: *-*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Elaborate the concept of elastic method, ultimate load method and limit state method and Interpret codes and specification of working stress method and limit state method*	Create
CO2:	*Analyze, design of beam and slab by limit state method*	Analyze
CO3:	*Summarize the behaviour of RC beams in bond, Anchorage, shear and torsion*	Understand
CO4:	*Discuss the types of columns and design of columns and footings*	Create
CO5:	*Design staircase, flat slab and RC walls*	Create

UNIT - I METHODS OF DESIGN OF CONCRETE STRUCTURES [9]

Concept of Elastic method, ultimate load method and limit state method – Advantages of Limit State Method over other methods – Design codes and specification – Limit State philosophy as detailed in IS code – Design of beams and slabs by working stress method – RC wall and Shear wall

UNIT - II LIMIT STATE DESIGN FOR FLEXURE [9]

. Analysis and design of singly and doubly reinforced rectangular and flanged beams - Analysis and design of one way, two way slabs subjected to uniformly distributed load for various boundary conditions

UNIT - III LIMIT STATE DESIGN FOR BOND, ANCHORAGE, SHEAR & TORSION [9]

Concept of development length – Design of RC members for bond and Anchorage - Design requirements as per current code - Design of RC members for combined bending shear and torsion.

UNIT - IV LIMIT STATE DESIGN OF COLUMNS AND FOOTINGS [9]

Types of columns – Design of short Rectangular and circular columns for axial, uniaxial and biaxial bending – Design of isolated footing for axial load (pad and isolated)

UNIT - V DESIGN OF STAIR CASE, FLAT SLAB [9]

Design of staircases (open well and doglegged) – Design of flat slabs with and without drop

Total (L: 45 T: 0) = 45 Periods

Text Books :

1. Sinha, S.N., Handbook Reinforced Concrete Design, Tata McGraw-Hill Publishing Company Ltd., New Delhi, First Edition, 2017.
2. Gambhir, M.L., Fundamentals of Reinforced Concrete Design, PHI Learning Pvt. Ltd, New Delhi, First Edition, 2014.

Reference Books :

1. Krishna Raju, N., Design of Reinforced Concrete Structures, CBS Publishers & Distributors, Fourth Edition, New Delhi, 2019.
2. Unnikrishnan Pillai, S. and Devdas Menon., Reinforced Concrete Design, Tata Mc Graw-Hill Publishing Company Ltd, New Delhi, Third Edition, 2017.
3. IS 456:2000, Plain and Reinforced Concrete - Code of Practice (Including Amendment 1, 2, 3,& 4)
4. http://nptel.ac.in/courses/105105105/

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE515** **Course Name:** **DESIGN OF REINFORCED CONCRETE**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Elaborate the concept of elastic method, ultimate load method and limit state method and Interpret codes and specification of working stress method and limit state method*	3	3	2	-	-	-	-	-	-	-	-	3	2	3
CO2	*Analyze, design of beam and slab by limit state method*	3	3	1	-	-	2	-	-	-	-	-	3	2	3
CO3	*Study the behaviour of RC beams in bond, Anchorage, shear and torsion*	3	3	1	2	-	2	-	-	-	-	-	2	2	3
CO4	*Discuss the types of columns and design of columns and footings*	3	3	2	2	-	2	-	-	-	-	-	3	2	3
CO5	*Design staircase, flat slab and RC walls*	3	3	3	2	-	2	-	-	-	-	-	3	2	3
Average		3	3	2	2	-	2	-	-	-	-	-	3	2	3

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

20CE516	**WATER SUPPLY ENGINEERING**	L	T	P	C
		3	0	0	3

Prerequisite: -

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Analyse the quantity and quality of water from various sources and estimate water demand.*	Analyse
CO2:	*Select the suitable source of water supply after analysis of water quality and other parameters.*	Apply
CO3:	*Illustrate various process involved in water conveyance system.*	Understand
CO4:	*Select suitable water treatment to be given and design of components of a water treatment plant*	Apply
CO5:	*Choose the appropriate water distribution network for a city and plumbing systems for a building.*	Apply

UNIT - I PLANNING OF WATER SUPPLY SYSTEM [9]

Public water supply system – Planning – Objectives – Design period – Standards and Planning factors for public water supply system – Population forecasts – Variation demand Pattern – Continuous Vs Intermittent Supplies – Water quality analysis and standards

UNIT - II SOURCES OF WATER [9]

.Surface and Ground water sources – Elementary hydrology to compute impounded storage requirements – Mass curve analysis – Wells, Infiltration galleries – Deep tube wells – Construction, development and sanitary protection of wells, Hydraulics of ground water flow – estimating yields of wells – Steady state conditions – Intakes structure

UNIT - III CONVEYANCE OF WATER [9]

Pipes and Channels for transporting water – Hydraulics of pipe flow – Use of charts and Nomograms for flow computations – Materials for pipes and conduits – Selection of Materials and Class for pipes – Laying, Jointing and testing of G.I, C.I,R.C.C pipes – Pumps and pumping stations – Selection of pumps – Series and parallel operation-Water transmission for irrigation system

UNIT - IV TREATMENT OF WATER [9]

Objectives – Unit process of water treatment – Principles, functions and design of flash mixers, floculators, sedimentation tank and sand filters – Principles of disinfection , Water softening, aeration, iron and manganese removal, fluoride removal – Residue management – Demineralization – Desalination – Membrane systems – Recent advances

UNIT - V STORAGE AND DISTRIBUTION OF WATER [9]

Types, functions and requirement of water distribution system – Service reservoirs – Functions and drawings – Network design – Economics – Computer applications – Analysis of distribution network using Hardy Cross method – Equivalent pipes – Elementary methods of pipe sizing – Operation and maintenance – Leak detection – Principles of design of water supply in buildings – House service connection – Fixtures and fittings – Systems of plumbing and drawings of types of plumbing – Introduction to IoT in water supply distribution system.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1. Garg,S.K., Water Supply Engineering,Vol.1,Khanna Publishers, New Delhi, Thirty third Edition, 2017
2. Punmia, B.C. Ashok Kumar Jain. and Arun Kumar Jain., Environmental Engineering (Water Supply Engineering), Laxmi Publications, New Delhi, Second Edition, 2016.

Reference Books :

1. Modi,P.N., Water Supply Engineering, Vol.1, Standard Book House, New Delhi, Sixth Edition, 2018.
2. Paul Guyer, J., An Introduction to Water Supply Systems, Create Space Independent Publishing Platform, California, Second Edition, 2017.
3. Birdie, G.S. and Birdie, J.S, Water Supply and Sanitation Engineering, Dhanpat Rai & Sons, New Delhi, Ninth Edition, 2014.
4. http://nptel.ac.in/courses/105106119/

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE516 **Course Name: WATER SUPPLY ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Analyse the quantity and quality of water from various sources and estimate water demand.*	3	3	3	2	-	3	2	2	-	2	1	2	2	3
CO2	*Select the suitable source of water supply after analysis of water quality and other parameters.*	3	3	2	2	-	3	2	2	-	2	1	2	2	3
CO3	*Illustrate various process involved in water conveyance system.*	3	3	2	2	-	3	-	-	-	2	1	2	2	2
CO4	*Select suitable water treatment to be given and design of components of a water treatment plant*	3	3	3	2	-	3	-	2	-	2	1	2	3	2
CO5	*Choose the appropriate water distribution network for a city and plumbing systems for a building.*	3	3	3	2	2	3	-	-	-	2	1	2	3	2
Average		3	3	3	2	2	3	2	2	-	2	1	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

20CE521	**ENVIRONMENTAL ENGINEERING LABORATORY**	L	T	P	C
		0	0	3	1

Prerequisite: -

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Perform common environmental experiments relating to water and wastewater quality, and interpret the results.*	*Evaluate*
CO2:	*Apply the laboratorial results to problem identification, quantification, and basic environmental design and technical solutions.*	*Apply*
CO3:	*Demonstrate the ability to write clear technical laboratorial reports.*	*Understand*
CO4:	*Analyse the impact of water and wastewater treatment on people and the environment.*	*Analyze*
CO5:	*Apply ethical issues associated with decision making and professional conduct in the laboratorial and field environment*	*Apply*

List of Experiments:

1. Sampling and preservation methods and significance of characterization of water and Waste water.
2. Determination of PH and turbidity
3. Determination of Iron
4. Determination of Fluoride
5. Determination of Hardness
6. Determination of residual chlorine
7. Determination of chlorides
8. Determination of Optimum Coagulant Dosage
9. Determination of available Chlorine in Bleaching powder
10. Determination of dissolved oxygen
11. Determination of suspended, dissolved and total solids
12. Determination of B.O.D.
13. Determination of C.O.D.
14. Introduction to Bacteria logical Analysis (Demonstration only)

Total : 45 Periods

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE521** **Course Name:** **ENVIRONMENTAL ENGINEERING LABORATORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Perform common environmental experiments relating to water and wastewater quality, and interpret the results.*	3	3	3	3	-	2	2	1	1	-	-	2	2	3
CO2	*Apply the laboratorial results to problem identification, quantification, and basic environmental design and technical solutions.*	3	3	3	3	-	2	2	1	1	-	-	2	2	3
CO3	*Demonstrate the ability to write clear technical laboratorial reports.*	3	3	3	3	-	2	2	1	1	-	-	2	2	3
CO4	*Analyse the impact of water and wastewater treatment on people and the environment.*	3	3	3	3	-	2	2	1	1	-	-	2	2	3
CO5	*Apply ethical issues associated with decision making and professional conduct in the laboratorial and field environment*	3	3	3	3	-	2	2	1	1	-	-	2	2	3
	Average	3	3	3	3	-	2	2	1	1	-	-	2	2	3

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

20CE522	**CONCRETE LABORATORY**	L	T	P	C
		0	0	3	1

Prerequisite: -

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Perform tests on fresh concrete as per IS codes of practice*	*Evaluate*
CO2:	*Carry out testing of hardened concrete as per IS codes of practice*	*Evaluate*
CO3:	*Conduct testing of concrete by Nondestructive test – Rebound hammer*	*Evaluate*
CO4:	*Conduct testing of concrete by Nondestructive test Ultra sonic pulse velocity test*	*Evaluate*
CO5:	*Interpret on quality of concrete as per IS codes of practice*	*Understand*

List of Experiments:

I. Tests on Fresh concrete

1. Slump value
2. Flow table
3. Compaction factor
4. Vee-Bee Consistometer

II. Tests on Hardened concrete

5. Compressive strength
6. Split tensile strength
7. Flexural strength
8. Modulus of Elasticity

III. Non Destructive tests

9. Rebound hammer
10. Ultra sonic pulse velocity

Total : 45 Periods

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE522 **Course Name: CONCRETE LABORATORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Perform tests on fresh concrete as per IS codes of practice*	3	2	3	3	-	-	-	2	1	-	-	-	3	3
CO2	*Carry out testing of hardened concrete as per IS codes of practice*	3	2	3	3	-	-	-	2	1	-	-	-	3	3
CO3	*Conduct testing of concrete by Nondestructive test – Rebound hammer*	3	3	3	3	2	-	-	2	1	-	-	-	3	3
CO4	*Conduct testing of concrete by Nondestructive test Ultra sonic pulse velocity test*	3	3	3	3	2	-	-	2	1	-	-	-	3	3
CO5	*Interpret on quality of concrete as per IS codes of practice*	3	3	3	3	-	-	-	2	1	-	-	-	3	3
	Average	3	3	3	3	2	-	-	2	1	-	-	-	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20HR523	**CAREER DEVELOPMENT SKILLS - III**	0	2	0	0

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Understand the nearness of leading various texts.*	*Apply*
CO2:	*Perform well in verbal and logical reasoning.*	*Apply*
CO3:	*Understand and develop the etiquette necessary to present oneself in a professional setting.*	*Understand*
CO4:	*Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.*	*Create*
CO5:	*Enhance the comprehension Skills in core subjects.*	*Apply*

UNIT - I **WRITTEN AND ORAL COMMUNICATION – PART 1** **[06]**

Reading Comprehension Level 3 - Self Introduction - News Paper Review - Self Marketing - Debate- Structured and Unstructured GDs Psychometric Assessment – Types & Strategies to answer the questions Practices: Sentence Completion - Sentence Correction - Jumbled Sentences - Synonyms & Antonyms - Using the Same Word as Different Parts of Speech - Interpretation of Pictorial Representations – Editing.

UNIT - II **VERBAL & LOGICAL REASONING – PART 2** **[06]**

Syllogism - Assertion and Reasons - Statements and Assumptions - Identifying Valid Inferences - identifying Strong Arguments and Weak Arguments - Statements and Conclusions- Cause and Effect - Deriving Conclusions from Passages - Seating Arrangements Practices: Analogies - Blood Relations - Statement & Conclusions.

UNIT - III **QUANTITATIVE APTITUDE – PART 3** **[06]**

Probability - Calendar- Clocks - Logarithms - Permutations and Combinations.

UNIT - IV **QUANTITATIVE APTITUDE – PART 4** **[06]**

Algebra - Linear Equations - Quadratic Equations – Polynomials – Problem on Numbers – Ages – Train – Time and Work – Sudoku – Puzzles.

UNIT - V **DOMAIN PROFICIENCY** **[06]**

Competitive exam training: ENGINERING Mechanics – Mechanics of Solids – Fluid Mechanics – Construction materials - Surveying.

Total (L= 0, T = 30) = 30 Periods

Text Books :

1 Anne Laws, Writing Skills, Orient Black Swan., Hyderabad, 2011.

2 AbhijitGuha, Quantitative Aptitude, TMH, New Delhi,Third Edition,2009

Reference Books :

1 Agarwal. R.S ,A.Modern Approach to Verbal and Non- verbal Reasoning, Revised Edition 2008, Reprint 2009, S.Chand& Co Ltd., New Delhi.

2 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005.

3 M.B. Lal&Goswami, Objective Instant Arithmetic,Upkar Publications, New Delhi, second edition,2012.

4 Norman Lewis. W.R., "Word Power Made Easy", Goyal Publications

5 Khurmi, R.S., and Gupta, J.K., Civil Engineering - Conventional and Objective type, S. Chand Publishers, New Delhi, First Edition,2018.

Course Faculty **Module Coordinator** **Chairman BoS/ S&H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20HR523 **Course Name: CAREER DEVELOPMENT SKILLS - III**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Understand the nearness of leading various texts.*	-	-	-	-	-	-	-	1	3	3	-	-	1	1
CO2	*Perform well in verbal and logical reasoning.*	-	-	-	-	-	-	-	1	3	3	-	2	1	1
CO3	*Understand and develop the etiquette necessary to present oneself in a professional setting.*	-	-	-	-	-	-	-	1	3	3	-	1	1	1
CO4	*Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.*	-	-	-	-	-	-	-	1	3	3	-	2	1	1
CO5	*Enhance the comprehension Skills in core subjects.*	-	-	-	-	-	-	-	1	3	3	-	-	1	1
	Average	-	-	-	-	-	-	-	1	**3**	**3**	**-**	**2**	**1**	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/ S&H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20CE611	**IRRIGATION ENGINEERING**	3	0	0	3

Prerequisite: -

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Explain the concept of irrigation engineering and to determine crop water requirement.*	*Understand*
CO2:	*Relate the suitability of surface irrigation methods in practical situation.*	*Remember*
CO3:	*Outline the various concepts in the irrigation structures.*	*Understand*
CO4:	*Interpret canal losses and design of canals by using silt theories.*	*Understand*
CO5:	*Illustrate the irrigation water management by applying managerial skills.*	*Understand*

UNIT - I INTRODUCTION TO IRRIGATION ENGINEERING [9]

Irrigation - requirements of irrigation - Advantages and disadvantages of irrigation - Crop and crop seasons - consumptive use of water - Duty and Delta - Factors affecting duty - Irrigation efficiencies - Investigation and Preparation of Irrigation Projects.

UNIT - II IRRIGATION METHODS [9]

Surface irrigation - Flooding methods - Canal irrigation - Lift irrigation - Tank irrigation - Sprinkler irrigation - Drip irrigation.

UNIT - III NON-RIGID AND RIGID STRUCTURES [9]

Weirs - Elementary profile - Weirs on pervious soils - Tank surplus weir - Gravity dams - Earth dams - Arch dams - Spillways - Factors affecting location and type of dams - Forces acting on a dam.

UNIT - IV CANAL IRRIGATION ENGINEERING [9]

Classification of canals - Canal alignment - Distribution network-Canal losses - Sedimentation losses - Silt theory - Design of canals based on silt theories and use of chart-Balancing depth of cutting - Design procedure for fixing longitudinal section - Canal lining- types, Construction and Maintenance.

UNIT - V IRRIGATION WATER MANAGEMENT [9]

Need for optimization - Minimizing irrigation losses - On farm development works - Participatory irrigation management - Water users associations - Performance evaluation-Changing paradigms in water management – IoT in irrigation water management.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1. Santhosh Kumar Garg., Irrigation Engineering and Hydraulic Structures, Khanna Publishers, New Delhi, Second Edition, 2011.
2. Punmia, B.C, Arun Kumar Jain. Ashok Kumar Jain. and Pande Brij Basi Lal., Irrigation and Water Power Engineering, Laxmi Publications, New Delhi, Sixteenth Edition, 2009.

Reference Books :

1. Sharma,R. K. and Sharma, T. K., Irrigation Engineering, S.Chand & Co, New Delhi, Third Edition,2008.
2. Cuenca, Richard H., Irrigation Systems Design, Planning and Construction, Cabi Publishing, United Kingdom, First Edition, 2007.
3. Sahasrabudhe, S.R., Irrigation Engineering and Hydraulic Structures Third Edition, SK Kataria & Sons, New Delhi, Third Edition, 2011.
4. http://nptel.ac.in/downloads/105105110/pdf.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE611 **Course Name: IRRIGATION ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain the concept of irrigation engineering and to determine crop water requirement.*	3	2	-	-	-	-	2	-	-	-	-	-	2	3
CO2	*Relate the suitability of surface irrigation methods in practical situation.*	3	3	-	-	-	-	2	-	-	-	-	-	2	3
CO3	*Outline the various concepts in the irrigation structures.*	3	3	3	-	-	-	2	-	-	-	-	-	2	3
CO4	*Interpret canal losses and design of canals by using silt theories.*	3	3	3	-	-	-	2	-	-	-	-	-	2	3
CO5	*Illustrate the irrigation water management by applying managerial skills.*	3	2	3	-	-	-	2	-	-	-	2	-	2	3
	Average	3	3	3	-	-	-	2	-	-	-	2	-	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty ` **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20CE612	**STRUCTURAL ANALYSIS II**	3	0	0	3

Prerequisite: *- Structural analysis I*

Course Outcomes: On Completion of this course, the student will be able to **Cognitive Level**

CO1:	*Solve various forces in three hinged, two hinged and fixed arches.*	*Apply*
CO2:	*Analyze the space frames, suspension cables and bridges by using classical methods.*	*Apply*
CO3:	*Analyze the continuous beam, pin jointed plane frame and rigid jointed plane frames by flexibility method.*	*Analyze*
CO4:	*Analyze the continuous beam, pin jointed plane frame and rigid jointed plane frames by stiffness method.*	*Analyze*
CO5:	*Examine the plastic hinge mechanism in the analysis of indeterminate beams & frames and apply the concept of upper & lower bound theorem*	*Analyze*

UNIT - I ARCHES [09]

Actual arch, Theoretical arch - Eddy's theorem - Types of arches - Analysis of three hinged and two hinged parabolic and circular arches - Settlement and temperature effects - Analysis of fixed arches (Principle only).

UNIT - II SUSPENSION BRIDGES AND ANALYSIS OF SPACE FRAME [09]

Equilibrium of cable - Suspension cables - Suspension bridges with three hinged stiffening girders - Analysis of Space trusses using method of tension coefficients - Anchorage of cables.

UNIT - III FLEXIBILITY MATRIX METHOD [09]

Indeterminacy - Primary structure - Compatibility conditions - Analysis of indeterminate pin-jointed plane frames, continuous beams, rigid jointed plane frames (with redundancy restricted to two).

UNIT - IV STIFFNESS MATRIX METHOD [09]

Element and global stiffness matrices - Analysis of continuous beams - Analysis of pin-jointed plane frames and rigid frames by direct stiffness method (with redundancy restricted to two).

UNIT - V PLASTIC ANALYSIS OF STRUCTURES [09]

Statically indeterminate axial problems - Beams in pure bending - Plastic moment of resistance - Plastic modulus - Shape factor - Load factor - Plastic hinge and mechanism - Upper and lower bound theorems - Plastic analysis of indeterminate beams and frames.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1. Vaidyanadhan, R. Perumal, P., Structural Analysis, Vol. 1 & Vol. 2, Laxmi Publications, New Delhi, Fourth Edition, 2016.
2. Rajasekaran,S.Sankerasubramanian,G., Computational Structural Mechanics, Prentice Hall India Learning Private Limited, New Delhi, Seventh Edition, 2015.

Reference Books :

1. Punmia, B.C.Ashok Kumar Jain. and Arun Kumar Jain., Theory of Structures – SMTS-II, Laxmi Publications, New Delhi, Thirteenth Edition, 2017.
2. Manicka Selvam, V.K, Elements of Matrix Methods and Stability Analysis of Structures, Khanna Publishers, New Delhi, Seventh Edition, 2016.
3. Weaver William and Gere, James M., Matrix Analysis of Framed Structures, CBS Publishers and Distributors, New Delhi, Second Edition, 2004.
4. http://nptel.ac.in/courses/105101086/

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE612 **Course Name: STRUCTURAL ANALYSIS II**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Solve various forces in three hinged, two hinged and fixed arches.*	3	3	2	-	-	-	-	-	-	-	-	2	3	3
CO2	*Analyze the space frames, suspension cables and bridges by using classical methods.*	3	3	2	-	-	-	-	-	-	-	-	2	3	3
CO3	*Analyze the continuous beam, pin jointed plane frame and rigid jointed plane frames by flexibility method.*	3	3	2	-	-	-	-	-	-	-	-	2	3	3
CO4	*Analyze the continuous beam, pin jointed plane frame and rigid jointed plane frames by stiffness method.*	3	3	2	-	-	-	-	-	-	-	-	2	3	3
CO5	*Examine the plastic hinge mechanism in the analysis of indeterminate beams & frames and apply the concept of upper & lower bound theorem*	3	3	2	-	-	-	-	-	-	-	-	2	3	3
	Average	3	3	2	-	-	-	-	-	-	-	-	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty ` **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

20CE613	**DESIGN OF STEEL STRUCTURES**	L	T	P	C
		3	0	0	3

Prerequisite: *-*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Describe the concepts of limit state design and do the design of joints.*	*Apply*
CO2:	*Design the various sections of tension members.*	*Apply*
CO3:	*Design the various types of compression members as per IS code.*	*Apply*
CO4:	*Solve the flexural members as per IS code.*	*Apply*
CO5:	*Design various components of steel roof truss.*	*Apply*

UNIT - I INTRODUCTION **[09]**

Properties of steel –Structural steel sections - Limit State Design Concepts –Loads on structures – Connections using rivets, welding, bolting – Design of bolted, riveted and welded joints - Eccentric Connections – Efficiency of joints.

UNIT - II TENSION MEMBERS **[09]**

Types of tension members – Net area – Net effective sections for angles and Tee in tension – Design of connections in tension members – Use of lug angles – Design of tension splice – Concept of shear lag.

UNIT - III COMPRESSION MEMBERS **[09]**

Types of compression members - Theory of columns - Basis of current codal provision for compression member design - Slenderness ratio - Design of single section and compound section compression members - Design of lacing and battening type columns.

UNIT - IV BEAMS **[09]**

Design of laterally supported and unsupported beams - Built up beams - Beams subjected to uniaxial and biaxial bending - Design of plate girders riveted and welded - Intermediate and bearing stiffeners - Web splices.

UNIT - V ROOF TRUSSES **[09]**

Roof and side coverings – Components of trusses – Load combinations – Design procedure of roof truss – Design of purlin.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1 Subramanian, N., Design of Steel Structures, Oxford University Press, New Delhi, Third Edition, 2018.

2 Bhavikatti, S. S., Design of Steel Structures, I.K. International Publishing House Pvt. Limited, New Delhi, Fourth Edition, 2015.

Reference Books :

1 Duggal, S.K., Limit State Design of Steel Structures, McGraw-Hill Education (India) Pvt Limited, New Delhi, Third Edition, 2019.

2 Wei Wen Yu., Cold Formed Steel Design, John Wiley & Sons, Hoboken, Third Revised Edition, 2000.

3 Negi, L.S., Design of Steel Structures, Tata McGraw Hill Publishing Pvt. Ltd, New Delhi, Second Edition, 2017

4 IS 800-2007 Indian Standard General Construction in Steel – Code of Practice (Third Revision).

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE613 **Course Name: DESIGN OF STEEL STRUCTURES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Describe the concepts of limit state design and do the design of joints.*	3	3	3	-	-	3	-	-	-	-	-	1	3	3
CO2	*Design the various sections of tension members.*	3	3	3	-	-	3	-	-	-	-	-	2	3	3
CO3	*Design the various types of compression members as per IS code.*	3	3	3	-	-	3	-	-	-	-	-	2	3	3
CO4	*Solve the flexural members as per IS code.*	3	3	3	-	-	3	-	-	-	-	-	2	3	3
CO5	*Design various components of steel roof truss.*	3	3	3	-	-	3	-	-	-	-	-	2	3	3
Average		3	3	3	-	-	3	-	-	-	-		2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty ` **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20CE614	**WASTE WATER ENGINEERING**	3	0	0	3

Prerequisite: *Water Supply Engineering*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Explain the concept of sources of waste water generation, estimation of sewage generation, storm runoff and effluent standards and legislations*	*Understand*
CO2:	*Illustrate the design concepts and implementation of sewage transmission systems.*	*Understand*
CO3:	*Infer the design principles of unit operations and processes in primary treatment of sewage.*	*Understand*
CO4:	*Elucidate the fundamental scientific process underlying for design and choose the various secondary units of wastewater treatment.*	*Understand*
CO5:	*Identify the suitable methods for disposal of sewage and sludge.*	*Apply*

UNIT - I PLANNING OF SEWERAGE SYSTEMS [9]

Sources of waste water generation - Effects - Estimation of sanitary sewage flow - Estimation of storm runoff- Factors affecting Characteristics and composition of sewage and their significance - Effluent standards - Legislation requirements

UNIT - II SEWER DESIGN [9]

Sewerage - Hydraulics of flow in sewers - Objectives - Design period - Design of sanitary and storm sewers - Laying, joining & testing of sewers - appurtenances -Pumps-selection of pumps and pipe Drainage - Plumbing System for Buildings - One pipe and two pipe system.

UNIT - III PRIMARY TREATMENT OF SEWAGE [9]

Objective - Unit Operation and Processes - Selection of treatment processes - Primary treatment - Principles, functions design and drawing of screen, grit chambers and primary sedimentation tanks - Operation and Maintenance aspects - Septic tank - Grey water harvesting.

UNIT - IV SECONDARY TREATMENT OF SEWAGE [9]

Objective-Selection of Treatment Methods - Activated Sludge Process and Trickling filter, other treatment methods - Oxidation ditches, UASB - Waste Stabilization Ponds - Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment - Construction and Operation & Maintenance of Sewage Treatment Plants.

UNIT - V DISPOSALOF SEWAGE AND SLUDGE [9]

Standards for Disposal - Methods - dilution - Self-purification of surface water bodies - Oxygen sag curve - Land disposal - Sewage farming - Soil dispersion system - Sludge characterization -Thickening - Sludge digestion - Biogas recovery -Sludge Conditioning and Dewatering -Disposal - Advances in Sludge Treatment and disposal.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1. Garg, S.K., Environmental Engineering Vol. II, Sewage disposal and Air Pollution Engineering, Khanna Publishers, New Delhi, Thirty Seventh Edition,2017.
2. Punmia, B.C. Jain, A.K. and Jain. A., Environmental Engineering, Vol.II, Lakshmi Publications, New Delhi, Fifteenth Edition, 2007.

Reference Books :

1. Modi,P.N., Sewage Treatment & Disposal & Waste Water Engineering, Standard Book House, New Delhi, Seventeenth Edition, 2020.
2. Franklin Burton. George Tchobanoglous. and Stensel, H.David., Waste Water Engineering–Treatment and Reuse, Tata Mc.Graw-Hill Company, New Delhi, Fourth Edition,2011.
3. Hammer, Mark J.,Water and Waste Water Technology, Prentice Hall of India, New Delhi, Seventh Edition, 2008.
4. Manual on Sewerage and Sewage Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE614 **Course Name: WASTE WATER ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain the concept of sources of waste water generation, estimation of sewage generation, storm runoff and effluent standards and legislations*	3	3	3	2	-	2	-	2	-	-	-	2	2	3
CO2	*Illustrate the design concepts and implementation of sewage transmission systems.*	3	3	3	2	-	-	-	-	-	1	-	2	2	2
CO3	*Infer the design principles of unit operations and processes in primary treatment of sewage.*	3	3	3	2	-	-	2	2	-	1	-	2	2	2
CO4	*Elucidate the fundamental scientific process underlying for design and choose the various secondary units of wastewater treatment.*	3	3	3	2	-	-	2	2	-	1	-	2	3	2
CO5	*Identify the suitable methods for disposal of sewage and sludge.*	3	3	3	2	-	-	2	2	-	-	-	2	3	3
	Average	3	3	3	2	-	-	2	2	-	1	-	2	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty ` **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20CE621	**IRRIGATION AND ENVIRONMENTAL ENGINEERING DRAWING**	0	0	3	1

Prerequisite: - *Irrigation Engineering, Environmental Engineering-I*

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Design and present detailed d*rawings of *surplus weir and tank sluice.*	*Create*
CO2:	*Design and present detailed d*rawings of various *canal regulatory structures.*	*Create*
CO3:	*Prepare layout of water and waste water treatment plants.*	*Create*
CO4:	*Design water treatment structures based on various requirements and draw different views.*	*Create*
CO5:	*Design waste water treatment structures based on various requirements and draw different views.*	*Create*

List of Experiments:

1. Design and detailed drawings of tank surplus weir.
2. Design and detailed drawings of tank sluice with tower head.
3. Design and detailed drawings of canal drop (Notch type).
4. Design and detailed drawings of canal regulator.
5. Design and detailed drawings of syphon aqueduct.
6. General layout of water and waste water treatment plants.
7. Design and detailed drawings of sedimentation tank with coagulation.
8. Design and detailed drawings of flash mixer.
9. Design and detailed drawings of rapid sand filter.
10. Design and detailed drawings of trickling filter.
11. Design and detailed drawings of septic tank.

Total : 45 Periods

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE621** **Course Name:** **IRRIGATION AND ENVIRONMENTAL ENGINEERING DRAWING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Design and present detailed* drawings of *surplus weir and tank sluice.*	3	3	3	3	-	2	3	3	-	-	-	-	3	3
CO2	*Design and present detailed* drawings of various *canal regulatory structures.*	3	3	3	3	-	2	3	3	-	-	-	-	3	3
CO3	*Prepare layout of water and waste water treatment plants.*	3	-	-	-	-	-	3	-	-	-	-	1	-	-
CO4	*Design water treatment structures based on various requirements and draw different views.*	3	3	3	3	-	2	3	3	-	-	-	1	3	3
CO5	*Design waste water treatment structures based on various requirements and draw different views.*	3	3	3	3	-	2	3	2	-	-	-	1	3	3
	Average	**3**	**3**	**3**	**3**	**-**	**2**	**3**	**3**	**-**	**-**	**-**	**1**	**3**	**3**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty ` **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20CE622	**SURVEY CAMP***	0	0	3	1

Prerequisite: - *Survey Practical*

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Calculate areas for the given site.*	*Evaluate*
CO2:	*Prepare contour map of the area as per given technical specifications.*	*Create*
CO3:	*Prepare the profile pattern for proposed highway project.*	*Create*
CO4:	*Come across the design of elevated point for the construction of new water tank.*	*Create*
CO5:	*Choose and Work with modern survey equipment's.*	*Apply*

Triangulation.

II. Contour Surveying.

III. L.S/C. S for road works.

IV. Surveying for existing water tank and proposed water tank.

V. Total station surveying – Applications.

EVALUATION PROCEDURE

1. Internal Marks : 30 marks
(Based on observation of student's field work by the staff in charge)

2. Evaluation of Survey Camp Report : 20 marks
(Evaluated by the external examiner appointed by the University)

3. Viva voce examination : 50 marks
(Evaluated by the internal examiner appointed by the HoD with the approval of Principal and external examiner appointed by the COE, Autonomous – with equal weight age)

*2 weeks during V Semester vacation.

Total : 100 marks

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE622 **Course Name: SURVEY CAMP***

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Calculate areas for the given site.*	3	2	3	2	-	-	-	-	-	-	-	2	2	3
CO2	*Prepare contour map of the area as per given technical specifications.*	3	2	2	2	-	-	-	-	-	-	-	2	2	3
CO3	*Prepare the profile pattern for proposed highway project.*	3	2	2	3	-	2	-	-	-	-	-	2	2	3
CO4	*Come across the design of elevated point for the construction of new water tank.*	3	2	3	2	-	-	-	-	-	-	-	2	2	3
CO5	*Choose and Work with modern survey equipment's.*	3	2	2	2	3	-	-	-	-	-	-	3	2	3
	Average	**3**	**2**	**2**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty ` **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20HR624	**CAREER DEVELOPMENT SKILLS - IV**	0	2	0	0

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Employ critical thinking in personal interviews type situations.*	*Apply*
CO2:	*Understand the Quantitative Aptitude problems in geometry.*	*Understand*
CO3:	*Understand the data interpretation and analysis by using various graphs.*	*Understand*
CO4:	*Enhance the skills in resume writing and presentation.*	*Create*
CO5:	*Enhance the comprehension Skills in core subjects.*	*Apply*

UNIT - I WRITTEN AND ORAL COMMUNICATION – PART 2 [06]

Self-Introduction – GD – Personal Interview Skills Practices on Reading Comprehension Level 2 – Paragraph Writing – Newspaper and Book Review Writing – Skimming and Scanning – Interpretation of Pictorial Representations – Sentence Completion – Sentence Correction – Jumbled Sentences – Synonyms& Antonyms – Using the Same Word as Different Parts of Speech – Editing.

UNIT - II QUANTITATIVE APTITUDE [06]

Geometry – Straight Line – Triangles – Quadrilaterals – Circles – Co-ordinate Geometry – Cube – Cone – Sphere.

UNIT - III DATA INTERPRETATION AND ANALYSIS [06]

Data Interpretation based on Text – Data Interpretation based on Graphs and Tables. Graphs Column Graphs, Bar Graphs, Line Charts, Pie Chart, Graphs representing Area, Venn Diagram & Flow Charts.

UNIT - IV RESUME WRITING & PRESENTATION SKILLS [06]

An Introduction to the Resume – Types of Resumes – Common Resume Errors – Anatomy of a Resume – What is a Cover Letter? – Types of Cover Letters – Enhancing the Language and Style of Your Resume and Cover Letter – Assessment.

Presentation Skills: Oral presentation and public speaking skills; business presentations. – Understand the Situation – Know Your Tools – Know Yourself – Organize it, Write the Script – Practice – Delivering a Presentation.

UNIT - V DOMAIN PROFICIENCY [06]

Highway Engineering-Railways Airport and Harbour Engineering-Concrete Technology – Structural Analysis-I-Design of Reinforced Concrete-Soil mechanics- Foundation Engineering-Water Supply Engineering.

Total (L= 0, T = 30) = 30 Periods

Text Books :

1 Anne Laws, Writing Skills, Orient Black Swan., Hyderabad, 2011.

2 Abhijit Guha, Quantitative Aptitude, TMH, New Delhi, Third Edition,2009

Reference Books :

1 Agarwal. R.S , A.Modern Approach to Verbal and Non- verbal Reasoning, Revised Edition 2008, Reprint 2009, S.Chand& Co Ltd., New Delhi.

2 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005.

3 M.B. Lal & Goswami, Objective Instant Arithmetic, Upkar Publications, New Delhi, Second Edition, 2012.

4 V.K. Mehta & Rohit Mehta, Objective Electrical Technology, S Chand publications, First Edition, 2012.

Course Faculty **Module Coordinator** **Chairman BoS/ S&H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20HR624 **Course Name: CAREER DEVELOPMENT SKILLS - IV**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Employ critical thinking in personal interviews type situations.*	-	-	-	-	2	-	-	-	1	3	-	2	-	-
CO2	*Understand the Quantitative Aptitude problems in geometry.*	-	-	-	-	2	-	-	-	1	3	-	2	-	-
CO3	*Understand the data interpretation and analysis by using various graphs.*	-	-	-	-	2	-	-	-	1	3	-	2	-	-
CO4	*Enhance the skills in resume writing and presentation.*	-	-	-	-	2	-	-	-	1	3	-	2	-	-
CO5	*Enhance the comprehension Skills in core subjects.*	-	-	-	-	2	-	-	-	1	3	-	2	-	-
	Average	-	-	-	-	2	-	-	-	**1**	**3**	**-**	**2**	**-**	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty ` **Module Coordinator** **Chairman BoS/ S&H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20CE661	**PREFABRICATED STRUCTURES (Professional Elective - I)**	3	0	0	3

Prerequisite: *-*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Demonstrate the general principles of fabrication and applications of fabrication.*	*Understand*
CO2:	*Interpret the behavior of prefabricated structural components such as roof, floor panels, footings, wall panels.*	*Understand*
CO3:	*Relate ideas in manufacturing* precast elements *for stationary and mobile production.*	*Remember*
CO4:	*Recall the techniques for erection of different types of prefabricated structural members.*	*Remember*
CO5:	*Illustrate the prefabricated structural components for accidental forces.*	*Understand*

UNIT - I PRINCIPLES OF PREFABRICATION [9]

Types of prefabrication – site and plant prefabrication -Economy of prefabrication – Modular coordination – Standardization- Disuniting of Prefabricates, production, transportation, erection, stages of loading – Applications of Prefabrication

UNIT - II PREFABRICATION OF STRUCTURAL ELEMENTS [9]

Behaviour of structural components - Roof and floor panels- wall panels – footings – Joints for different structural Connections – Effective sealing of joints for water proofing- Columns – Shear walls.

UNIT - III MANUFACTURING METHODS AND TECHNOLOGY [9]

Manufacturing methods – Stationary and mobile production- Storage of precast elements - Dimensional tolerances

UNIT - IV HOISTING AND ERECTION [9]

Equipments for hoisting and erection – Techniques for erection of different types of members like Slabs, Beams, Wall panels and Columns – Advanced techniques - Vacuum lifting pads.

UNIT - V DESIGN FOR ACCIDENTAL FORCES [9]

Progressive collapse-Equivalent design loads for disaster effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1 Soundararajan, V. Jagadeeshkumar, R. and Kalpanadevi.S., Prefabricated Structures, ARS Publications, Chennai, First Edition, 2017.

2 Ganesan,R. and. Latha, A., Prefabricated Structures, Sree Kamalamani Publications, Chennai, Third Edition, 2014.

Reference Books :

1 Lewicki. B., Building with Large Prefabricates, Elsevier Publishing Company, London, 1966.

2 Alfred Steinle. Hubert Bachmann. Mathias Tillmann. Philip Thrift. Precast Concrete Structures, Wiley, Hoboken, Second Edition, 2019.

3 Handbook on Precast Concrete for Buildings, Indian Concrete Institute, 2016.

4 http://nptel.ac.in/courses/106106127/

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE661 **Course Name: PREFABRICATED STRUCTURES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Demonstrate the general principles of fabrication and applications of fabrication.*	3	-	-	-	-	2	-	-	-	-	-	-	3	2
CO2	*Interpret the behavior of prefabricated structural components such as roof, floor panels, footings, wall panels.*	3	-	-	-	-	2	-	-	-	-	-	-	3	2
CO3	*Relate ideas in manufacturing* precast elements *for stationary and mobile production.*	3	-	-	-	-	2	-	-	-	-	-	-	3	2
CO4	*Recall the techniques for erection of different types of prefabricated structural members.*	3	-	-	-	-	2	-	-	-	-	-	-	3	2
CO5	*Illustrate the prefabricated structural components for accidental forces.*	3	2	2	-	-	2	-	-	-	-	-	2	3	3
	Average	3	2	2	-	-	2	-	-	-	-	-	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty ` **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20CE662	**DESIGN OF REINFORCED CONCRETE STRUCTURES (Professional Elective - I)**	3	0	0	3

Prerequisite: *-*

Course Outcomes: On Completion of this course, the student will be able to **Cognitive Level**

CO1:	*Design the retaining wall and perform the stability check.*	Apply
CO2:	*Design RC wall and shear wall under various loading conditions.*	Apply
CO3:	*Design the water tank with appropriate design procedure.*	Apply
CO4:	*Analyze and design different types of slabs.*	Apply
CO5:	*Design the Corbel, Pile caps, Bunkers and silos as per IS code.*	Apply

UNIT - I RETAINING WALLS [9]

Introduction – Earth pressure theories – Types of retaining wall – Design and detailing of cantilever and counter fort retaining wall.

UNIT - II Design of RC and Shear Wall [9]

Introduction – Design of RC wall – Types and use of Shear walls – Design of shear wall with boundary elements

UNIT - III DESIGN OF WATER TANKS [9]

Design of underground and on ground rectangular water tanks– Use of Parts I, II and IV of I.S.3370 Codes – Overhead tanks of rectangular shape and circular shape with domical roof – Design of all components including staging and foundation.

UNIT - IV Design of Flat Slabs and Yield Line Theory [9]

Introduction – Design of flat slab (IS Code Method). Yield Line Theory – Equilibrium and virtual work method – Analysis and design of simply supported square, rectangular and circular slabs.

UNIT - V Design of Special RC Elements [9]

Design and detailing of corbels (IS code method) – Design of pile caps –Design principles of bunkers and silos

Total (L: 45 T: 0) = 45 Periods

Text Books :

1. Krishna Raju N, Pranesh R N., Reinforced Concrete Design: IS 456-2000 Principles And Practice, New Age International Pvt Ltd Publishers, Delhi, Reprint Edition, 2018.
2. Subramanian N., Design of Reinforced Concrete Structures, Oxford University Press, New Delhi, First Edition, 2014.

Reference Books :

1. Varghese P.C., Advanced Reinforced Concrete Design, Prentice Hall of India, New Delhi, Second Edition 2013.
2. Krishna Raju N., Advanced Reinforced Concrete Design, CBS Publisher, New Delhi, Third Edition, 2020.
3. Unnikrishna Pillai S. and Devdas Menon, Reinforced Concrete Design, Tata McGraw-Hill, New Delhi, Third Edition, 2011.
4. https://archive.nptel.ac.in/courses/105/105/105105105/

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE662** **Course Name:** **DESIGN OF REINFORCED CONCRETE STRUCTURES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Design the retaining wall and perform the stability check.*	3	3	3	2	-	2	-	-	-	2	-	2	2	3
CO2	*Design RC wall and shear wall under various loading conditions.*	3	3	2	-	-	2	-	-	-	2	-	2	3	3
CO3	*Design the water tank with appropriate design procedure.*	3	3	3	2	-	2	-	-	-	2	-	2	2	3
CO4	*Analyze and design different types of slabs.*	3	3	3	-	-	2	-	-	-	2	-	2	3	3
CO5	*Design the Corbel, Pile caps, Bunkers and silos as per IS code.*	3	3	3	2	-	2	-	-	-	2	-	2	3	3
	Average	**3**	**3**	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**-**	**2**	**3**	**3**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty ` **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20CE663	**MAINTENANCE AND REHABILITATION OF STRUCTURES (Professional Elective - I)**	3	0	0	3

Prerequisite: *- Nil*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Explain the maintenance processes and causes of deterioration of structures*	*Understand*
CO2:	*Illustrate different types of materials used for repairing concrete structures*	*Understand*
CO3:	*Outline the techniques of damage diagnosis and the assessment procedure.*	*Understand*
CO4:	*Extend appropriate protection methods techniques for corrosion damaged structures.*	*Understand*
CO5:	*Summarize the strengthening methods of structures and demolition methods.*	*Understand*

UNIT - I MAINTENANCE AND REPAIR STRATEGIES [9]

Maintenance, importance of maintenance, routine and preventive maintenance, Rehabilitation, Repair, Retrofit and strengthening, need for rehabilitation of structures - Various cracks in R.C. buildings, causes and effects, Various methods of crack repair, Grouting, Routing and sealing, Stitching, Dry packing, Autogenous healing, Overlays, Repair to active cracks, Repair to dormant cracks –- Various damages to masonry structures and causes

UNIT - II REPAIR MATERIALS [9]

Various repair materials, Criteria for material selection, Methodology of selection, Health and safety precautions for handling and applications of repair materials - Polymer Concrete and Mortar, Quick setting compounds - Gas forming grouts, Sulfoaluminate grouts, Polymer grouts, Acrylate and Urethane grouts - Latex emulsions, Epoxy bonding agents - Protective coatings for Concrete and Steel -FRP sheets

UNIT - III DAMAGE DIAGNOSIS AND ASSESSMENT [9]

Visual inspection, Non Destructive Testing using Rebound hammer, Ultra sonic pulse velocity, Semi destructive testing, Probe test, Pull out test, Chloride penetration test, Carbonation, Carbonation depth testing, Corrosion activity measurement - Importance of substrate/surface preparation, General surface preparation methods and procedure, Reinforcing steel cleaning.

UNIT - IV CORROSION DAMAGES AND PROTECTION [9]

Corrosion damage of reinforced concrete, methods of corrosion protection, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, Cathodic protection. Repair of structures distressed due to corrosion, fire, leakage, marine exposure, earthquake-coatings for set concrete and steel reinforcement

UNIT - V STRENGTHENING AND DEMOLITION [9]

Strengthening of Structural elements, Column jacketing, Beam jacketing, Beam Column joint jacketing, Reinforced concrete jacketing, Steel jacketing, FRP jacketing - Strengthening, Beam shear strengthening, Flexural strengthening - Structural Health Monitoring - demolition techniques -Engineered demolition methods - Case studies

Total (L: 45 T: 0) = 45 Periods

Text Books :

1 Vidivelli, B.,Rehabilitation of concrete structures Standard Publishes Distribution Chennai, First Edition, 2009.

2 Varghese, P.C., Maintenance, Repair and Rehabilitation and Minor works of building, Prentice Hall India Pvt. Ltd. New Delhi, Fourth Edition, 2014.

Reference Books :

1 Dodge Woodson,R., Concrete Structures, Protection, Repair and Rehabilitation, Butterworth- Heinemann, Elsevier, Amsterdam, Illustrated Edition, 2009.

2 DovKominetzky, M.S., Design and Construction Failures, Galgotia, Publications Pvt.Ltd. New Delhi, First Edition 2001.

3 Ravishankar, K., Krishnamoorthy,T.S., Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures, Allied Publishers, Chennai, Fourth Edition, 2014.

4 Hand book on Seismic Retrofit of Buildings, CPWD and Indian Buildings Congress, Narosa Publishers, 2008.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE663** **Course Name:** **MAINTENANCE AND REHABILITATION OF STRUCTURES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain the maintenance processes and causes of deterioration of structures*	3	3	2	2	-	3	-	-	-	-	-	2	3	3
CO2	*Illustrate different types of materials used for repairing concrete structures*	3	3	2	2	-	3	-	-	-	-	-	2	3	3
CO3	*Outline the techniques of damage diagnosis and the assessment procedure.*	3	3	2	2	-	3	-	-	-	-		2	3	3
CO4	*Extend appropriate protection methods techniques for corrosion damaged structures.*	3	3	2	2	-	2	-	-	-	-	-	2	3	3
CO5	*Summarize the strengthening methods of structures and demolition methods.*	3	3	2	2	-	2	-	-	-	-	-	2	3	3
Average		**3**	**3**	**2**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20CE664	**HYDROLOGY (Professional Elective - I)**	3	0	0	3

Prerequisite: *-*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Explain the mechanics of rainfall, its spatial and temporal measurements.*	*Understand*
CO2:	*Extend the losses from precipitation and evaporation process.*	*Understand*
CO3:	*Identify the base flow separation and unit hydrograph of different derivations*	*Apply*
CO4:	*Apply the flood discharge by Gumbel's method and muskingum's channel routing.*	*Apply*
CO5:	*Utilize the concepts of the Aquifer and steady flow analysis*	*Apply*

UNIT - I PRECIPITATION **[9]**

Hydrologic cycle – Types of precipitation – Forms of precipitation – Measurement of Rainfall – Rain gauges - Spatial measurement methods – Temporal measurement methods – Frequency analysis of point rainfall – Intensity, duration, frequency relationship – Probable maximum precipitation..

UNIT - II ABSTRACTION FROM PRECIPITATION **[9]**

Losses from precipitation – Evaporation process – Reservoir evaporation - Horton's equation, pan evaporation measurements and evaporation suppression – Infiltration process and Infiltration capacity – Measurement of infiltration – Horton's equation - double ring infiltrometer - Infiltration indices – Effective rainfall.

UNIT - III HYDROGRAPH **[9]**

Factors affecting Hydrograph – Base flow separation – Unit hydrograph – Derivation of unit hydrograph – S curve hydrograph – Unit hydrograph of different deviations – synthetic Unit Hydrograph.

UNIT - IV FLOODS AND FLOOD ROUTING **[9]**

Flood frequency studies-Recurrence interval – Gumbel's method – Flood routing – Reservoir flood routing – Muskingum's Channel Routing – Flood control

UNIT - V GROUND WATER HYDROLOGY **[9]**

Types of aquifers - Darcy's law – Dupuit's assumptions – Confined Aquifer – Unconfined Aquifer - Recuperation test – Transmissibility – Specific capacity – Pumping test – Steady flow analysis only.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1 Subramanya, K., Engineering Hydrology, McGraw-Hill Education (India) Private Ltd, New Delhi, Fifth Edition, 2020.

2 Jayarami Reddy P., A Textbook of Hydrology, Laxmi Publications, Tata McGraw Hill, New Delhi, Third Edition, 2016.

Reference Books :

1 Warren Viessman, J.R. and Lewis, Gary L., Introduction to Hydrology, Pearson Education, New Delhi, Fifth Edition, 2015.

2 Raghunath, H.M., Hydrology, Principles, Analysis and Design, New Age International Pvt. Ltd, New Delhi, Third Edition, 2015.

3 Todd, D.K. and Mays, Larry.W.,Ground Water Hydrology, John Wiley and Sons, New York, Third Edition, 2013.

4 Savindra Singh., Fundamentals of Hydrology, Pravalika Publications, Allahabad, First Revised Edition,2018.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE664 **Course Name: HYDROLOGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain the mechanics of rainfall, its spatial and temporal measurements.*	3	3	2	-	-	3	-	-	-	-	-	2	3	3
CO2	*Extend the losses from precipitation and evaporation process.*	3	3	2	-	-	3	-	-	-	-	-	2	3	3
CO3	*Identify the base flow separation and unit hydrograph of different derivations*	3	3	2	-	-	3	-	-	-	-		2	3	3
CO4	*Apply the flood discharge by Gumbel's method and muskingum's channel routing.*	3	3	2	-	-	3	-	-	-	-	-	2	3	3
CO5	*Utilize the concepts of the Aquifer and steady flow analysis*	3	3	2	-	-	3	-	-	-	-	-	2	3	3
	Average	**3**	**3**	**2**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty ` **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20CE665	**TRAFFIC ENGINEERING AND MANAGEMENT (Professional Elective - I)**	3	0	0	3

Prerequisite: -

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Interpret basic knowledge on traffic engineering basics.*	*Understand*
CO2:	*Analyse the various traffic data required for design.*	*Analyze*
CO3:	*Design control measures for traffic regulations.*	*Create*
CO4:	*Design various kinds of intersections and channelization's.*	*Create*
CO5:	*Evaluate an assortment of traffic management systems.*	*Evaluate*

UNIT - I INTRODUCTION **[9]**

Significance and scope - Characteristics of vehicles and road users - Skid resistance and braking efficiency - Components of traffic engineering-Road, traffic and land use characteristics.

UNIT - II TRAFFIC SURVEYS AND ANALYSIS **[9]**

Basic principles of traffic flow - Surveys and analysis - Volume, capacity, speed and delays, origin and destination, parking, pedestrian studies, accident studies and safety- Level of services

UNIT - III TRAFFIC CONTROL **[9]**

Traffic signs and road markings - Design of traffic signals and signal co-ordination - Traffic control aids and street furniture - Street lighting- Computer applications in signal design.

UNIT - IV GEOMETRIC DESIGN OF INTERSECTIONS **[9]**

Conflicts at intersections - Classification of 'at grade' intersections -Channelized intersections - Principles of intersection design - Elements of intersection design - Rotary design - Grade separation and interchanges -Design principles

UNIT - V TRAFFIC MANAGEMENT **[9]**

Traffic management - Transportation system management (TSM) - Travel demand management (TDM) - Traffic forecasting techniques - Restrictions on turning movements - One way streets-traffic segregation - Traffic calming - Tidal flow operations - Exclusive bus lanes - Intelligent transportation system (ITS)...

Total (L: 45 T: 0) = 45 Periods

Text Books :

1 Kadiyali, L.R., Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, Fourth Edition, 2019.

2 Khanna K. and Justo C.E.G., Highway Engineering, Khanna Publishers, Roorkee, Third Edition, 2015.

Reference Books :

1 Mannering, Fred L. Washburn,Scott S. and Kilareski, Walter P., Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt. Ltd, New Delhi, First Edition,2011.

2 Garber. and Hoel., Principles of Traffic and Highway Engineering, CENGAGE Learning, New Delhi, Fourth Edition 2010.

3 Hobbs, F.D., Traffic Planning and Engineering, University of Brimingham, Peragamon Press Ltd, Third Edition 2005.

4 Jotin Khisty, C. and Kent Lall, B., Transportation Engineering –An Introduction, Prentice Hall of India Pvt. Ltd, Noida, Third Edition, 2016.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE665** **Course Name:** **TRAFFIC ENGINEERING AND MANAGEMENT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Interpret basic knowledge on traffic engineering basics.*	3	2	2	3	-	3	2	-	-	-	-	2	3	3
CO2	*Analyse the various traffic data required for design.*	3	3	3	2	-	3	2	-	-	-	-	2	3	3
CO3	*Design control measures for traffic regulations.*	3	3	3	2	-	3	2	-	-	-		2	3	3
CO4	*Design various kinds of intersections and channelization's.*	3	3	3	2	-	3	2	-	-	-	-	2	3	3
CO5	*Evaluate an assortment of traffic management systems.*	3	2	2	2	-	3	2	-	-	-	-	2	3	3
	Average	**3**	**3**	**3**	**2**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**3**	**3**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20CE666	**GROUND IMPROVEMENT TECHNIQUES (Professional Elective - I)**	3	0	0	3

Prerequisite: *-*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Outline the geotechnical problems of various soil deposits and recommend suitable ground improvement*	*Remember*
CO2:	*Illustrate appropriate techniques for treatment of cohesive soils.*	*Understand*
CO3:	*Recall proper techniques for in situ treatment of cohesionless soils.*	*Remember*
CO4:	*Summarize the concept of earth reinforcement and design of reinforced earth.*	*Understand*
CO5:	*Relate ground conditions and suggest method of improvement.*	*Remember*

UNIT - I INTRODUCTION **[9]**

Role of ground improvement in foundation engineering – methods of ground improvement – Geotechnical problems in alluvial, lateritic and black cotton soils – Selection of suitable ground improvement techniques based on soil conditions.

UNIT - II TREATMENT OF COHESIVE SOILS **[9]**

Dewatering Techniques – Well points – Vacuum and electro osmotic methods – Seepage analysis for two – dimensional flow for fully and partially penetrated slots in homogeneous deposits – Stabilization of soft clay ground using stone columns and Lime piles - Installation techniques -Simple cases – Design.

UNIT - III IN-SITU TREATMENT OF COHESIONLESS SOILS **[9]**

Insitu densification of cohesionless soils – Shallow as deep compaction – Dynamic compaction -Vibroflotation, Sand compaction piles and deep compaction. Consolidation of cohesionless soils -Preloading with sand drains, and fabric drains, – Simple design – Relative merits of above methods and their limitations.

UNIT - IV SOIL REINFORCEMENT **[9]**

Concept of reinforcement – Types of reinforcement material – Reinforced earth wall – Mechanism – Simple design – applications of reinforced earth. Role of Geotextiles in filtration, drainage, separation, road work and containment.

UNIT - V GROUND IMPROVEMENTTECHNIQUES **[9]**

Land slide treatment –Ground freezing technique – Grouting for Dolomitic soil and rock - Grouting in loosened soil - Jet grouting for deep excavation – Vacuum consolidation - Types of grouts – Grouting equipments and machinery – Injection methods – Grout monitoring -Stabilization with cement, lime and chemicals – Stabilization of expansive soil..

Total (L: 45 T: 0) = 45 Periods

Text Books :

1 Purushothama Raj, P., Ground Improvement Techniques, Lakshmi Publications, New Delhi, Fifth Edition, 2016.

2 Koerner, R.M., Construction and Geotechnical Methods in Foundation Engineering, McGraw Hill, New Delhi, Third Edition, 2004.

Reference Books :

1 Mihal, S., An Introduction to Ground Improvement Engineering, Medtech Publisher, Bengaluru, First Edition, 2013.

2 Moseley, M.P., Ground Improvement, CRC Press, Boca Raton, Third Edition, 2019.

3 Moseley, M.P and Kirsch. K., Ground Improvement, Spon Press, Taylor and Francis Group, London, Second Edition, 2004.

4 Jones C.J.F.P. Earth Reinforcement and Soil Structure, Thomas Telford Publishing, London, Third Edition, 1996.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE666** **Course Name:** **GROUND IMPROVEMENT TECHNIQUES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Outline the geotechnical problems of various soil deposits and recommend suitable ground improvement*	3	2	2	3	-	2	2	-	-	-	-	2	2	2
CO2	*Illustrate appropriate techniques for treatment of cohesive soils.*	3	2	3	3	-	2	2	-	-	-	-	2	2	2
CO3	*Recall proper techniques for in situ treatment of cohesionless soils.*	3	2	3	3	-	2	2	-	-	-	-	2	2	2
CO4	*Summarize the concept of earth reinforcement and design of reinforced earth.*	3	2	2	3	-	2	2	-	-	-	-	2	2	2
CO5	*Relate ground conditions and suggest method of improvement.*	3	2	3	3	-	2	2	-	-	-	-	2	2	2
	Average	**3**	**2**	**3**	**3**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**2**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty ` **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20CE712	**QUANTITY SURVEYING AND ESTIMATION**	3	0	0	3

Prerequisite: -

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Work out the quantities of different works of* load bearing and framed structures	*Apply*
CO2:	*Calculate the quantities of various items for other structures.*	*Apply*
CO3:	*Prepare tenders, contract documents and reports as per norms and analyse the rates for various items of works*	*Analyze*
CO4:	*Carry out valuation of plots and buildings*	*Apply*
CO5:	*Construct detailed report on estimation and valuation process*	*Apply*

UNIT - I ESTIMATE OF BUILDINGS [9]

Load bearing and framed structures – Calculation of quantities of brick work, RCC, PCC, Plastering, white washing, color washing and painting / varnishing for shops, rooms, residential building with flat and pitched roof – Various types of arches – Calculation of brick work and RCC works in arches – Estimate of joineries for paneled and glazed doors, windows, ventilators, handrails etc.

UNIT - II ESTIMATE OF OTHER STRUCTURES [9]

Estimating of septic tank, soak pit – sanitary and water supply installations – water supply pipe line– sewer line – tube well – open well – estimate of bituminous- wet mix macadam and cement concrete roads –estimate of retaining walls – culverts – estimating of irrigation works – aqueduct, syphon, fall.- Estimating of steel structures.

UNIT - III RATE ANALYSIS, TENDERS AND CONTRACTS [9]

Data – Schedule of rates – Analysis of rates – Specifications – sources – Preparation of detailed and general specifications – Tenders – TTT Act – e-tender – Preparation of Tender Notice and Document – Contracts – Types of contracts – Drafting of contract documents – Arbitration and legal requirements.

UNIT - IV VALUATION [9]

Necessity – Basics of value engineering – Analysis of rates– Capitalized value – Depreciation – Escalation – Value of building – Calculation of Standard rent – Mortgage – Lease.

UNIT - V REPORT PREPARATION [9]

Principles for report preparation – report on estimate of residential building – Culvert – Roads –Water supply and sanitary installations – Tube wells – Open wells.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1. Dutta, B.N., Estimating and Costing in Civil Engineering, CBS Publishers & Distributors Private Limited, New Delhi, Twenty Eighth edition, 2022.
2. Purushothamaraj, P. Rajendran, V., Estimation and Quantity Surveying, Sri Krishna Hi-tech Publishing Company Ltd,Chennai, Second edition, 2016.

Reference Books :

1. Donaid Towey, Construction Quantity Surveying, Technology and Engineering Publishers & Distributors Pvt. Ltd Hoboken USA., Second Edition,2018.
2. PWD Data Book and Tamil Nadu Transparency In Tenders (Public Private Partnership Procurement) Rules, 2012.
3. Arbitration and Conciliation (Amendment Act), 2021.
4. Standard Bid Evaluation Form, Procurement of Goods or Works, The World Bank, April1996.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE712** **Course Name:** **QUANTITY SURVEYING AND ESTIMATION**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Work out the quantities of different works of* load bearing and framed structures	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO2	*Calculate the quantities of various items for other structures.*	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO3	*Prepare tenders, contract documents and reports as per norms and analyse the rates for various items of works*	3	3	-	-	-	3	-	-	-	-	3	3	-	3
CO4	*Carry out valuation of plots and buildings*	3	3	-	-	-	2	-	-	-	-	3	3	-	3
CO5	*Construct detailed report on estimation and valuation process*	3	3	-	-	-	3	-	-	-	-	-	3	-	3
	Average	3	3	-	-	-	3	-	-	-	-	3	2	-	3

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

20CE721	**STRUCTURAL DESIGN AND DRAWING LABORATORY**	L	T	P	C
		0	0	3	1

Prerequisite: - *Structural Analysis - I & II and Design of reinforced concrete*

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Analyse the structural frame using software.*	*Analyse*
CO2:	*Analyse and design of reinforced concrete elements.*	*Analyse*
CO3:	*Analyse and design of steel elements.*	*Analyse*
CO4:	*Illustrate the design of retaining wall and water tank*	*Understand*
CO5:	*Develop the design of plate girder*	*Apply*

List of Experiments:

1. Introduction to software tools available to analysis the structural systems.
2. Analysis of building frames using standard software.
3. Design and detailing of one way and two way slab (from analysed building frame).
4. Design and detailing of beams (from analysed building frame).
5. Design and detailing of columns (from analysed building frame).
6. Design and detailing of foundations (from analysed building frame).
7. Analysis and design of truss.
8. Analysis of steel building.
9. Design and detailing of retaining wall.
10. Design and detailing of Water tank.
11. Design and detailing of Plate girder.

Total : 45 Periods

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE721** **Course Name:** **STRUCTURAL DESIGN AND DRAWING LABORATORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Analyse the structural frame using software.*	3	3	3	3	3	-	-	2	-	-	-	3	2	3
CO2	*Analyse and design of reinforced concrete elements.*	3	3	3	3	3	-	-	2	-	-	-	3	2	3
CO3	*Analyse and design of steel elements.*	3	3	3	3	3	-	-	2	-	-	-	3	2	3
CO4	*Illustrate the design of retaining wall and water tank*	3	3	3	3	3	-	-	2	-	-	-	3	2	3
CO5	*Develop the design of plate girder*	3	3	3	3	3	-	-	2	-	-	-	3	2	3
	Average	3	***3***	**3**	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**3**	**2**	**3**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

20CE722	DESIGN PROJECT	L	T	P	C
		0	0	6	3

Prerequisite: - *Survey Practical*

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Recognize civil engineering problems by assessment of available literature.*	*Analyze*
CO2:	*Perceive knowledge on planning of a structure.*	*Apply*
CO3:	*Identify with appropriate techniques to analyze and design complex civil engineering problems.*	*Apply*
CO4:	*Apply engineering and management principles through efficient handling of project.*	*Apply*
CO5:	*Demonstrate their project by report writing and presentation skills.*	*Understand*

Guidelines:

1. The design project work may contain planning, analysis, experimental analysis, design and *cost evaluation* of civil engineering structures.
2. The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member.
3. The progress of the project is evaluated based on a minimum of three reviews and end semester review.
4. In design project, literature survey, projects task plan and design phases should have been completed.
5. A project report is required at the end of the semester.
6. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Total : 45 periods

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE722 **Course Name: DESIGN PROJECT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Recognize civil engineering problems by assessment of available literature.*	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	*Perceive knowledge on planning of a structure.*	3	3	2	-	-	-	-	-	3	-	-	3	3	3
CO3	*Identify with appropriate techniques to analyze and design complex civil engineering problems.*	3	3	3	3	3	-	-	-	3	-	-	3	3	3
CO4	*Apply engineering and management principles through efficient handling of project.*	3	3	2	-	-	-	-	-	3	-	3	3	3	3
CO5	*Demonstrate their project by report writing and presentation skills.*	3	3	2	-	-	-	-	-	3	3	-	3	3	3
	Average	3	3	2	3	3	-	-	-	3	3	3	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20CE723	**INDUSTRIAL TRAINING** (4 weeks during VI Sem vacation)	0	0	0	2

Prerequisite: - *Survey Practical*

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Recall the basics of civil engineering concepts by self-learning.*	*Remember*
CO2:	***I****nterpret knowledge about the present industrial scenarios.*	*Understand*
CO3:	*Outline a presentation about the technology, materials, equipment, devices in industries during the training undergone.*	*Understand*
CO4:	*Summarize knowledge on the technical skill in the undergone Industrial training*	*Understand*
CO5:	*Relate the contents to the target audience and handle questions with confidence.*	*Remember*

Guidelines:

1. The students have to undergo practical industrial training for four weeks in recognized industrial establishments during their vacation periods.
2. At the end of the training they have to submit a report with following information:
   i. Profile of Industry
   ii. Organization structure
   iii. Plan and Design
   iv. Technology / Materials / Equipment / Devices
   v. Details of the training undergone
   vi. Learning points
3. The student will prepare a presentation individually about the industrial training for 15 minutes duration.
4. The assessments will be based equally on the report in the prescribed format and viva-voice examination by a committee nominated by the Head of the Department.

Total : 45 periods

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE723 **Course Name: INDUSTRIAL TRAINING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Recall the basics of civil engineering concepts by self-learning.*	3	3	-	2	-	2	-	-	-	2	-	-	-	3
CO2	*Interpret knowledge about the present industrial scenarios.*	3	3	-	2	-	2	-	-	-	2	-	-	-	3
CO3	*Outline a presentation about the technology, materials, equipment, devices in industries during the training undergone.*	3	3	-	2	-	2	-	-	-	2	-	-	-	3
CO4	*Summarize knowledge on the technical skill in the undergone Industrial training*	3	3	-	2	-	2	-	-	-	2	-	-	-	3
CO5	*Relate the contents to the target audience and handle questions with confidence.*	3	3	-	2	-	2	-	-	-	2	-	-	-	3
	Average	3	3	-	2	-	2	-	-	-	2	-	-	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

20MC053	**ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE**	L	T	P	C
		3	0	0	0

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On Completion of this course, the student will be able to **Cognitive Level**

CO1: Identify the connect up of Indian traditional knowledge

CO2: Explain basics of Indian traditional knowledge in modern scientific perspective.

CO3: Recognize the contribution of Indian mind in various fields.

CO4: Develop positive attitude toward Indian thoughts and traditions

CO5: Examine the Indian linguistic tradition and artistic tradition.

UNIT – I BASIC STRUCTURE OF INDIAN KNOWLEDGE SYSTEM [9]

Basic structure of Indian knowledge system

UNIT – II MODERN SCIENCE AND INDIAN KNOWLEDGE SYSTEM [9]

Modern science and Indian knowledge system

UNIT – III YOGA AND HOLISTIC HEALTH CARE [9]

Yoga and holistic health care

UNIT – IV CASE STUDIES [9]

Philosophical Tradition

UNIT – V INDIAN TRADITION [9]

Indian Linguistic Tradition, Phonology, morphology, syntax and semantics, Indian Artistic Tradition

Total = 45 Periods

Reference Books :

1. Sivaramakrishna. V (Ed.).Cultural Heritage of India – Course Material, Bharatiya Vidya Bhavan, Mumbai, Fifth Edition, 2014.
2. Swami Jitatmanand, "Modern Physics and Vedant",Bharatiya VidyaBhavan.
3. Fritz of Capra, “Tao of Physics”
4. Fritz of Capra, “The wave of Life”
5. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.
6. Jha. R.N., “Science of Consciousness Psychotherapy and Yoga Practices”, Vidyanidhi Prakasham, New Delhi, 2016.
7. Sharma. P.R. (English Translation), “Shodashang Hridayam”.

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20MC053** **Course Name:** **ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Identify the connect up of Indian traditional knowledge*	3	3	-	-	3	-	-	-	-	1	-	-	3	1
CO2	*Explain basics of Indian traditional knowledge in modern scientific perspective.*	3	3	-	-	2	-	-	-	-	1	-	-	3	2
CO3	*Recognize the contribution of Indian mind in various fields.*	2	3	-	-	2	-	-	-	-	1	-	-	3	3
CO4	*Develop positive attitude toward Indian thoughts and traditions*	2	2	-	-	3	-	-	-	-	1	-	-	3	1
CO5	*Examine the Indian linguistic tradition and artistic tradition.*	2	3	-	-	2	-	-	-	-	1	-	-	3	3
	Average	2	3	-	-	2	-	-	-	-	1	-	-	3	3

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20CE761	**PRE-STRESSED CONCRETE (Professional Elective -II)**	3	0	0	3

Prerequisite: *- Mechanics of Solids, Structural Analysis-I &II, Design of Reinforced concrete structure*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Outline the concept and methods of pre stressing systems for different materials*.	*Understand*
CO2:	*Identify the flexure and shear of prestressed concrete members.*	*Apply*
CO3:	*Analyze and design of prestressed concrete beam members.*	*Analyze*
CO4:	*Recall the design procedure of prestressed* tension and compression members.	*Remember*
CO5:	*Illustrate the composite members and other applications.*	*Understand*

UNIT - I INTRODUCTION [9]

Principles of prestressing-classification– advantages over ordinary reinforced concrete – materials – necessity of high strength concrete and high tensile steel – Types of tensioning - Stress concept – Strength concept – Load balancing concept - Calculation of deflections – Factors influencing deflections – Short term and long term deflections - Losses in prestressing.

UNIT - II DESIGN FOR FLEXURE AND SHEAR [9]

Assumptions for calculating flexural stresses – Determination of ultimate flexural strength – Codal provisions--Design of flexural members – Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear, and Design of end blocks.

UNIT - III DESIGN OF CONTINUOUS BEAMS [9]

Methods of achieving continuity in prestressed concrete beams - Analysis and design of continuous beams – cap cable - concordant cable profile and linear transformation

UNIT - IV DESIGN OF TENSION AND COMPRESSION MEMBERS [9]

Types and Advantages - Design of prestressed concrete tension and compression members - Design of prestressed pipes and prestressed concrete cylindrical water tanks

UNIT - V COMPOSITE MEMBERS & PARTIAL PRESTRESSING [9]

Analysis for stresses-ultimate strength - Partial prestressing - Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing–applications

Case studies :Bunkers – Electric poles –Circular prestressing – Railway slabs

Total (L: 45 T: 0) = 45 Periods

Text Books :

1 Rajagopalan N, Prestressed Concrete, Narosa Publishing House, New Delhi, Second Edition,2010.
2 Krishna Raju N, Prestressed Concrete, Tata McGraw Hill Publishing Company Ltd, New Delhi, Sixth Edition ,2018.

Reference Books :

1 Praveen Nagarajan, Prestressed Concrete Design, Pearson Publisher, India, First Edition, 2013.
2 Sinha N C and Roy S K, Fundamentals of Prestressed Concrete, S Chand & Co, New Delhi,Third Edition, 2011.
3 Lin, T Y and Ned H Burns, Design of Prestressed Concrete Structures, John Wiley Sons, New York, Third Edition, 2010.
4 http://nptel.ac.in/courses/105106117/

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE761 **Course Name: PRESTRESSED CONCRETE**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Outline the concept and methods of pre stressing systems for different materials.*	3	3	3	3	2	-	-	-	-	-	-	-	-	-
CO2	*Identify the flexure and shear of prestressed concrete members.*	3	3	3	3	2	-	-	-	-	-	-	-	-	-
CO3	*Analyze and design of prestressed concrete beam members.*	3	3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	*Recall the design procedure of prestressed* tension and compression members.	2	3	3	3	2	-	-	-	-	-	-	-	-	-
CO5	*Illustrate the composite members and other applications.*	2	3	2	3	3	-	-	-	-	-	-	-	-	-
	Average	3	3	3	3	3	-	-	-	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20CE762	**BRIDGE ENGINEERING (Professional Elective -II)**	3	0	0	3

Prerequisite: -

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Classify the types of bridge structures, their selection and planning for the site condition*	*Understand*
CO2:	*Recall the IRC specifications, assessment of loads and design of bridges as per standards.*	*Remember*
CO3:	*Illustrate different aspects of substructure construction of bridges*	*Understand*
CO4:	*Illustrate different aspects of superstructure construction of bridges.*	*Understand*
CO5:	*Relate a clear understanding about inspection aspects for repair and maintenance of bridge structure*	*Remember*

UNIT - I INTRODUCTION [9]

History and development of bridges, classification of bridges, investigation of culverts and minor bridge, major bridge – topographic details ,catchment area, hydrologic particulars, geo-technical aspects, seismology and construction resources - design flood discharge – methods ,linear water way of bridges.

UNIT - II INTRODUCTION TO DESIGN OF BRIDGES [9]

I.R.C specification for road bridges & loads, forces acting on the bridges, types of bridges and loading standards – classification of culvert and bridges, components of bridge structures, need for loading standards, railway loading standards- Seismic designs.

UNIT - III BRIDGE - SUBSTRUCTURES [9]

Choice of foundation for piers and abutments–types of bridge foundations, cost ratio, clearance-pile foundation, well foundation– types scour depth– stability of well foundation–open foundation below sub soil water, baling out water, floating caisson

UNIT - IV BRIDGE - SUPERSTRUCTURES [9]

Construction of super structures – arch, slab, Tee beam bridges – construction of prestressed bridges –design procedure for bridge super structures, composite construction, box girders and continuous girders –site reaction methods of box girders and steel girder bridges–bearings–different types of bearings.

UNIT - V INSPECTION AND MAINTENANCE OF BRIDGES [9]

Inspection of bridges – aspects of Inspection, testing of bridges– criteria for assessment of safe load capacity – maintenance of super structure girders- repair and rebuilding bridges – temporary and movable bridges.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1 Krishnaraju.N, y "Design of Bridges "Oxford & IBH publishing Co.Pvt Ltd, New Delhi, Fifth Edition,2019.

2 Ponnuswamy, S.,"Bridge Engineering", Tata McGraw Hill, New Delhi,(2008). Third Edition,2017

Reference Books :

1 Johnson Victor, D. "Essentials of Bridge Engineering", Oxford and IBH Publishing Co. New Delhi, sixth Edition,2019

2 Jagadeesh.T.R,Jayaram.M.A "Design of Bridge Structures" PHI Learning Pvt. Ltd, New Delhi, First Edition 2009.

3 Aswani, M.G.Vazirani, V.N.Ratwani, M.M "Design of Concrete Bridges", Khanna Publishers, New Delhi, First Edition 2004

4 http://old.seamservices.com/cgi- bin/file.php? article = bridge .engineering. nptel.Pdf & code = afd634b29311523471 b998de8b6d8c85.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE762 **Course Name: BRIDGE ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Classify the types of bridge structures, their selection and planning for the site condition*	3	3	2	3	3	-	-	-	-	2	-	3	2	3
CO2	*Recall the IRC specifications, assessment of loads and design of bridges as per standards.*	3	2	3	2	2	-	-	-	-	2	-	2	3	2
CO3	*Illustrate different aspects of substructure construction of bridges*	3	2	3	3	3	3	-	1	-	2	-	3	3	2
CO4	*Illustrate different aspects of superstructure construction of bridges.*	2	3	3	3	2	3	2	1	1	2	-	3	2	3
CO5	*Relate a clear understanding about inspection aspects for repair and maintenance of bridge structure*	2	3	2	3	3	2	-	2	-	2	-	3	2	3
	Average	3	3	3	3	3	3	2	1	1	2	-	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20CE763	**CONSTRUCTION SAFETY PRACTICES (Professional Elective - II)**	3	0	0	3

Prerequisite: *- Nil*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Identify labour hazards and related environmental and construction material issues and implement construction safety management.*	*Remember*
CO2:	*Assembling safety programs for workers to implement workplace safety constructs for various types of workplace assessment.*	*Understand*
CO3:	*Designing for construction safety and implementing guidelines for supervisors, top management and workers at higher levels of organizational operations to work safely.*	*Apply*
CO4:	*During the construction stage, and during subsequent use and maintenance, designers can reduce risks to health and safety.*	*Understand*
CO5:	*Construction equipment handling in safety and demolition work is primarily about maintaining a safe environment and preventing injuries.*	*Understand*

UNIT - I CONSTRUCTION ACCIDENTS [9]

Construction Accidents - Construction Safety Management: Importance – Causes of Accidents, Safety Measurers – Environmental Issues in Construction – Construction Industry related laws. Human Factors in Construction Safety - Legal and Financial aspects of accident in Construction – Occupational and Safety Hazard Assessment – Case studies.

UNIT - II SAFETY PROGRAMMES AND CONTRACTUAL OBLIGATIONS [9]

Safety Programmes – Construction safety – Element of effective safety programmes – job –site assessment – Safety meetings – Safety Incentives. Contractual Obligations – Safety in Construction Contracts – Substance abuse – Safety Record keeping.

UNIT - III DESIGNING FOR SAFETY [9]

Safety Culture–Safe Workers– Safety and First Line Supervisors – Safety and Middle Managers – Top Management Practices, Company Activities and Safety – Safety Personnel– Sub contractual Obligation– Project Coordination and Safety Procedures– Workers Compensation- Codal Practices for safety.

UNIT - IV OWNER'S AND DESIGNER'S OUTLOOK [9]

Accident Prevention – Cost of Accidents – Safety and Productivity – Safety Provision in the Factories act – Accident Reporting Investigation and Statistics – Total loss control and damage control – Safety sampling – Safety audit – Critical incidents technique – Safety equipment – Planning and Site preparation – safety system of storing construction materials – excavation – Blasting – Timbering – Scaffolding – Safe use of Ladder – Safety in Welding.

UNIT - V SAFETY IN HANDLING EQUIPMENT [9]

Safety in hand tools – Safety in grinding – Hoisting Apparatus and Conveyors – Safety in the Use of Mobile Cranes – Manual Handling – Safety in Demolition work – Trusses, Girders and beams – First aid - Fire hazard and Prevention Methods – Interesting experience at the construction site against the fire accident.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1 Bhattacharjee S K., Safety Management in Construction Principles and Practice, Khanna Publishers, Delhi, First Edition, 2011.

2 Rita Yi Man Li & SunWah Poon., Construction Safety, Springer, New York, First Edition, 2013.

Reference Books :

1 S.K.Bhattacharjee., Safety Management in Construction, Khanna Publishers, New Delhi, First Edition, 2011.

2 Alan Griffith., and Tim Howarth., Construction Safety and Health Management, Pearson, Walton, Second Edition, 2015.

3 Stefan Mordue & Roland Finch., BIM for Construction Health and Safety II, NBS Publications, Philippines, First Edition, 2014.

4 Mishra R.K., Specifications of Construction Safety (English), AITBS Publishers, India, Second Edition, 2017.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE763 **Course Name: CONSTRUCTION SAFETY PRACTICES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Identify labour hazards and related environmental and construction material issues and implement construction safety management.*	3	2	2	-	-	2	-	-	2	-	-	-	2	3
CO2	*Assembling safety programs for workers to implement workplace safety constructs for various types of workplace assessment.*	2	3	2	2	-	3	-	-	-	-	-	-	3	-
CO3	*Designing for construction safety and implementing guidelines for supervisors, top management and workers at higher levels of organizational operations to work safely.*	3	-	3	-	-	3	-	-	-	2	-	-	3	3
CO4	*During the construction stage, and during subsequent use and maintenance, designers can reduce risks to health and safety.*	2	2	2	-	-	2	2	-	-	2	-	-	-	-
CO5	*Construction equipment handling in safety and demolition work is primarily about maintaining a safe environment and preventing injuries.*	-	2	-	2	-	3	-	3	-	-	-	-	-	2
	Average	**3**	**2**	**2**	**3**	**-**	**3**	**2**	**3**	**2**	**2**	**-**	**-**	**3**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20CE764	**AIR POLLUTION MANAGEMENT (Professional Elective - II)**	3	0	0	3

Prerequisite: -

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Classify the sources, effects and dispersion of air pollutants*	*Understand*
CO2:	*Describe control and monitoring of particulate contaminants*	*Understand*
CO3:	*Describe control and monitoring of Gaseous Contaminants*	*Analyze*
CO4:	*Identify the control strategies for biological air pollution*	*Apply*
CO5:	*Identify the control strategies for air and noise pollution*	*Understand*

UNIT - I SOURCES, EFFECTS AND DISPERSION OF AIR POLLUTANTS [9]

Classification of air pollutants -Particulates and gaseous pollutants - Sources of air pollution - Source inventory- Effects of air pollution on human beings, materials, vegetation, animals - Global warming - Ozone layer depletion - Sampling and Analysis - Basic principles of sampling - Source and ambient sampling - Analysis of pollutants - Principles - Elements of atmosphere - Meteorological factors - Wind roses - Lapse rate -Atmospheric stability and turbulence- Plume rise-Dispersion of pollutants – Dispersion models- Applications.

UNIT - II CONTROL OF PARTICULATECONTAMINANTS [9]

Settling chambers - Filters, gravitational, Centrifugal – multiple type cyclones, prediction of collection efficiency, pressure drop, wet collectors, and Electrostatic Precipitation theory – ESP design – Operational Considerations –Process Control and Monitoring – Automobile air pollution and control.

UNIT - III CONTROL OF GASEOUS CONTAMINANTS [9]

Absorption – principles - description of equipment-packed and plate columns - design and performance equations – Adsorption - principal adsorbents - Equipment descriptions – Design and performance equations–Condensation-Incineration-Combustion-Control of air pollutants in automobile-Equipment description.

UNIT - IV BIOLOGICAL AIR POLLUTION [9]

Biological Air Pollution - Control Technologies – Bio-Scrubbers, Bio filters – Operational Considerations –Process Control and Monitoring.

UNIT - V AIR QUALITY REGULATIONS AND NOISE POLLUTION [9]

Town planning regulation for new industries - Legislation and enforcement - Environmental impact assessment and ambient air quality standards – Sources of noise pollution- Effects - Assessments -Standards- Control Strategy - Prevention.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1 Roa M and Roa H.V.N “Air Pollution”, McGraw Hill Education**,** New Delhi, First Edition, 2017.
2 Anjaneyulu,D.,“Air Pollution and Control Technologies”, Allied Publishers, Mumbai, First Edition, 2002.

Reference Books :

1 Dr. S. Anandkumarvarma “Air Pollution and Control Engineering, Sri Krishna Hi Tech Publishing Company Pvt Ltd, New Delhi, First Edition,2019.
2 Lawrence Kwan, Norman C Perelra., Yung-Tse Hung.,” Air Pollution Control Engineering”, Tokyo, First Edition 2004.
3 Singal, S.P., “Noise Pollution and Control Strategy”, Narosa Publishing House, New Delhi, First Edition, 2005.
4 Heumann, W.L “Industrial Air Pollution Control Systems”, McGraw-Hill, New York, First Edition 1997.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE764** **Course Name:** **AIR POLLUTION MANAGEMENT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Classify the sources, effects and dispersion of air pollutants*	3	3	2	-	-	3	-	-	-	-	-	2	3	3
CO2	*Describe control and monitoring of particulate contaminants*	3	3	2	-	-	3	-	-	-	-	-	2	3	3
CO3	*Describe control and monitoring of Gaseous Contaminants*	3	3	2	-	-	3	-	-	-	-		2	3	3
CO4	*Identify the control strategies for biological air pollution*	3	3	2	-	-	3	-	-	-	-	-	2	3	3
CO5	*Identify the control strategies for air and noise pollution*	3	3	2	-	-	3	-	-	-	-	-	2	3	3
	Average	**3**	**3**	**2**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20CE765	**GEOGRAPHICAL INFORMATION SYSTEM (Professional Elective -II)**	3	0	0	3

Prerequisite: -

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Familiarize with concepts of choosing map projections, 2D transformation*	*Understand*
CO2:	*Understand the data models and data structures used for spatial data*	*Understand*
CO3:	*Explain the retrieved data using the GIS techniques*	*Understand*
CO4:	*Classify geospatial analysis and network analysis*	*Analyze*
CO5:	*Illustrate the web based GIS architecture and concepts of Map server*	*Understand*

UNIT - I MAP AND CARTOGRAPHIC PRINCIPLES [9]

Map: Definition, Classification based on Function, Scale, Characteristics –Shape of Earth – Ellipsoid and Geoid – Projections and Co-ordinate System - Rectangular and Geographic Coordinates – UTM and UPS - Types of Map Projections – Basics of 2D transformations – Affine transformation - Choice of Map Projection –Evolution of cartography-Geo-Spatial, Spatial and Non-spatial data – Definition of GIS – Evolution GIS – Components of GIS

UNIT - II GIS DATA INPUT AND DATA MODELS [9]

Concepts of Point, Line Polygon / Area, elevation and surface –Concepts of Tessellations-Attributes and Levels of Measurement - Data Sources – Ground and Remote Sensing survey – Collateral data collection – Input: Map scanning and digitization, Registration and Geo referencing – Concepts of RDBMS - Raster Data Model – Grid – Data Encoding - Data Compression – Vector Data Model – Topological properties – Arc Node Data Structure – Raster Vs. Vector Comparison – File Formats for Raster and Vector – Data conversion between Raster and vector.

UNIT - III RASTER AND VECTOR DATA ANALYSIS [9]

Raster Data analysis: Local, Neighborhood and Regional Operations – Map Algebra – Vector Data Analysis: Topological Analysis, point-in-polygon, Line-in-polygon, Polygon-in-Polygon – Proximity Analysis: buffering, Thiessen Polygon – Non-topological analysis: Attribute data Analysis concepts of SQL– ODBC

UNIT - IV NETWORK ANALYSIS AND DATA MANAGEMENT [9]

Network – Creating Network Data - Origin, Destination, Stops, Barriers – Closest Facility Analysis, Service Area Analysis, OD Cost matrix analysis, Shortest Path Analysis – Address Geocoding – Surface Analysis – Point data to Surface: Various methods of interpolation-DEM: View shed Analysis

UNIT - V DATA OUTPUT AND WEB BASED GIS [9]

Map Compilation – Cartographic functionalities for Map Design – Symbolization – Conventional signs and symbols - Meta Data – Web based GIS: Definition, Merits - Architecture – Map Server – Case Studies - Open Source GIS – Import and Export of spatial data

Total (L: 45 T: 0) = 45 Periods

Text Books :

1 Lillessand, Kiffer, Chipman, Remote Sensing and Image Interpretation, John Wiley & Sons, New York, Seventh Edition 2015.

2 Lo, Albert C P,.Yeung K W Concepts and Techniques of Geographic Information Systems, Prentice Hall, New Jersey, Second Edition 2016.

Reference Books :

1 John Jensen, Ryan Jensen, Introductory Geographic Information Systems, , Pearson Publishers, New Delhi, International Edition,2012.

2 Kang-tsung Chang, Introduction to Geographic Information Systems with Data Set CD-ROM, McGraw Hill, Pearson Publishers , New York , Ninth Edition, 2018.

3 Borden Dent, Jeff Torguson, Thomas Hodler, “Cartography: Thematic Map Design”, Tata McGraw Hill, New Delhi, First Edition, 2008.

4 Menno-Jan Kraak, Ferjan Ormeling, Cartography: Visualization of Spatial Data, Pearson Publishers., New Delhi Third Edition,2009.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE765** **Course Name:** **GEOGRAPHICAL INFORMATION SYSTEM**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Familiarize with concepts of choosing map projections, 2D transformation*	3	2	2	3	-	2	2	-	-	-	-	2	3	3
CO2	*Understand the data models and data structures used for spatial data*	3	3	3	3	-	2	2	-	-	-	-	2	3	3
CO3	*Explain the retrieved data using the GIS techniques*	3	3	3	3	-	3	2	-	-	-		2	3	3
CO4	*Classify geospatial analysis and network analysis*	3	3	3	3	-	2	2	-	-	-	-	2	3	3
CO5	*Illustrate the web based GIS architecture and concepts of Map server*	3	2	2	2	-	3	2	-	-	-	-	2	3	3
	Average	**3**	**3**	**3**	**3**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**3**	**3**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20CE766	**URBAN PLANNING AND DEVELOPMENT (Professional Elective - II)**	3	0	0	3

Prerequisite: *- Town Planning*

Course Outcomes: On Completion of this course, the student will be able to **Cognitive Level**

CO1:	*analysis of town planning standards, zoning, and growth by surveying the town.*	*Understand*
CO2:	*The residential building site requirements of residential buildings and the classification of rural housing designing for residential areas.*	*Understand*
CO3:	*If the landscape architecture, budgeting, and design of public Buildings.*	*Understand*
CO4:	*Road traffic control, and considerations for various types of road construction using bypasses and freeways.*	*Understand*
CO5:	*Town Planning Development Control is responsible for making by-laws for local authority and owner's responsibility for determining street parking, lighting and plot size.*	*Apply*

UNIT - I TOWN PLANNING AND SURVEYS [9]

General-evolution of planning-objects of town planning-Economic justification for town planning-principles of Town planning-Necessity of town planning-origin of towns-growth of towns-stages in town development-personality of town-Distribution of land uses- Forms of planning-site for an ideal Town-Requirements of new Towns-Planning of the modern Town-Powers required for enforce T.P. schemes-cost of Town planning-present position of Town Planning in India..

UNIT - II HOUSING [9]

General-Importance of housing-Demand for houses-Building site-Requirements of residential buildings- Classification of residential buildings-Design of residential areas-Rural Housing-Agencies for housing-Investment in housing- HUDCO-CIDCO- Housing problem in India.

UNIT - III PUBLIC BUILDINGS, PARKS AND PLAY GROUNDS [9]

General - Location of Public Buildings – Classification of public Buildings - Principles of design of public buildings - Town centres - Grouping of public buildings - Civic aesthetics .General-Types of recreation-Location of urban green spaces-classification of parks, park systems-park design-Finance of parks-parkways-playgrounds-space standards- Landscape architecture.

UNIT - IV ROADS AND TRAFFIC MANAGEMENT [9]

General-Objects- Requirements of good city road-Factors to be considered-Classification of urban roads-Types of street systems-Through and By-pass roads-Outer and inner ring roads-Expressways- Freeways-Precincts-Road aesthetics

UNIT - V BUILDING BYE - LAWS [9]

General- Objects of bye-laws-importance of bye-laws-Function of local authority- Responsibility of owner-Applicability of bye-laws-set-back-Light plane-Floor space index- Off-street parking-Fire protection-Minimum plot sizes-Some other terms-Principles underlying building bye-laws-Building bye-laws for residential area of a typical town planning scheme-Building bye-laws-Development control rules- General rules of metropolitan Area-CMDA rules.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1 B. K. Pattanaik, Introduction to Urban Development and Planning, SAGE Publications India Pvt. Ltd, Chennai, First Edition, 2020

2 Chris Couch, Urban Planning, Palgrave Publication, New york, 2018

Reference Books :

1 ArnabJana, Advances in urban planning in developing nations, Routledge publications, London, First Edition, 2021.

2 S S Dhaliwal S L Goel, Urban Development and Management, Deep & Deep Publication, New Delhi, 2013.

3 David Adams, Steve Tiesdell, Urban Planning, design and development, Routledge publications,London,2013

4 Binode BehariDutt, Town planning in ancient India, Neha Publishers & Distributors, Delhi,2009

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE766** **Course Name:** **URBAN PLANNING AND DEVELOPMENT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*An analysis of town planning standards, zoning, and growth by surveying the town.*	3	2	2	-	-	2	-	-	2	-	2	2	2	2
CO2	*The residential building site requirements of residential buildings and the classification of rural housing designing for residential areas.*	2	3	2	2	-	2	-	-	-	-	-	2	2	-
CO3	*If the landscape architecture, budgeting, and design of public Buildings.*	2	-	3	-	-	2	-	-	-	2	-	2	2	2
CO4	*Road traffic control, and considerations for various types of road construction using bypasses and freeways.*	2	2	2	-	-	2	-	-	-	2	-	-	-	-
CO5	*Town Planning Development Control is responsible for making by-laws for local authority and owner's responsibility for determining street parking, lighting and plot size.*	-	2	-	2	-	2	-	-	-	-	-	-	-	2
	Average	**2**	**2**	**2**	**3**	**-**	**2**	**-**	**-**	**2**	**2**	**2**	**2**	**2**	**2**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20CE767	**INDUSTRIAL STRUCTURES (Professional Elective - III)**	3	0	0	3

Prerequisite: -

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Explore the basic concept of planning and requirements of industrial structures.*	*Understand*
CO2:	*Summarize about Industrial building and industrial roofing structures.*	*Understand*
CO3:	*Identify the uses of Gantry Girders, design of CORBELS and Nibs and Machine Foundations.*	*Apply*
CO4:	*Utilize the design of nuclear containment structures.*	*Apply*
CO5:	*Illustrate the basic concept of power transmission structures.*	*Understand*

UNIT - I PLANNING AND FUNCTIONAL REQUIREMENTS [9]

Classification of Industries and Industrial Structures - Planning for Layout Requirements Regarding Lighting, Ventilation and Fire Safety - Protection against Noise and Vibration - Guidelines from Factories Act

UNIT - II ROOF FOR INDUSTRIAL BUILDINGS [9]

Roofs for Industrial Buildings - Steel and RC - Folded Plates and Shell Roofs.

UNIT - III MAJOR COMPONENTS OF INDUSTRIAL STRUCTURES [9]

Gantry Girders - Design of Corbels and Nibs - Machine Foundations – Flooring – Special Walls - Pipe racks – RC Ducts – Conveyors

UNIT - IV POWERPLANT STRUCTURES [9]

Bunkers and Silos - Chimneys and Cooling Towers - High Pressure Boilers and Piping Design - Nuclear Containment Structures

UNIT - V POWER TRANSMISSION STRUCTURES [9]

Cables - Transmission Line Towers - Substation Structures - Tower Foundations - Testing Towers

Total (L: 45 T: 0) = 45 Periods

Text Books :

1. S.S.Bhavikatti, Design of steel structures by limit state method as per IS 800-2007 , I K International Publishing House Pvt. Ltd, New Delhi, Fourth Edition, 2013.
2. Varghese. P. C., Advanced Reinforced Concrete Design, Second Edition, PHI Learning, New Delhi, 2009.

Reference Books :

1. Henn W. Buildings for Industry, Vol.I and II, London Hill Books, London, 1995
2. Manohar.S.N., Tall Chimneys - Design and Construction, Tata McGraw Hill, New Delhi, 1994.
3. Santhakumar.A.R. and Murthy.S.S., Transmission Line Structures, Tata McGraw Hill, New Delhi, 1992.
4. Gary, W., Steel Designer's Manual, Prentice Hall, New Delhi, Sixth Edition, 2008.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE767** **Course Name:** **INDUSTRIAL STRUCTURES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explore the basic concept of planning and requirements of industrial structures.*	2	3	3	-	-	2	2	-	2	-	-	2	2	2
CO2	*Summarize about Industrial building and industrial roofing structures.*	2	3	3	-	-	2	-	-	3	-	-	2	2	3
CO3	*Identify the uses of Gantry Girders, design of CORBELS and Nibs and Machine Foundations.*	2	3	3	-	-	2	-	-	2	-	-	2	2	3
CO4	*Utilize the design of nuclear containment structures.*	3	3	3	3	-	2	-	-	3	-	-	3	2	3
CO5	*Illustrate the basic concept of power transmission structures.*	3	3	3	3	-	2	-	-	3	-	-	3	2	3
	Average	**3**	**3**	**3**	**3**	**-**	**2**	**2**	**-**	**3**	**-**	**-**	**3**	**2**	**3**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20CE768	**BASICS OF DYNAMICS AND ASEISMIC DESIGN (Professional Elective - III)**	3	0	0	3

Prerequisite: *-*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Relate the knowledge of static and dynamics to study the motion of SDOF system*	*Understand*
CO2:	*Interpret the natural frequencies and mode shape for two degree of freedom system and multiple degree of* system *to analyze the complex dynamic engineering problem.*	*Remember*
CO3:	*Identify the impact of earthquake waves including the tectonic plate theory and elastic rebound theory to manage projects in earthquake engineering*	*Apply*
CO4:	*Recall the IS code provisions for the determination of lateral loads and prediction of soil-structure interaction effects*	*Understand*
CO5:	*Identify the need for IS code specification for earthquake resistant design.*	*Apply*

UNIT - I THEORY OF VIBRATIONS [9]

Difference between static loading and dynamic loading – Degree of freedom – Idealization of structure as single degree of freedom system – Formulation of Equations of motion of SDOF system - D Alembert's principles – effect of damping – free and forced vibration of damped and undamped structures – Response to harmonic and periodic forces

UNIT - II MULTIPLE DEGREE OF FREEDOM SYSTEM [9]

Two degree of freedom system – modes of vibrations – formulation of equations of motion of multi degree of freedom (MDOF) system - Eigen values and Eigen vectors – Response to free and forced vibrations - damped and undamped MDOF system – Modal superposition methods.

UNIT - III ELEMENTS OF SEISMOLOGY [9]

Elements of Engineering Seismology - Causes of Earthquake – Plate Tectonic theory – Elastic rebound Theory – Characteristic of earthquake – Magnitude and intensity of earthquakes – Spectral Acceleration

UNIT - IV RESPONSE OF STRUCTURES TO EARTHQUAKE [9]

Effect of earthquake on different type of structures – Behaviour of Reinforced Cement Concrete Structure under earthquake loading – Pinching effect – Bouchinger Effects – Evaluation of earthquake forces as per IS:1893 – 2002 - Response Spectra – Lessons learnt from past earthquakes.

UNIT - V DESIGN METHODOLOGY [9]

Causes of damage – Planning considerations / Architectural concepts as per IS:4326 – 1993 – Guidelines for Earthquake resistant design – Earthquake resistant design for masonry and Reinforced Cement Concrete buildings – Design and detailing as per IS:13920 – 1993

Total (L: 45 T: 0) = 45 Periods

Text Books :

1. Damodarasamy ,S R., Kavitha, S, Basics of structural dynamics and Aseismic design, PHI Learning Pvt.Ltd ,New Delhi, Kindle Edition,2009
2. Agarwal. P and Shrikhande. M., Earthquake Resistant Design of Structures, Prentice Hall of India Pvt. Ltd, New Delhi, 2011

Reference Books :

1. Chopra, A.K., Dynamics of Structures – Theory and Applications to Earthquake Engineering, 5th Edition, Pearson Education, 2020.
2. Biggs, J.M, Introduction to Structural Dynamics, McGraw Hill Book Co., New York, 1964
3. Dowrick, D.J, Earthquake Resistant Design, John Wiley & Sons, London, 2009
4. Paz, M. and Leigh.W. Structural Dynamics – Theory & Computation, 5th Edition, CBS Publishers & Distributors, Shahdara, Delhi, 2013.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE768 **Course Name: BASICS OF DYNAMICS AND ASEISMIC DESIGN**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Relate the knowledge of static and dynamics to study the motion of SDOF system*	3	2	2	3	-	2	-	-	2	-	2	2	2	2
CO2	*Interpret the natural frequencies and mode shape for two degree of freedom system and multiple degree of* system *to analyze the complex dynamic engineering problem.*	3	3	2	2	-	3	-	-	3	-	-	2	2	-
CO3	*Identify the impact of earthquake waves including the tectonic plate theory and elastic rebound theory to manage projects in earthquake engineering*	2	3	3	-	-	3	-	2	-	2	3	2	2	3
CO4	*Recall the IS code provisions for the determination of lateral loads and prediction of soil-structure interaction effects*	2	2	2	2	-	2	-	-	2	2	3	-	-	-
CO5	*Identify the need for IS code specification for earthquake resistant design.*	-	2	-	2	-	3	-	-	2	-	3	-	-	3
	Average	**3**	**2**	**2**	**2**	**-**	**3**	**-**	**-**	**2**	**2**	**3**	**2**	**2**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20CE769	**INTRODUCTION TO SMART CITIES**				
	(Professional Elective - III)	3	0	0	3

Prerequisite: -

Course Outcomes: On Completion of this course, the student will be able to **Cognitive Level**

CO1:	Discuss the importance, features and case histories of smart cities in India	*Understanding*
CO2:	Describe mobility and energy in smart city	*Understanding*
CO3:	Explain water and waste management techniques in smart city	*Understanding*
CO4:	Model smart environment and smart buildings	*Applying*
CO5:	Plan e-governance and ICT in smart city	*Applying*

UNIT - I Introduction **[9]**

Definitions – Evolution – Features and strategies – Challenges – India 100 smart cities policy and mission, smart city planning and development, financing smart cities development. Governance of smart cities – case studies in India.

UNIT - II Smart Urban Mobility and Smart Energy **[9]**

Need for urban mobility – multiple perspectives – objectives – components – emerging concepts and strategies – ICT supported smart mobility systems – policy priorities. Introduction to smart energy – urban density and energy use – objectives – elements of smart energy management system – strategies – smart grid – challenges.

UNIT - III Water and Waste Management **[9]**

Smart water management – definitions – water resource and cycle – functions and objectives – steps in implementation – benefits – policy challenges. Smart waste management – approaches and implementation – existing systems – strategies – challenges and polices.

UNIT - IV Smart Environment and Smart Buildings **[9]**

Global background of environmental concerns – concept of environmental resources - basic environmental challenges – smart environment – stakeholders – ICT framework for environmental management. Intelligent buildings – objectives – components – systems of smart building – benefits, challenges.

UNIT - V E- Governance and ICT **[9]**

Governance challenges in new era – history of smart governance – functions and objectives – ICT in governance – system infrastructure – benefits, challenges and future vision. Taxonomy of layers of ICT architecture – major technology areas – components – emerging technologies in ICT – challenges and concerns in ICT.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1. Anilkumar P.P, "Introduction to Smart Cities", 1st Edition, Pearson India Education Service Pvt Ltd, Noida,Uttar Pradesh, India, 2019.
2. Germaine R. Halegoua, "Smart Cities", 1st Edition, The MIT Press Essential Knowledge Series, London, England, 2020.

Reference Books :

1. Andy Pike, Andres Rodriguez-Pose & John Tomaney, "Handbook of Local and Regional Development", 3rd Edition, Taylor & Francis, United Kingdom, 2010.
2. Hudson W.R., Haas R., Uddin W., Infrastructure Management, McGraw-Hill, 1997
3. Grig N.S., Infrastructure engineering and management, Wiley-Interseience, 1988
4. Mission statement &guidelines on Smart City Scheme". Government of India - Ministry of Urban Development http://smartcities.gov.in/upload/uploadfiles/files/Smart City Guidelines(1).pdf

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE769** **Course Name:** **INTRODUCTION TO SMART CITIES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Discuss the importance, features and case histories of smart cities in India	2	1	-	-	-	3	1	-	-	-	-	1	-	-
CO2	Describe mobility and energy in smart city	3	2	1	-	-	3	1	-	-	-	-	1	-	-
CO3	Explain water and waste management techniques in smart city	3	2	1	-	-	3	1	-	-	-	-	1	-	-
CO4	Model smart environment and smart buildings	3	2	-	-	-	3	1	-	-	-	-	1	-	-
CO5	Plan e-governance and ICT in smart city	2	1	-	-	-	3	1	-	-	-	-	1	-	-
	Average	3	2	1	-	-	3	1	-	-	-	-	1	-	-

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20CE771	**ENVIRONMENTAL IMPACT ASSESSMENT (Professional Elective - III)**	3	0	0	3

Prerequisite: *-*

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Explain scoping and screening of developmental projects for environmental and social assessments*	*Understand*
CO2:	*Explain different methodologies for environmental impact assessment*	*Understand*
CO3:	*Identify the process of EIA by prediction and assessment procedure*	*Apply*
CO4:	*Plan to environmental impact assessments by using environmental management plans*	*Apply*
CO5:	*Evaluate environmental impact assessment reports by using case studies*	*Analyze*

UNIT - I INTRODUCTION **[9]**

Impact of development projects – Sustainable development- Need for Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) – EIA capability and limitations – Legal provisions on EIA-Stages of EIA, Types of EIA.

UNIT - II METHODOLOGIES **[9]**

Methods of EIA – Check lists – Matrices – Networks – Cost-benefit analysis – Analysis of alternatives.

UNIT - III PREDICTION AND ASSESSMENT **[9]**

Assessment of impact on land, water, air, social cultural activities and on flora & fauna – Mathematical models – Public participation.

UNIT - IV ENVIRONMENTAL MANAGEMENT PLAN **[9]**

Plan for mitigation of adverse impact on environment – Options for mitigation of impact on water, air, land and on flora & fauna - Addressing the issues related to the Project Affected People Post project monitoring.

UNIT - V CASE STUDIES **[9]**

EIA for infrastructure projects – Dams – Highways – Multi-storey Buildings – Water Supply and Drainage Projects – Waste water treatment plants, STP.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1 Canter, R.L., “Environmental Impact Assessment”, McGraw Hill, New Delhi, Second Edition, 2010

2 Shukla, S.K. and Srivastava, P.R., “Concepts in Environmental Impact Analysis”, Common Wealth Publishers, New Delhi, First Edition 1992.

Reference Books :

1 John G. Rau and David C Hooten “Environmental Impact Analysis Handbook”, McGraw Hill Book Company, 1990.

2 “Environmental Assessment Source book”, Vol. I, II & III. The World Bank, Washington, D.C., 1991

3 Judith Petts, “Handbook of Environmental Impact Assessment Vol. I & II”, Blackwell Science, 1999.

4 http://nptel.ac.in/courses/120108004/module3/lecture3.pdf

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE771** **Course Name:** **ENVIRONMENTAL IMPACT ASSESSMENT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain scoping and screening of developmental projects for environmental and social assessments*	3	2	2	3	-	2	-	-	2	-	2	2	2	2
CO2	*Explain different methodologies for environmental impact assessment*	3	3	2	2	-	3	-	-	3	-	-	2	2	-
CO3	*Identify the process of EIA by prediction and assessment procedure*	2	3	3	-	-	3	-	2	-	2	3	2	2	3
CO4	*Plan to environmental impact assessments by using environmental management plans*	2	2	2	2	-	2	2	3	2	2	3	-	-	-
CO5	*Evaluate environmental impact assessment reports by using case studies*	-	2	-	2	-	3	-	3	2	-	3	-	-	3
	Average	**3**	**2**	**2**	**2**	**-**	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**2**	**3**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20CE772	**INDUSTRIAL WASTE MANAGEMENT (Professional Elective - III)**	3	0	0	3

Prerequisite: *-*

Course Outcomes: On Completion of this course, the student will be able to **Cognitive Level**

CO1:	*Illustrate the awareness of pollution from industries*	*Understand*
CO2:	*Identify the Recycle, reuse and byproduct methods*	*Apply*
CO3:	*Learn about control of pollution from major industries*	*Understand*
CO4:	*Analyze the treatment and disposal of industrial wastes*	*Analyze*
CO5:	*Describe about the handling and disposal of hazardous waste from industries*	*Understand*

UNIT - I INTRODUCTION **[9]**

Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health – Environmental legislations related to prevention and control of industrial effluents and hazardous wastes.

UNIT - II CLEANER PRODUCTION **[9]**

Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and byproduct recovery – Applications - Waste minimization.

UNIT - III POLLUTION FROM MAJOR INDUSTRIES **[9]**

Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants – Waste water reclamation concepts.

UNIT - IV TREATMENT TECHNOLOGIES **[9]**

Equalization – Neutralization – Removal of suspended and dissolved organic solids – Chemical oxidation – Adsorption - Removal of dissolved in organics – Combined treatment of industrial and municipal wastes – Membrane Technologies - Residue management – Dewatering – Disposal.

UNIT - V HAZARDOUS WASTE MANAGEMENT **[9]**

Hazardous wastes - Physico chemical treatment – solidification – incineration – Secure landfills.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1. Rao,M.N&Dutta, A.K.,"Waste water Treatment", Oxford - IBH Publication, New Delhi, Third edition,2017.
2. Eckenfelder JrW.W., "Industrial Water Pollution Control", McGraw-Hill Book Company, New Delhi, Third Edition,1999

Reference Books :

1. PatwardhanA.D.,"Industrial Waste Water Treatment", PHI Learning PVT LTD (RS) Second edition, 2009
2. Stephenson R. Land J.B. Black burn,Jr.,"Industrial Wastewater Systems Hand book", CRC Publisher, New York, First edition ,2018
3. Wun Jern Ng.,"Industrial Waste water Treatment, "World Scientific Publishing Company, New Delhi, 2006
4. Bishop,P.L., "Pollution Prevention: Fundamental & Practice", McGraw-Hill, New Delhi ,2000.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE772 **Course Name: INDUSTRIAL WASTE MANAGEMENT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Illustrate the awareness of pollution from industries*	3	2	2	3	-	-	-	-	2	-	2	2	2	2
CO2	*Identify the Recycle, reuse and byproduct methods*	3	3	2	3	-	-	-	-	3	-	-	2	2	-
CO3	*Learn about control of pollution from major industries*	2	3	3	-	-	-	-	2	-	2	3	2	2	3
CO4	*Analyze the treatment and disposal of industrial wastes*	2	2	2	3	-	-	-	3	2	2	3	-	-	-
CO5	*Describe about the handling and disposal of hazardous waste from industries*	-	2	-	2	-	-	-	3	2	-	3	-	-	3
Average		**3**	**2**	**2**	**3**	**-**	**-**	**-**	**3**	**2**	**2**	**3**	**2**	**2**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20CE773	**GEOGRAPHICAL INFORMATICS APPLICATION FOR CIVIL ENGINEERING (Professional Elective - III)**	3	0	0	3

Prerequisite: -

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Identify various survey by using latest equipments.*	*Apply*
CO2:	*Identify the deformation studies in various structures and Analysis of Risk.*	*Apply*
CO3:	*Illustrate modeling soil survey, mining pollution and soil degradation analysis using Remote Sensing and GIS*	*Understand*
CO4:	*Classify the site suitability analysis for transport infrastructure and highway maintenance system.*	*Analyze*
CO5:	*Design the storage, modeling of catchments, flood and rainfall data.*	*Analyze*

UNIT - I LAND RESOURCE MANAGEMENT [9]

Total Station and GPS Surveys – Topographic and Bathymetric Surveys – Cadastral Information – Soil and Land Use Surveys - Land Information System (LIS) – Real Estate Information System

UNIT - II STRUCTURAL STUDIES [9]

Deformation studies of deflection - Dam deformation - structural movement - Pavement yield - shifting sand-bank and shoreline – Landslide Risk Analysis

UNIT - III SOIL CONSERVATION AND MANAGEMENT [9]

Soil survey interpretation and mapping - impact of agricultural and industrial activity on soil properties - soil erosion - factors influencing soil erosion - soil contamination using Hyper spectral Remote Sensing - mining pollution- EMR responses with contaminated soil - modeling soil characteristics using satellite data - soil degradation assessment using Remote Sensing and GIS - Land reclamation studies

UNIT - IV URBAN AND TRANSPORTATION MANAGEMENT [9]

Monitoring Urban Growth through Remote Sensing - Geo-demographic Analysis – Property Market Analysis Urban Renewal - traffic analysis - accident analysis - site suitability analysis for transport infrastructure –transportation databases: creation and maintenance - Vehicle routing – Highway maintenance system – Intelligent Transportation System

UNIT - V WATER RESOURCES PLANNING AND MANAGEMENT [9]

Location of storage/diversion works – capacity curve generation – sediment yield - modelling of catchments – Delineation of watershed - Watershed modelling for sustainable development - Rainfall – Runoff modelling –LiDAR Mapping for Urban area –Water quality mapping and monitoring – Flood Risk Zoning - Flood damage assessment – Flood Modelling - Assessment of droughts and mitigation

Total (L: 45 T: 0) = 45 Periods

Text Books :

1. Andrew N. Rencz, Manual of Remote Sensing: Remote Sensing for Natural Resource Management and Environmental Monitoring, John Wiley & Sons Inc, April 2004 .
2. Rashed, Tarek; Jürgens, Carsten (Eds.), Remote Sensing of Urban and Suburban Areas, Springer, New Delhi,First Edition. 2010.

Reference Books :

1. GertA,Schulitz,EdwinT,Engman, Remote Sensing in hydrology and Water Management, Springer- Verlay Barlin Heilelberg, Germany, First edition, 2000.
2. Harvey J. Miller, Shih-Lung Shah, Geographic Information Systems for Transportation – Principles and Applications, Oxford University Press,Oxford, 2001.
3. Rodrigo Nobrega ,Multi-Scale GIS Data-Driven Method for Early Assessment of Wetlands Impacted by Transportation Corridors , Intech,2008.
4. Enguerran Grandchamp, Raster and Vector Integration for Fuzzy Vector Information Representation Within GIS, Information session, Hong Kong, 2016.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE773** **Course Name:** **GEOGRAPHICAL INFORMATICS APPLICATION FOR CIVIL ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Identify various survey by using latest equipments.*	3	3	3	2	2	2	-	-	2	-	-	2	-	-
CO2	*Identify the deformation studies in various structures and Analysis of Risk.*	3	3	3	2	2	2	-	-	2	-	-	2	--	-
CO3	*Illustrate modeling soil survey, mining pollution and soil degradation analysis using Remote Sensing and GIS*	3	3	3	2	2	2	-	-	2	-	-	2	-	-
CO4	*Classify the site suitability analysis for transport infrastructure and highway maintenance system.*	3	3	2	3	2	2	-	-	3	-	-	3	-	-
CO5	*Design the storage, modeling of catchments, flood and rainfall data.*	3	3	3	3	2	2	-	-	3	-	-	3	-	-
	Average	3	3	3	3	2	2	-	-	3	-	-	2	-	-

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20AU901	**BASICS OF AUTOMOBILE ENGINEERING** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Provide basic platform knowledge of automobile engineering*	*Understand*
CO2:	*Explain the working principal of petrol and diesel engines*	*Understand*
CO3:	*Interpret the method of power transmission unit*	*Understand*
CO4:	*Built knowledge of steering and brake*	*Understand*
CO5:	*Illustrate the knowledge of automotive electrical systems and functioning*	*Understand*

UNIT - I INTRODUCTION [09]

Automobile - Components of an automobile - Classification of automobiles - Layout of chassis - Types of drives front wheel- rear wheel - four wheel.

UNIT - II IC ENGINES [09]

Classification - ignition system - firing order - Otto/ Diesel cycles - Two stroke and four stroke engines – scavenging - Cooling and Lubrication systems - Fuel Supply system – air fuel ratio - Carburetor – types.

UNIT - III TRANSMISSION SYSTEM [09]

Clutch - Function - single plate - multi plate - friction clutches - Centrifugal and semi centrifugal clutch - Gear Box -slide mesh - constant mesh and synchromesh gear box - Torque convertor – overdrive - Propeller shaft and rear axle- Universaljoint – Differential - Rear axle drives - Wheels and Tyres.

UNIT - IV STEERING AND BRAKE [09]

Steering system - function and principle - Ackerman and Davis steering principles - wheel alignment –steering gear boxes.Brakes - Mechanical - hydraulic and vacuum brake - master cylinder - wheel cylinder -Bleeding of brakes.

UNIT - V ELECTRICAL SYSTEMS [09]

Battery – types - Dynamo and Alternator – Cut-out relay - Diagram of Wiring system - Lighting System and Accessories - Headlight - switches - Windscreen Wipers – Horn – Speedometer – Heater and Air conditioning.

Total = 45 Periods

Text Books :

1 Kirpal Singh, Automobile Engineering, Vol. I & II, Standard Publishers, New Delhi, Fourteenth Edition, 2018.

2 Gupta,S. K., A Textbook of Automobile Engineering, S.Chand Publishing, New Delhi, Second Edition, 2020.

Reference Books :

1 Rajput, R K, A Textbook of Automobile Engineering, Laxmi Publications (P) Ltd, New Delhi, Second Edition, 2017.

2 Ganesan. V, Internal Combustion Engines, Tata McGraw-Hill Publishing Co., New Delhi, Fourth Edition, 2012.

3 Mathur M.L. and Sharma R.P, A Course in Internal Combustion Engines, DhanpatRai and sons, New Delhi, Second Edition, 2016.

4 Ramalingam K.K, Automobile Engineering, Scitech Publications (India) Pvt. Ltd, Chennai, Second Edition, 2011.

Course Faculty **Module Coordinator** **Chairman BoS /AE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20AU901 **Course Name: Basics of Automobile Engineering**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Provide basic platform knowledge of automobile engineering*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	*Explain the working principal of petrol and diesel engines*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	*Interpret the method of power transmission unit*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	*Built knowledge of steering and brake*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	*Illustrate the knowledge of automotive electrical systems and functioning*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS /AE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20AU902	**AUTOMOTIVE ENGINE TECHNOLOGY** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Illustrate the fundamental concepts and functions of an automotive engine and working cycles*	*Understand*
CO2:	*Explain the combustion phenomena in SI engines*	*Understand*
CO3:	*Identify the CI engines injection, ignition and combustion phenomena*	*Understand*
CO4:	*Outline the emission control techniques.*	*Understand*
CO5:	*Demonstrate themeasurement techniques and emission standards.*	*Understand*

UNIT – I CONSTRUCTION AND OPERATION [09]

Constructional details of spark ignition (SI) and compression ignition (CI) engines. Working principles. Two stroke SI and CI engines. Comparison of SI and CI engines and four stroke and two stroke engines. Engine classification, firing order. Otto, diesel and dual cycles. Introduction to Lean burn engine technologies.

UNIT – II SI ENGINES [09]

Air fuel ratio requirements - Carburetion - Throttle body injection, Multi point injection. Function of Components, Spark plug, Ignition System - battery coil, magneto coil, Electronic. Combustion in SI Engines - Combustion Chambers, Stages of Combustion - factors affecting flame propagation, Knock in SI engines, variables affecting knocking. Pollution from SI engines.

UNIT – III CI ENGINES [09]

Diesel fuel injection system, Function of Components, Jerk type pump, Distributor pump, Mechanical and pneumatic Governor, Fuel Injector, Types of nozzles, importance of Swirl, Squish, Turbulence air motion, Combustion in CI Engines - Combustion Chambers, Stages of Combustion, Factors affecting Ignition Delay, Knock in CI engines. Pollution from CI engines.

UNIT - IV EMISSION CONTROL TECHNIQUES [09]

Design of engine, optimum selection of operating variables for control of emissions, EGR, charge stratification, SCR, DPF, Lean NOX catalyst technology. Thermal reactors, secondary air injection, catalytic converters, catalysts, fuel modifications, fuel cells, Two stroke engine pollution and control.

UNIT - V MEASUREMENT TECHNIQUES, EMISSION STANDARDS AND TEST PROCEDURES [09]

NDIR, FID, Chemiluminescent analyzers, Gas Chromatograph, smoke meters, emission standards, driving cycles - USA, Japan, Euro and India. Test procedures - ECE, FTP Tests. SHED Test - Chassis dynamometers, dilution tunnels.

Total = 45 Periods

Text Books :

1 Ganesan. V, Internal Combustion Engines, Tata McGraw-Hill Publishing Co., New Delhi, Fourth Edition, 2012.

2 Mathur M.L. and Sharma R.P, A Course in Internal Combustion Engines, Dhanpat Rai and sons, New Delhi, Second Edition, 2016.

Reference Books :

1 Ramalingam K.K, Automobile Engineering, Scitech Publications (India) Pvt. Ltd, Chennai, Second Edition, 2011.

2 John B. Heywood, Internal Combustion Engine Fundamentals, Tata McGraw Hill Education, New Delhi, Second Edition, 2018.

3 Gupta H.N, Fundamentals of Internal Combustion Engines, PHI Learning Private Ltd., New Delhi, Second Edition, 2013.

4 Obert, E.F., Internal Combustion Engineering and Air Pollution, Intext Education Publishers, New York, Third Edition, 1988.

Course Faculty **Module Coordinator** **Chairman BoS /AE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20AU902 **Course Name: Automotive Engine Technology**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Illustrate the fundamental concepts and functions of an automotive engine and working cycles*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	*Explain the combustion phenomena in SI engines.*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	*Identify the CI engines injection, ignition and combustion phenomena*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	*Outline the emission control techniques.*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	*Demonstrate the measurement techniques and emission standards.*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS /AE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20AU903	**AUTOMOTIVE VEHICLE TECHNOLOGY** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to ***Cognitive Level***

CO1:	*Identify the construction and working of various types of automobile engines.*	*Understand*
CO2:	*Evaluate the significance of clutch and transmission system.*	*Understand*
CO3:	*Illustrate the types of axle, suspension and classification of steering system.*	*Understand*
CO4:	*Discuss the various vehicle control systems.*	*Understand*
CO5:	*Demonstrate the various new generation vehicles.*	*Understand*

UNIT - I AUTOMOBILE ENGINE [09]

Construction layout, types and components of engines, SI – CI – Wankel engine, working of engines, lubrication system, coolant system, power supply, alternate and dynamo, flywheel and damper.

UNIT - II CLUTCH AND TRANSMISSION [09]

Types of clutches, construction and working procedure of single plate clutch, multi-plate clutch, cone clutch, gears – types of gears, terminology of spur gear, gear trains, construction and working of manual and automatic gear box.

UNIT - III AXLE, SUSPENSION AND STEERING [09]

Types of axles, necessity of axle for an automobile, suspension system, types and construction of suspension system, significance of suspension system, steering system and vehicle handling, classification of steering system, merits and demerits of power steering.

UNIT - IV VEHICLE CONTROL SYSTEM [09]

Cruise control, antilock braking system, tyre slip controller, electronic steering control, global positioning system, autonomous navigation system.

UNIT - V NEW GENERATION VEHICLES [09]

Electric vehicles, hybrid vehicles, flexible fuel vehicles, solar powered vehicles, high energy and power density batteries, regenerative braking, safety air bags.

Total = 45 Periods

Text Books :

1 David A. Crolla, Automotive Engineering – Powertrain, Chassis system and Vehicle body, Butterworth-Heinemann, New Delhi, First Edition, 2009.

2 Ganesan. V, Internal Combustion Engines, Tata McGraw-Hill Publishing Co., New Delhi, Fourth Edition, 2012.

Reference Books :

1 Heinz Heisler,Advance Vehicle Technology, Butterworth-Heinemann, London, Second Edition, 2002.

2 Mathur M.L. and Sharma R.P, A Course in Internal Combustion Engines, DhanpatRai and sons, New Delhi, Second Edition, 2016.

3 James Larminie and John Lowry, Electric Vehicle Technology Explained, John Wiley & Sons, New York, Second Edition, 2012.

4 William B Ribbens, Understanding Automotive Electronics, Butterworth-Heinemann, Woburn, Eighth edition, 2017.

Course Faculty **Module Coordinator** **Chairman BoS /AE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20AU903 **Course Name: Automotive Vehicle Technology**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Identify the construction and working of various types of automobile engines.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	*Evaluate the significance of clutch and transmission system.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	*Illustrate the types of axle, suspension and classification of steering system.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	*Discuss the various vehicle control systems.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	*Demonstrate the various new generation vehicles.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS /AE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20AU904	**AUTOMOTIVE SAFETY** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the automotive safety and its importance.*	*Understand*
CO2:	*Analyze the safety concepts.*	*Understand*
CO3:	*Illustrate the various safety equipment functions and importance*	*Understand*
CO4:	*Identify the various crash test and impact test mechanics.*	*Understand*
CO5:	*Examine the function of warning and avoidance systems.*	*Understand*

UNIT - I INTRODUCTION [09]

Evolution of automotive safety - Active safety: driving safety, conditional safety, perceptibility safety, operatingsafety- passive safety: exterior safety, interior safety, safety sandwich construction – NCAP.

UNIT - II SAFETY CONCEPTS [09]

Design of the body for safety -Energy equation - engine location - deceleration of vehicle inside passenger compartment - deceleration on impact with stationary and movable obstacle.

UNIT - III SAFETY EQUIPMENTS [09]

Seat belt - regulations, automatic seat belt tightener system - collapsible steering column - tiltable steering wheel - air bags - electronic system for activating air bags - bumper design for safety - Collision warning system - Central Locking system - Child safety.

UNIT - IV CRASH AND IMPACT MECHANICS [09]

Design of crash crumple zones - Behavior of specific body structures in crash testing - Roll over crash tests - Regulatory requirements for crash testing & testing procedure - vehicle impacts- Side and Frontal Pole Impact.

UNIT - V COMFORT AND CONVENIENCE SYSTEM [09]

Steering and mirror adjustment - central locking system - Garage door opening system - tyre pressure control system - rain sensor system - environment information system.

Total = 45 Periods

Text Books :

1 LjuboVlacic, Michel Parent and Fumio Harashima, Intelligent Vehicle Technologies, Butterworth-Heinemann publications, Oxford, First Edition, 2001.

2 Robert Bosch GmbH, Safety, Comfort and Convenience Systems, John Wiley& Sons, New Delhi, Third edition, 2007

Reference Books :

1 Bosch, Automotive HandBook, SAE International, New York, Eighth Edition, 2011.

2 Vivek D. Bhise, Ergonomics in the automotive design process. CRC Press, New York, 2012.

3 Ronald K Jurgen, Automotive Electronics Handbook, Tata McGraw-Hill Inc., New York, Second Edition, 1999.

4 William B Ribbens, Understanding Automotive Electronics, Butterworth-Heinemann, Woburn, Eighth edition, 2017.

Course Faculty **Module Coordinator** **Chairman BoS /AE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20AU904 **Course Name: Automotive Safety**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain the automotive safety and its importance.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2	*Analyze the safety concepts.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3	*Illustrate the various safety equipment functions and importance*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	*Identify the various crash test and impact test mechanics.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5	*Examine the function of warning and avoidance systems.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**3**	-	-	-	-	-	**-**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS /AE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20AU905	**HYBRID VEHICLES** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to ***Cognitive Level***

CO1:	*Summarize the electric and hybrid vehicle operation and architectures.*	*Understand*
CO2:	*Explain the different subsystems of hybrid and electric vehicle*	*Understand*
CO3:	*Demonstrate the energy requirement for vehicles*	*Understand*
CO4:	*Model and simulate the vehicle characteristics, operating modes, and performance parameters of the vehicle*	*Understand*
CO5:	*Design and develop the systems of hybrid and electric vehicles*	*Understand*

UNIT - I NEED FOR ALTERNATIVE SYSTEM [09]

Need for hybrid and electric vehicles – main components and working principles of a hybrid and electric vehicles, Different configurations of hybrid and electric vehicles. Comparative study of diesel, petrol, hybrid and electric Vehicles. Advantages and Limitations of hybrid and electric Vehicles.

UNIT - II SUBSYSTEMS OF HYBRID AND ELECTRIC VEHICLES [09]

Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design, Properties of Batteries.

UNIT - III ENERGY SOURCES [09]

Battery Parameters- - Different types of batteries – Lead Acid- Nickel Metal Hydride – Lithium ion- Sodium based- Metal Air. Battery Modeling- Equivalent circuits, Battery charging- Quick Charging devices. Fuel Cell- Fuel cell Characteristics- Fuel cell types-Half reactions of fuel cell. Ultra capacitors. Battery Management System.

UNIT - IV MOTORS AND CONTROLLERS [09]

Types of Motors, Characteristic of DC motors, AC single phase and 3-phase motor, PM motors, Switched reluctance motors, Motor Drives and speed controllers, Torque Vectoring, Regenerative Braking. Rectifiers, Inverters, DC/DC converters.

UNIT - V DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES [09]

Design requirement for electric vehicles- Range, maximum velocity, acceleration, power requirement, mass of the vehicle. Various Resistance- Transmission efficiency- Electric vehicle chassis and Body Design, Electric Vehicle Recharging and Refueling Systems, performance of electrical vehicles.

Total = 45 Periods

Text Books :

1 Iqbal Husain, Electric and Hybrid Vehicles-Design Fundamentals, CRC Press, New York, Second Edition, 2010.

2 Mehrdad Ehsani, Modern Electric, Hybrid Electric and Fuel Cell Vehicles, CRC Press, New York, Second Edition, 2009.

Reference Books :

1 James Larminie and John Lowry, Electric Vehicle Technology Explained, John Wiley & Sons, New York, Second Edition, 2012.

2 Lino Guzzella, Vehicle Propulsion Systems, Springer-Verlag Berlin, Heidelberg, Third Edition, 2013

3 Ron HodKinson, Light Weight Electric/ Hybrid Vehicle Design, Butterworth Heinemann Publication, London, 2001

4 Ronald K Jurgen, Electric and Hybrid – Electric Vehicles, SAE International, New York, First Edition, 2011.

Course Faculty **Module Coordinator** **Chairman BoS /AE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20AU905 **Course Name: Hybrid Vehicles**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Summarize the electric and hybrid vehicle operation and architectures.*	3	3	2	-	-	-	3	-	-	-	-	-	-	-
CO2	*Explain the different subsystems of hybrid and electric vehicle*	3	3	2	-	-	-	3	-	-	-	-	-	-	-
CO3	*Demonstrate the energy requirement for vehicles*	3	3	3	-	-	-	3	-	-	-	-	-	-	-
CO4	*Model and simulate the vehicle characteristics, operating modes, and performance parameters of the vehicles.*	3	3	2	-	-	-	3	-	-	-	-	-	-	-
CO5	*Design and develop the systems of hybrid and electric vehicles.*	3	2	2	-	-	-	3	-	-	-	-	-	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS /AE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20AU906	**OFF HIGHWAY VEHICLES** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the construction and requirement of off road vehicles.*	*Understand*
CO2:	*Explain the different types of earth moving machines and explain the different sub systems.*	*Understand*
CO3:	*Describe the specifications, functions, merits and demerits of different types and subsystems of scrappers, graders and ditchers.*	*Understand*
CO4:	*Discuss the construction and working principle of farm equipment, military and combat vehicles.*	*Understand*
CO5:	*Explain the vehicle systems and features.*	*Understand*

UNIT - I CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES [09]

Construction layout, capacity and applications. Power Plants, Chassis and Transmission, Multi-axle vehicles.

UNIT - II EARTH MOVING MACHINES [09]

Earthmovers like dumpers, loaders - single bucket, Multi bucket and rotary types - bulldozers, excavators, backhoe loaders, scrappers, drag and self powered types, Bush cutters, stumpers, tree dozer, rippers etc. – Power and capacity of earth moving machines.

UNIT - III SCRAPPERS ,GRADERS, SHOVELS AND DITCHERS [09]

Scrappers, elevating graders, motor graders, self powered scrappers and graders, Power shovel, revolving and stripper shovels – drag lines – ditchers – capacity of shovels.

UNIT - IV FARM EQUIPMENT, MILITARY AND COMBAT VEHICLES [09]

Power take off, special implements. Special features and constructional details of tankers, gun carriers and transport vehicles.

UNIT - V VEHICLE SYSTEMS AND FEATURES [09]

Brake system and actuation – OCDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics. Hydro-pneumatic suspension cylinders. Power steering system. Kinematics for loader and bulldozer operational linkages. Safety features, safe warning system for dumper.

Total = 45 Periods

Text Books :

1 Robert L. Peurifoy, Clifford J. Schexnayder, Construction, planning, Equipment and methods, Tata McGraw Hill Publishing company Ltd, New Delhi, Ninth Edition, 2018.

2 Nakra C.P., Farm machines and equipment, Dhanparai Publishing company, New Delhi, First Edition, 2003.

Reference Books :

1 Wong.J.Y., Theory of Ground Vehicles, John Wiley & Sons, New York, Fifth Edition, 2022.

2 Ageikin S., Off the road wheeled and combined traction devices – Ashgate Publishing Co. Ltd., New Delhi, First Edition,1988

3 Heinz Heisler, Vehicle and Engine Technology, , SAE International, New York, Second Edition, 1999

4 Sean Bennet and Ian Andrew Norman, Heavy Duty Truck systems, Delmar Cengage learning, New York, Fifth Edition, 2011.

Course Faculty **Module Coordinator** **Chairman BoS /AE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20AU906 **Course Name: Off HighwayVehicles**

CO	Course Outcomes	Programme Outcomes												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Describe the construction and requirement of off road vehicles.*	3	3	2	-	-	-	3	3	-	-	-	-	-	-
CO2	*Explain the different types of earth moving machines and explain the different sub systems.*	3	3	2	-	-	-	3	-	-	-	-	-	-	-
CO3	*Describe the specifications, functions, merits and demerits of different types and subsystems of scrappers, graders and ditchers.*	3	3	3	-	-	-	3	3	-	-	-	-	-	-
CO4	*Discuss the construction and working principle of farm equipment, military and combat vehicles.*	3	3	2	-	-	-	3	3	-	-	-	-	-	-
CO5	*Explain the vehicle systems and features.*	3	2	2	-	-	-	3	-	-	-	-	-	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS /AE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20AU907	**MODERN AND INTELLIGENT VEHICLE SYSTEM** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify the various systems involved in driver support systems and their working principle.*	*Understand*
CO2:	*Familiarize with global positioning systems, geographical information systems and navigationsystems.*	*Understand*
CO3:	*Comprehend the constructional and working features of safety systems and security systems.*	*Understand*
CO4:	*Recognize about the various comfort systems.*	*Understand*
CO5:	*Explain the various adaptive control systems.*	*Understand*

UNIT - I DRIVER ASSISTANCE SYSYTEMS [09]

Introduction, driver support systems – driver information, driver perception, driver convenience, driver monitoring. Vehicle support systems – general vehicle control, vehicle status monitoring and automated highway systems.

UNIT - II TELEMATICS [09]

Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition and application of Internet of Things (IoT) in automotive industry.

UNIT - III SAFETY SYSTEMS AND SECURITY SYSTEMS [09]

Airbags, seat belt tightening system, collision avoidance and warning systems, child lock, antilock braking systems, Anti-theft technologies, smart card system and number plate coding.

UNIT - IV COMFORT SYSTEMS [09]

Active suspension systems, requirement and characteristics, different types, power steering, collapsible and tilt able steering column and power windows.

UNIT - V ADAPTIVE CONTROL SYSTEMS [09]

Adaptive cruise control, adaptive noise control, anti spin regulation, traction control systems and cylinder cut off technology and autonomous driving.

Total = 45 Periods

Text Books :

1 LjuboVlacic, Michel Parent and Fumio Harashima, Intelligent Vehicle Technologies, Butterworth-Heinemann publications, Oxford, First Edition, 2001.

2 Ronald K Jurgen, Navigation and Intelligent Transportation Systems – Progress in Technology, Automotive Electronics Series, SAE, New York, First Edition, 1998.

Reference Books :

1 Richard Bishop, Intelligent Vehicle Technology and Trends, Artech House, London, First Edition, 2005.

2 William B Ribbens, Understanding Automotive Electronics, Butterworth-Heinemann, Woburn, Eighth edition, 2017.

3 Robert Bosch, Automotive Handbook, Bently Publishers, Cambridge, Tenth Edition, 2018.

4 Robert Bosch, Bosch Automotive Electrics and Automotive Electronics, Springer Vieweg Wiesbaden, Switzerland, Fifth Edition, 2013.

Course Faculty **Module Coordinator** **Chairman BoS /AE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20AU907** **Course Name:** **Modern and Intelligent Vehicle System**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Identify the various systems involved in driver support systems and their working principle.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2	*Familiarize with global positioning systems, geographical information systems and navigation systems.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3	*Comprehend the constructional and working features of safety systems and security systems*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	*Recognize about the various comfort systems.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5	*Explain the various adaptive control systems.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**3**	**-**	-	-	-	-	-	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS /AE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20AU908	**VEHICLE MAINTENANCE** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the importance, types and requirements of vehicle maintenance and related records and schedules.*	*Understand*
CO2:	*Practice the engine overhauling, reconditioning; methods, procedures, tools of power plants, ignition system, cooling system and other engine components.*	*Understand*
CO3:	*Demonstrate the maintenance procedures of clutch, gear box, propeller shaft and steering systems.*	*Understand*
CO4:	*Demonstrate the construction, testing, fault diagnosis and maintenance of body panel and body tinkering.*	*Understand*
CO5:	*Describe the maintenance procedures of electrical systems. .*	*Understand*

UNIT - I MAINTENANCE TOOL, SHOP, SCHEDULE, RECORDS [09]

Standard tool set, torque wrenches, compression and vacuum gauges, engine analyzer and scanner, computerized wheelalignment and balancing, gauges for engine tune up and pollution measurement, spark plug cleaner, cylinder re-boringmachine, fuel injection calibration machine. Importance of maintenance. Schedule and unscheduled maintenance. Scope of maintenance. Equipment downtime. Vehicle inspection. Reports. Log books. Trip sheet. Lay out andrequirements of maintenance shop.

UNIT - II ENGINE REPAIR AND OVERHAULING [09]

Dismantling of engine and its components. Cleaning methods. Inspection and checking. Repair and reconditioningmethods for all engine components. Maintenance of ignition system, fuel injection system, cooling system - lubricationsystem. Engine trouble shooting chart.

UNIT - III MAINTENANCE, REPAIR AND OVERHAULING OF THE CHASSIS [09]

Maintenance, servicing and repair of clutch, fluid coupling, gearbox, torque converter, propeller shaft. Maintenance offront axle, rear axle, brakes, steering systems.

UNIT - IV MAINTENANCE AND REPAIR OF VEHICLE BODY [09]

Body panel tools for repairing. Tinkering and painting. Use of soldering, metalloid paste. Tyre maintenance, metallic,plastics

UNIT - V MAINTENANCE AND REPAIR OF ELECTRICAL SYSTEMS [09]

Care, maintenance, testing and troubleshooting of battery, starter motor, dynamo, alternator and regulator.Transistorized regulator problems.

Total = 45 Periods

Text Books :

1 John E. Dolce, Analytical Fleet Maintenance Management, SAE International, New York, Third Edition, 2009.

2 James D. Halderman, Advanced Engine Performance Diagnosis, Pearson Education, New Delhi, Seventh Edition, 2019.

Reference Books :

1 Bosch Automotive Handbook, SAE International, New York, Tenth Edition,2018

2 Willam H. Crouse and Donald L. Anglin, Automotive Mechanics, Tata McGraw Hill Publishing Company, New Delhi, Tenth Edition, 2007.

3 Service Manuals from different vehicle manufacturers.

4 Judge. A.N, Motor vehicle engine servicing, Pitman Paper pack, London, Third Edition, 1969.

Course Faculty **Module Coordinator** **Chairman BoS /AE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20AU908 **Course Name: Vehicle Maintenance**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Describe the importance, types and requirements of vehicle maintenance and related records and schedules.*	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO2	*Practice the engine overhauling, reconditioning; methods, procedures, tools of power plants, ignition system, cooling system and other engine components.*	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO3	*Demonstrate the maintenance procedures of clutch, gear box, propeller shaft and steering systems.*	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO4	*Demonstrate the construction, testing, fault diagnosis and maintenance of body panel and body tinkering.*	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO5	*Describe the maintenance procedures of electrical systems.*	3	3	2	-	-	-	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS /AE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CS901	**PROGRAMMING IN JAVA** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Discover java programming fundamentals to solve real world problem.*	*Understand*
CO2:	*Implement the concept of class and constructor.*	*Apply*
CO3:	*Examine important features of java like inheritance and interfaces.*	*Understand*
CO4:	*Illustrate the features of package and exception handling.*	*Understand*
CO5:	*Apply the concepts of string manipulations.*	*Apply*

UNIT – I JAVA FUNDAMENTALS [09]

The Java Buzzwords – Data Types – Variables– Local Variable – Instant Variable – Static variable – Array-Single Dimensional Array-Multi Dimensional Array – Operators – Control Statements – if – if else – nested if– else if– for – for each – while – do while – Switch – Break– Continue.

UNIT – II CLASS FUNDAMENTALS AND CONSTRUCTORS [09]

Class Fundamentals –Declaring Objects – Methods – Instant Method– Static Method– Method Overloading– Recursion – this keyword – Garbage Collection – Constructors – Argument constructor– No-Argument Constructor – Constructor Overloading – Access Control.

UNIT – III INHERITANCE AND INTERFACES [09]

Inheritance – Single – Multilevel – Hierarchical – Super keyword – Method Overriding – Abstract class – Final variable– Final class – Interfaces – Default Interface Methods – Static Methods in Interface.

UNIT – IV PACKAGES AND EXCEPTION HANDLING [09]

Packages –User define Package – Predefine Package – Access Protection – Importing Packages – Array List– Wrapper Classes – Exception Handling Fundamentals – Exceptions Types –Try and Catch – Multiple Catch – Nested Try – Throw – Throws – Finally.

UNIT – V STRING AND STRING BUFFER [09]

The String Constructors – String Length – Character Extraction – String Comparison – Searching Strings – Modifying a String – Data Conversion using valueOf method – Methods in String Buffer – append – delete – replace – insert – reverse – capacity.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Herbert Schildt, Java - The Complete Reference, Oracle Press, McGraw-Hill Education, New Delhi, Eleventh Edition, 2018.

2 Cay S. Horstmann, Core Java Volume 1 - Fundamentals, Prentice Hall, India, Tenth Edition, 2015.

Reference Books :

1 Herbert Schildt, Java - A Beginner Guide, Oracle Press, McGraw-Hill Education, New Delhi, Sixth Edition, 2014.

2 Joshua Bloch, Effective Java: A Programming Language Guide, Addison-Wesley Professional, USA, Third Edition, 2018.

3 Allen B. Downey and Chris Mayfield, Think Java: How to Think Like a Computer Scientist, O'Reilly, California, First Edition, 2016.

4 https://onlinecourses.nptel.ac.in/noc19_cs07/preview

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CS901 **Course Name: PROGRAMMING IN JAVA**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Discover java programming fundamentals to solve real world problem.*	3	3	2	3	3	-	-	-	-	-	-	3	-	-
CO2:	*Implement the concept of class and constructor.*	3	3	2	3	2	-	-	-	-	-	-	3	-	-
CO3:	*Examine important features of java like inheritance and interfaces.*	3	3	1	3	2	-	-	-	-	-	-	2	-	-
CO4:	*Illustrate the features of package and exception handling.*	3	3	2	2	3	-	-	-	-	-	-	3	-	-
CO5:	*Apply the concepts of string manipulations.*	3	3	2	3	2	-	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CS902	**BASIC CONCEPTS OF DATA STRUCTURE** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Elaborate the different linear data structure to solve simple problems.*	*Understand*
CO2:	*Build the various tree structures with its operations.*	*Understand*
CO3:	*Describe the concept of AVL tree, splay tree, B tree and B+ tree.*	*Understand*
CO4:	*Apply graph data structure to solve real time problems.*	*Apply*
CO5:	*Discover various sorting, hashing and searching techniques.*	*Apply*

UNIT– I ARRAY AND LINKED LIST [09]

Abstract Data Types (ADT) – List ADT – Array Based Implementation – Linked List Implementation – Singly Linked Lists – Doubly Linked Lists – Circularly Linked Lists – Applications of Lists: Polynomial Manipulation – Radix sort.

UNIT– II STACK AND QUEUE [09]

Stack ADT – Implementation of Stack using Array and Linked List – Applications of Stack : Evaluating arithmetic expressions – Conversion of Infix to postfix expression Recursion – Queue ADT – Implementation of Queue using Array and Linked List – Applications of Queues

UNIT – III TREE STRUCTURES [09]

Tree ADT – Binary Tree ADT – Binary Tree Traversal – Expression Trees – Applications of Trees – Binary Search Tree – AVL Trees – B Tree – B+ Tree.

UNIT – IV GRAPHS [09]

Introduction to Graphs and its Types – Breadth First Traversal – Depth First Traversal – Topological Sorting – Minimum Spanning Tree: Prim's and Kruskal's algorithms –- Shortest Path Algorithms: Dijkstra's Algorithm – Applications of Graphs.

UNIT – V SEARCHING,HASHING AND SORTING [09]

Searching: Linear and Binary Search – Hashing :Hash function– Separate Chaining – Open Addressing – Sorting: Bubble Sort – Selection Sort – Insertion Sort – Heap Sort – Merge Sort.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 M. A. Weiss, Data Structures and Algorithm Analysis in C, Pearson Education, India, Second Edition, 2015.

2 Reema Thareja, Data Structures Using C, Oxford University Press, England, Second Edition, 2011

Reference Books :

1 R. F. Gilberg, B. A. Forouzan, Data Structures, Thomson, India, Second Edition, 2005.

2 A.K. Sharma, Data Structures using C, Pearson Education, India, First Edition, 2011.

3 Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Fundamentals of Data Structures in C++,University Press, United States, Second Edition, 2008

4 http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CS902** **Course Name:** **BASIC CONCEPTS OF DATA STRUCTURE**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Elaborate the different linear data structure to solve simple problems.*	3	2	3	-	2	-	-	-	-	-	-	2	-	-
CO2:	*Build the various tree structures with its operations.*	3	2	3	-	2	-	-	-	-	-	-	2	-	-
CO3:	*Describe the concept of AVL tree, splay tree, B tree and B+ tree.*	3	3	2	-	2	-	-	-	-	-	-	2	-	-
CO4:	*Apply graph data structure to solve real time problems.*	3	2	2	-	2	-	-	-	-	-	-	2	-	-
CO5:	*Discover various sorting, hashing and searching techniques.*	3	2	2	-	2	-	-	-	-	-	-	2	-	-
	Average	**3**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	-	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CS903	**FUNDAMENTALS OF DATABASE CONCEPTS** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline database architecture and the E-R Model for Database design.*	*Understand*
CO2:	*Apply Structured query language to create and manipulate a relational database.*	*Apply*
CO3:	*Build functions, triggers and recursive queries.*	*Apply*
CO4:	*Demonstrate the purpose of normalization.*	*Understand*
CO5:	*Discover about transaction and query processing concepts.*	*Understand*

UNIT – I BASIC CONCEPTS AND E-R MODEL [9]

Database System Applications – Purpose of Database Systems – Views of Data – Database Languages –Database and Application Architecture. Overview of the Design Process – The Entity-Relationship model – Complex Attributes – Mapping Cardinalities and Keys.

UNIT – II RELATIONAL MODEL AND SQL FUNDAMENTALS [9]

Introduction to Relational Model: Structure of Relational Databases – Database Schema –Keys – Schema Diagrams. Overview of the SQL Query Language – SQL Data Definition – Basic Structure of SQL Queries – Additional Basic Operations – Set operations – Null values – Aggregate functions – Modification of the Database.

UNIT - III INTERMEDIATE SQL AND ADVANCED SQL [09]

Join Expressions – Views – Transactions – Integrity Constraints – Authorization –Accessing SQL from Programming Language – Functions and Procedures – Triggers – Recursive Queries.

UNIT - IV NORMALIZATION [09]

Functional Dependencies – Non-loss Decomposition – First, Second and Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

UNIT - V TRANSACTIONS AND QUERY PROCESSING [09]

Transaction Concept – A Simple Transaction Model – Storage Structure – Transaction Atomicity and Durability – Transaction Isolation – Serializability – Concurrency Control – Lock-Based protocols – Query Processing overview

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Abraham Silberschatz, Henry F. Korth and S. Sudharshan, Database System Concepts, Tata McGraw Hill, New Delhi, Seventh Edition, 2019.

2 RamezElmasri and Shamkant B. Navathe, Fundamentals of Database Systems, Pearson Education, New Delhi, Seventh Edition, 2016.

Reference Books :

1 Abraham Silberschatz, Henry F. Korth and S. Sudharshan, Database System Concepts, Tata McGraw Hill, New Delhi, Sixth Edition, 2015.

2 S.K.Singh, Database Systems Concepts, Design and Applications, Pearson Education, New Delhi, Second Edition, 2011.

3 C.J.Date, A.Kannan and S.Swamynathan, An Introduction to Database Systems, Pearson Education, New DelhiEighth Edition, 2006.

4 http://freevideolectures.com/course/2668/database-management-system#

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CS903** **Course Name:** **FUNDAMENTALS OF DATABASE CONCEPTS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Outline database architecture and the E-R Model for Database design.*	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO2:	*Apply Structured query language to create and manipulate a relational database.*	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO3:	*Build functions, triggers and recursive queries.*	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO4:	*Demonstrate the purpose of normalization.*	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO5:	*Discover about transaction and query processing concepts.*	3	3	3	-	2	2	-	-	-	-	-	2	-	-
	Average	**3**	**3**	**3**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CS904	**INTERNET PROGRAMMING** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the technologies around the internet.*	*Understand*
CO2:	*Construct the idea of web designing at user interface.*	*Apply*
CO3:	*Discuss the concept of data processing on client and server side.*	*Understand*
CO4:	*Construct the web oriented response at server side in PHP and XML format*	*Apply*
CO5:	*Illustrate the web service architecture and to enable rich client presentation using AJAX.*	*Understand*

UNIT – I INTRODUCTION TO WEB [09]

Web Essentials: Clients, Servers, and Communications. The Internet – History – Basic Internet Protocols: TCP and IP – DNS – URL. The World Wide Web – HTTP: Request Message – Response Message – Web Clients – Web Servers – Case Study.

UNIT – II BASICS OF HTML AND CSS [09]

HTML. An Introduction to HTML History and Version - Structure of HTML Page – HTML tags for data formatting - Tables – Links – Images - List – Frames – Forms - HTML 5 Tags and Validation. Style Sheets: CSS Syntax and Structure – CSS Rules for Backgrounds, Colours, and Properties – Manipulating Texts, Fonts, borders and Boxes - Margin – Padding Lists – CSS Positioning.

UNIT– III CLIENT SIDE SCRIPTING [09]

JavaScript: Syntax and Execution – Internal, embedded and External JavaScript. JavaScript: Variables – Arrays – Functions – Conditions – Loops – Type Conversion – Objects and DOM – Inbuilt Functions – Validation and Regular Expressions – Event Handling.

UNIT – IV SERVER SIDE SCRIPTING [09]

PHP: Introduction – Using PHP – variables – Program Control. Built-in Functions: Connecting to Database – Using cookies – Regular Expression. XML: Basics – DTD – XML Scheme – DOM and Presenting XML – XML parsers and validation.

UNIT– V AJAX and WEB SERVICE [09]

AJAX: Introduction – Ajax Client Server Architecture, XML http Request Object – Call Back Methods. Introduction to Web Services – Java web services: Basics – SOAP – WSDL: Creating, Publishing and Describing a web service – Consuming a web service – Database Driven Web Service from an application.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Randy Connolly and Ricardo Hoar, Fundamentals of Web Development, Pearson Education New Delhi, First Edition, 2016.

2 Paul Deitel, Harvey Deitel and Abbey Deitel , Internet and World Wide Web – How to Program, Pearson Education, New Delhi, Fifth Edition, 2012.

Reference Books :

1 Chris Bates, Web Programming – Building Internet Applications, John Wiley & Sons Ltd, USA, Third Edition, 2007.

2 John Dean, Web Programming With HTML5, CSS and JavaScript, Jones and Bartlett Publishers, Inc, United States, Third Edition, 2008.

3 Jon Duckett, Beginning Web Programming With HTML, XHTML and CSS, Wiley Publishing Inc, India, Second Edition, 2008.

4 www.tutorialspoint.com

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CO-PO MAPPING

Regulation: R 2020

Course Code: 20CS904 **Course Name: INTERNET PROGRAMMING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Summarize the technologies around the internet.*	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO2:	*Construct the idea of web designing at user interface.*	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO3:	*Discuss the concept of data processing on client and server side.*	3	3	3	-	3	1	-	-	-	-	-	2	-	-
CO4:	*Construct the web oriented response at server side in PHP and XML format*	3	3	3	-	3	1	-	-	-	-	-	2	-	-
CO5:	*Illustrate the web service architecture and to enable rich client presentation using AJAX.*	3	2	3	-	3	2	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**3**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CS905	**FUNDAMENTALS OF MOBILE APPLICATION DEVELOPMENT** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify various concepts of mobile programming that make it unique from programming for other platforms.*	*Understand*
CO2:	*Critique mobile applications on their design pros and cons.*	*Understand*
CO3:	*Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.*	*Apply*
CO4:	*Program mobile applications for the Android operating system that use basic and advanced phone features.*	*Understand*
CO5:	*Deploy applications to the Android marketplace for distribution.*	*Apply*

UNIT – I OVERVIEW OF THE ANDROID PLATFORM [09]

Introducing Android – Setting Up Your Android Development Environment – Writing Your First Android Application – Mastering the Android Development Tools

UNIT – II ANDROID APPLICATION BASICS [09]

Understanding the Anatomy of an Android Application – Defining Your Application Using the Android Manifest File – Managing Application Resources

UNIT – III ANDROID USER INTERFACE DESIGN ESSENTIALS [09]

Exploring User Interface Screen Elements – Designing User Interfaces with Layouts – Working with Fragments – Working with Dialogs

UNIT – IV ANDROID APPLICATION DESIGN ESSENTIALS [09]

Android application design: Using Android Preferences – Working with Files and Directories – Using Content Providers – Designing Compatible Applications

UNIT– V PUBLISHING AND DISTRIBUTING ANDROID APPLICATIONS [09]

The Android Software Development Process – Designing and Developing Bulletproof Android Applications – Testing Android Applications – Publishing Your Android Application

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Lauren Darcey, Shane Conder, Android Wireless Application Development, Pearson Education, India, Second Edition, 2011.

2 Ed Burnette, Hello Android: Introducing Google's Mobile Development Platform, The Pragmatic Publishers, North Carolina USA, Third Edition, 2010.

Reference Books :

1 Google Developer Training, Android Developer Fundamentals Course – Concept Reference, Google Developer Training Team, 2016.

2 Zigurd Mednieks, Laird Dornin, Blake Meike G, Masumi Nakamura, Programming Android: Java Programming for the New Generation of Mobile Devices, OReilly Media, USA, Second Edition, 2011.

3 2016Reto Meier, Professional Android 4 Application Development, Wrox Publications, John Wiley, New York, First Edition, 2012.

4 https://developer.android.com/training/basics/firstapp

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CS905** **Course Name:** **FUNDAMENTALS OF MOBILE APPLICATION DEVELOPMENT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Identify various concepts of mobile programming that make it unique from programming for other platforms.*	3	2	2	-	1	-	-	-	-	-	-	1	-	-
CO2:	*Critique mobile applications on their design pros and cons.*	3	2	3	-	2	-	-	-	-	-	-	2	-	-
CO3:	*Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.*	3	2	3	-	2	-	-	-	-	-	-	2	-	-
CO4:	*Program mobile applications for the Android operating system that use basic and advanced phone features.*	3	2	2	-	2	-	-	-	-	-	-	1	-	-
CO5:	*Deploy applications to the Android marketplace for distribution.*	3	2	3	-	2	-	-	-	-	-	-	2	-	-
	Average	**3**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CS906	**PRINCIPLES OF ETHICAL HACKING** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Discuss the basics of hacking with its ethics*	*Understand*
CO2:	*Extend the possibilities and types of Attacks*	*Understand*
CO3:	*Summarize the testing process with programming Language.*	*Understand*
CO4:	*Infer about the impact of hacking wireless network*	*Understand*
CO5:	*Outline about the protection scheme.*	*Understand*

UNIT - I ETHICAL HACKING OVERVIEW [9]

Introduction to Ethical Hacking – What You Can Do Legally – What You Cannot Do Legally – TCP/IP Concepts Review – IP Addressing – Overview of Numbering Systems

UNIT - II NETWORK ATTACKS AND ITS IMPACT [9]

Malicious Software – Protecting Against Malware Attacks – Intruder Attacks on Networks and Computers - Addressing Physical Security – Using Web Tools for Foot printing – Conducting Competitive Intelligence – Introduction to Social Engineering – Using Port-Scanning Tools – Conducting Ping Sweeps – Understanding Scripting.

UNIT - III SECURITY TESTING [9]

Enumerating Operating Systems – Introduction to Computer Programming – Understanding C,HTML, Pearl and Object Oriented Programming Basics – Windows OS Vulnerabilities – Tools for Identifying Vulnerabilities in Windows – Windows and Other Embedded Operating Systems – Vulnerabilities of Embedded OSs.

UNIT - IV WEB APPLICATION AND WIRELESS NETWORK [9]

Understanding Web Applications – Understanding Web Application Vulnerabilities – Tools for Web Attackers and Security Testers – Hacking Wireless Networks

UNIT - V PROTECTION SYSTEM [9]

Understanding Cryptography Basics – Understanding Symmetric and Asymmetric Algorithms – Understanding Public Key Infrastructure – Understanding Cryptography Attacks – Understanding Routers and Firewalls – Understanding Intrusion Detection and Prevention Systems – Understanding Honeypots

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Michael T. Simpson and Nicholas Antill, Ethical Hacking and Network defense, Cengage Learning, New Delhi, Third Edition, 2017.

2 Ankit Fadia, Ethical Hacking, Macmillan India Ltd, India, Second Edition, 2006.

Reference Books :

1 Steven Defino, Barry Kaufman and Nick Valenteen, Official Certified Ethical Hacker review guide, Cenage learning New Delhi, Second Edition, 2012.

2 Ankit Fadia, The Ethical Hacking Guide to Corporate Security, Macmillan Publishers, India, Second Edition, 2010.

3 James S. Tiller, The Ethical Hack: A Framework for Business value Penetration Testing, CRC Press, Florida, First Edition, 2005.

4 https://onlinecourses.nptel.ac.in/noc22_cs13

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CS906** **Course Name:** **PRINCIPLES OF ETHICAL HACKING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Discuss the basics of hacking with its ethics*	3	3	3	-	3	3	-	3	-	-	-	2	-	-
CO2:	*Extend the possibilities and types of Attacks*	3	3	2	-	1	2	-	1	-	-	-	1	-	-
CO3:	*Summarize the testing process with programming Language.*	3	3	2	-	3	3	-	2	-	-	-	3	-	-
CO4:	*Infer about the impact of hacking wireless network*	3	3	2	-	3	2	-	1	-	-	-	2	-	-
CO5:	*Outline about the protection scheme.*	3	3	2	-	3	2	-	1	-	-	-	3	-	-
	Average	**3**	**3**	**2**	**-**	**3**	**2**	**-**	**1**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CS907	**GREEN TECHNOLOGY** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify Green IT with its different dimensions and Strategies.*	Understand
CO2:	*Describe Green data centres and storage along with its green software methodologies.*	Understand
CO3:	*Outline the concepts o to manage the green IT with necessary components.*	Understand
CO4:	*Recognize various green enterprise activities, functions and their role with IT.*	Understand
CO5:	*Categorize various laws, standards and protocols for regulating green IT.*	Understand

UNIT – I GREEN IT [09]

Environmental Concerns and Sustainable Development – Environmental Impacts of IT – Green IT – Holistic Approach to Greening IT – Greening IT – Applying IT for enhancing Environmental sustainability – Green IT Standards and Eco-Labelling of IT – Enterprise Green IT strategy – Life Cycle of a device or hardware – Reuse, Recycle and Dispose.

UNIT – II SUSTAINABLE SOFTWARE DEVELOPMENT AND GREEN DATA CENTRES [09]

Current Practices – Sustainable Software – Attributes – Metrics – Methodology – Defining Actions – Data Centres: Associated Energy Challenges – IT Infrastructure – Management – Green Data Centre Metrics – Green Data Storage – Storage Media Power Characteristics – Energy Management Techniques for Hard Disks.

UNIT – III ENTERPRISE GREEN IT STRATEGY [09]

Approaching Green IT Strategies – Business Drivers – Business Dimensions for Green IT Transformation – Organizational Considerations – Steps to Develop Green IT Strategy – Metrics and Measurements – Multilevel Sustainable Information – Sustainability Hierarchy Models.

UNIT – IV GREEN ENTERPRISE READINESS AND THE ROLE OF IT [09]

Readiness and Capability – Development and Measuring of an Organization's G-Readiness Framework – Organizational and Enterprise Greening – Information systems in Greening Enterprises – IT Usage and Hardware – Inter-Organizational Enterprise activities and Green Issues – Enablers and making the case for IT and Green Enterprise.

UNIT – V LAWS, STANDARDS AND PROTOCOLS [09]

The regulatory environment and IT manufacturers – Non regulatory government initiatives – Industry associations and standards bodies – Green building standards – Green data centres – Social movements and Greenpeace – Cloud Computing – Energy Usage Model.

Total (L= 45, T = 0) = 45 Periods

Text Books :ENERGY MANAGEMENT

1 San Murugesan, G.R. Gangadharan, Harnessing Green IT - Principles and Practices, Wiley Publication, India, First Edition, 2012.

2 Bhuvan Unhelkar, Green IT Strategies and Applications - Using Environmental Intelligence, CRC Press, Florida, First Edition, 2016.

Reference Books :

1 Woody Leonhard, Katherrine Murray, Green Home computing for dummies, Wiley Publication, India, First Edition, 2009.

2 Bud E. Smith, Green Computing: Tools and Techniques for Saving Energy, Money and Resources, CRC Press, Florida, Second Edition, 2014.

3 Jason Harris, Green Computing and Green IT - Best Practices on regulations and industry, Lulu.com, First edition, 2008.

4 https://nptel.ac.in/courses/106/105/106105167/

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CO-PO MAPPING

Regulation: R 2020

Course Code: 20CS907 **Course Name: GREEN TECHNOLOGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Identify Green IT with its different dimensions and Strategies.*	3	3	3	-	3	-	-	-	-	-	-	2	-	-
CO2:	*Describe Green data centres and storage along with its green software methodologies.*	3	2	2	-	3	-	-	-	-	-	-	1		-
CO3:	*Outline the concepts o to manage the green IT with necessary components.*	3	3	2	-	3	-	-	-	-	-	-	2	-	-
CO4:	*Recognize various green enterprise activities, functions and their role with IT.*	3	3	3	-	3	-	-	-	-	-	-	1	-	-
CO5:	*Categorize various laws, standards and protocols for regulating green IT.*	3	3	3	-	3	-	-	-	-	-	-	2	-	-
	Average	3	3	3	-	3	-	-	-	-	-	-	2		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CS908	**ARTIFICIAL INTELLIGENCE AND ROBOTICS** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe agents structure and predict uninformed search algorithms for any AI problem*	*Understand*
CO2:	*Illustrate appropriate AI methods to solve a given problem.*	*Apply*
CO3:	*Explain a problem using first order and predicate logic.*	*Understand*
CO4:	*Identify planning algorithms and illustrate about learning*	*Apply*
CO5:	*Infer about robotics concept.*	*Understand*

UNIT – I FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE [9]

Intelligent Agents – Agents and environments – Good behavior– The Nature of Environments – The Structure of Agents – Solving Problems by Searching: Problem-Solving Agents – Example problems – Searching for solutions – Uninformed search strategies.

UNIT – II INFORMED SEARCHING TECHNIQUES [9]

Informed (Heuristic) Search Strategies – Heuristic functions – Local Search and Optimization Problems – Adversarial Search – Games – Optimal decisions in games – Alpha-Beta Pruning – Constraint Satisfaction Problems – Defining Constraint Satisfaction Problems.

UNIT – III LOGICAL REASONING [9]

First order logic – Representation revisited – Syntax and semantics for first order logic – Using first order logic – Knowledge engineering in first order logic – Inference in First order logic – Prepositional versus first order logic – Unification and lifting – Forward chaining – Backward chaining.

UNIT – IV PLANNING AND LEARNING [9]

Classical Planning: Definition of Classical Planning – Algorithm for Planning as State – Space Search –Planning graphs – Analysis of Planning Approaches – Learning from Examples: Forms of Learning – Supervised learning – Learning Decision trees – Ensemble Learning – Explanation-Based Learning.

UNIT – V ROBOTICS [9]

Introduction – Robot Hardware – Robot Perception – Planning to Move – Planning Uncertain Movements – Moving – Robotic Software Architectures – Application Domains.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Stuart Russell and Peter Norvig, Artificial Intelligence – A Modern Approach, Pearson Education, New Delhi, Third Edition, 2016

2 Kevin Night and Elaine Rich, Nair B., Artificial Intelligence (SIE) , McGraw Hill, New Delhi, Third Edition, 2008

Reference Books :

1 Dan W. Patterson, Introduction to AI and ES, Pearson Education, New Delhi, Third Edition, 2007.

2 Peter Jackson, Introduction to Expert Systems, Pearson Education, New Delhi, Third Edition, 2007.

3 Deepak Khemani, Artificial Intelligence, Tata McGraw Hill, New Delhi, Third Edition, 2013.

4 David L. Poole and Alan K. Mackworth, ―Artificial Intelligence: Foundations of Computational Agents‖, Cambridge University Press, England, First Edition, 2010.

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CO-PO MAPPING

Course Code: 20CS908

Regulation: R 2020

Course Name: ARTIFICIAL INTELLIGENCE AND ROBOTICS

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Describe agents structure and predict uninformed search algorithms for any AI problem*	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO2:	*Illustrate appropriate AI methods to solve a given problem.*	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO3:	*Explain a problem using first order and predicate logic.*	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO4:	*Identify planning algorithms and illustrate about learning*	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO5:	*Infer about robotics concept.*	3	3	3	-	3	2	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**3**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CS909	**BIG DATA AND ANALYTICS** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Discover the insights of big data analytics*	*Understand*
CO2:	*Identify the file systems and to know the map reduce technique*	*Understand*
CO3:	*Summarize data by utilizing various statistical and data mining approaches*	*Understand*
CO4:	*Deploy and Perform analytics on real-time streaming data*	*Understand*
CO5:	*Comprehend the various NoSql alternative database models*	*Understand*

UNIT – I INTRODUCTION TO BIG DATA [9]

Big Data – Definition, Characteristic Features – Big Data Applications – Big Data vs Traditional Data – Risks of Big Data – Structure of Big Data – Web Data – Evolution of Analytic Scalability – Evolution of Analytic Processes, Tools and methods – Analysis Vs Reporting – Modern Data Analytic Tools.

UNIT – II HADOOP FRAMEWORK [9]

Distributed File Systems – Large-Scale File System Organization – HDFS concepts – MapReduce Execution, Algorithms using MapReduce, Matrix-Vector Multiplication – Hadoop YARN.

UNIT - III DATA ANALYSIS [9]

Statistical Methods : Regression modelling – Multivariate Analysis – Classification: SVM & Kernel Methods – Rule Mining – Cluster Analysis – Types of Data in Cluster Analysis – Predictive Analytics – Data analysis using R.

UNIT – IV MINING DATA STREAMS [9]

Streams: Concepts – Stream Data Model and Architecture – Sampling data in a stream – Mining Data Streams and Mining Time-series data – Real Time Analytics Platform Applications – Real Time Sentiment Analysis – Stock Market Predictions.

UNIT – V BIG DATA FRAMEWORKS [9]

Introduction to NoSQL – Aggregate Data Models – Hbase: Data Model and Implementations – Hbase Clients – Examples – Cassandra: Data Model – Examples – Cassandra Clients – Hadoop Integration. Pig – Grunt – Pig Data Model – Pig Latin – developing and testing Pig Latin scripts.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analyticsll, John Wiley & Sons, Incorporated, United States, First Edition, 2012.
2. David Loshin, Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph, Elsevier Science, Netherlands, First Edition, 2013.

Reference Books :

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, Germany, Second Edition, 2014.
2. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley, United States, First Edition, 2013.
3. P. J. Sadalage and M. Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison-Wesley Professional, United States, Third Edition, 2013.
4. Richard Cotton, Learning R – A Step-by-step Function Guide to Data Analysis, O_Reilly Media, California, Third Edition, 2018.

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CS909** **Course Name:** **BIG DATA AND ANALYTICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Discover the insights of big data analytics*	3	3	2	-	3	2	-	-	-	-	-	1	-	-
CO2:	*Identify the file systems and to know the map reduce technique*	3	2	1	-	3	3	-	-	-	-	-	1	-	-
CO3:	*Summarize data by utilizing various statistical and data mining approaches*	3	3	2	-	3	2	-	-	-	-	-	1	-	-
CO4:	*Deploy and Perform analytics on real-time streaming data*	3	3	2	-	3	2	-	-	-	-	-	1	-	-
CO5:	*Comprehend the various NoSql alternative database models*	3	3	1	-	3	2	-	-	-	-	-	1	-	-
	Average	**3**	**3**	**2**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CS910	**HARDWARE AND TROUBLE SHOOTING** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify with the Basic functional units of a computer system.*	*Understand*
CO2:	*Discover the working Concepts of I/O devices in computer.*	*Understand*
CO3:	*Examine the interfaces and controllers connected to PC.*	*Understand*
CO4:	*Outline the system configuration, Installation and maintenance of PC.*	*Understand*
CO5:	*Summarize about faults, diagnostics and troubleshooting in PC.*	*Understand*

UNIT – I INTRODUCTION [9]

Introduction - Computer Organization – Number Systems and Codes – Memory – ALU – CU – Instruction prefetch – Interrupts – I/O Techniques – Device Controllers – Error Detection Techniques – Microprocessor – Personal Computer Concepts – Advanced System Concepts – Microcomputer Concepts – OS – Multitasking and Multiprogramming – Virtual Memory – Cache Memory – Modern PC and User.

UNIT – II PERIPHERAL DEVICES [9]

Introduction – Keyboard – CRT Display Monitor – Printer – Magnetic Storage Devices –FDD – HDD – Special Types of Disk Drives – Mouse and Trackball – Modem – Fax Modem – CD ROM Drive – Scanner – Digital Camera – DVD – Special Peripherals.

UNIT – III PC HARDWARE OVERVIEW [9]

Introduction – Hardware BIOS DOS Interaction – The PC family – PC hardware – Inside the System Box – Motherboard Logic – Memory Space – Peripheral Interfaces and Controllers – Keyboard Interface – CRT Display interface – FDC – HDC – Microprocessors in PC.

UNIT – IV INSTALLATION AND PREVENTIVE MAINTENANCE [9]

Introduction – system configuration – pre installation planning – Installation practice – routine checks – PC Assembling and integration – BIOS setup – Engineering versions and compatibility – preventive maintenance – DOS – Virus – Data Recovery.

UNIT – V TROUBLESHOOTING [9]

Introduction – computer faults – Nature of faults – Types of faults – Diagnostic programs and tools – Microprocessor and Firmware – Programmable LSI's – Bus Faults – Faults Elimination process – Systematic Troubleshooting – Symptoms observation and analysis – fault diagnosis – fault rectification – Troubleshooting levels – FDD, HDD, CD ROM Problems.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 B. Govindarajalu, IBM PC Clones Hardware, Troubleshooting and Maintenance, McGraw-Hill, New Delhi, Second Edition, 2003.

2 K.L. James, Computer Hardware Installation, Interfacing, Troubleshooting and maintenance, PHI Learning Private Limited, India, First Edition, 2013.

Reference Books :

1 Craig Zacker and John Rourke, PC Hardware: The Complete Reference, McGraw-Hill, New Delhi, Fifth Edition, 2001.

2 Jean Andrews, Guide to Hardware Managing, Maintaining and Troubleshooting, Cengage Learning (Course Technology), Boston, Fifth Edition, 2010

3 Cheryl A. Schmidt, Complete A+ guide to IT Hardware and Software, Pearson Education, India, Eighth Edition, 2020.

4 Scott M. Mueller, Upgrading and Repairing PCs, Pearson Education, India, Twenty Second Edition, 2012.

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CO-PO MAPPING

Regulation: R 2020

Course Code: 20CS910 **Course Name: HARDWARE AND TROUBLE SHOOTING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Identify with the Basic functional units of a computer system.*	3	2	-	-	2	-	-	-	-	-	-	2	-	-
CO2:	*Discover the working Concepts of I/O devices in computer.*	3	2	-	-	2	-	-	-	-	-	-	2	-	-
CO3:	*Examine the interfaces and controllers connected to PC.*	3	2	-	-	2	-	-	-	-	-	-	2	-	-
CO4:	*Outline the system configuration, Installation and maintenance of PC.*	3	2	-	-	2	-	-	-	-	-	-	2	-	-
CO5:	*Summarize about faults, diagnostics and troubleshooting in PC.*	3	2	-	-	2	-	-	-	-	-	-	2	-	-
	Average	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / CSE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20EC901	**BASICS OF MEDICAL ELECTRONICS** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On the successful completion of the course, students will be able to		***Cognitive Level***
CO1	*Describe the recording methods of various bio-potentials.*	*Understand*
CO2	*Illustrate the working of various equipment that deal with bio-chemical and non-electrical parameter measurement.*	*Understand*
CO3	*Discuss the different types of therapeutic equipment.*	*Understand*
CO4	*Interpret the principles of various medical imaging modalities.*	*Understand*
CO5	*Outline the recent trends in medical instrumentation.*	*Understand*

UNIT – I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING [09]

The origin of bio-potentials - Bio-potential electrodes - Carrier, chopper and isolation amplifiers -Transducers for biomedical applications: Strain gauge, piezoelectric transducer, thermocouple, thermistor, biosensors - ECG, EEG, EMG, PCG, ERG and EOG: Lead systems, recording methods.

UNIT - II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT [09]

Blood gas analyzers - Electrophoresis - Colorimeter & Photometer - Auto analyzer - Blood flow meter - Cardiac output - Respiratory measurement - Blood pressure measurement - Temperature measurement - Pulse measurement -Blood cell counters: Coulter counters.

UNIT - III THERAPEUTIC EQUIPMENTS [09]

Cardiac pacemakers - DC defibrillator - Dialyzers - Surgical diathermy - Physiotherapy and electrotherapy equipment - Oxygenators - Heart lung machine.

UNIT - IV MEDICAL IMAGING [09]

X-Ray - Computer Axial Tomography - Positron Emission Tomography - MRI and NMR - Ultrasonic Imaging systems.

UNIT - V RECENT TRENDS IN MEDICAL INSTRUMENTATION - [09]

Thermograph - Endoscopy unit - LASER in medicine - Biomedical telemetry - Radio-pill - Cardiac catheterization laboratory - Electrical safety of medical equipment.

Total (L: 45) = 45 Periods

Text Books :

1 R.S.Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw Hill, New Delhi, Third Edition, 2014

2 Leslie Cromwel, Fred J.Weibel, Erich A. Pfeiffer, Biomedical Instrumentation and Measurements, Pearson/Prentice Hall India, New Delhi,Second Edition, 2011.

Reference Books :

1 John G.Webster, Medical Instrumentation Application and Design, John Wiley & Sons Inc, New Jersy, Fourth Edition, 2009.

2 Joseph J.Carr and John M.Brown, Introduction to Biomedical Equipment Technology, John Wiley &Sons, New Jersy, Fourth Edition, 2008.

3 M. Arumugam, Biomedical Instrumentation, Anuradha Publications, Chennai, Second Edition, Reprint 2009.

4 R.L. Reka & C. Ravikumar, Biomedical Instrumentation/ Medical Electronics, Lakshmi Publications, Chennai, Second Edition, Reprint 2010.

Course Faculty **Module Coordinator** **Chairman BoS / ECE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
CO PO MAPPING

Regulation: R 2020

Course Code : 20EC901 **Course Name: Basics of Medical Electronics**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	*Describe the recording methods of various bio-potentials.*	2	1	2	-	-	1	-	-	-	-	-	1	-	-
2	*Illustrate the working of various equipment that deal with bio-chemical and non-electrical parameter measurement.*	2	1	2	-	-	1	-	-	-	-	-	1	-	-
3	*Discuss the different types of therapeutic equipment.*	2	1	2	-	-	1	-	-	-	-	-	1	-	-
4	*Interpret the principles of various medical imaging modalities.*	2	1	2	-	-	1	-	-	-	-	-	1	-	-
5	*Outline the recent trends in medical instrumentation.*	2	1	2	-	-	1	-	-	-	-	-	1	-	-
	Average	**2**	**1**	**2**		**-**	**1**	**-**	**-**	**-**	**-**	**-**	**1**		**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / ECE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EC902	**NANO TECHNOLOGY** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes: On completion of this course, the student will be able to		***Cognitive Level***
CO1	*Describe the evolution and associated techniques of Nano science.*	*Understand*
CO2	*Interpret the diversities in Nano systems.*	*Understand*
CO3	*Classify different Nano particles, shells and their Characterization.*	*Understand*
CO4	*Illustrate the importance of nanotechnology in biotechnology.*	*Understand*
CO5	*Outline the applications of nanotechnology in industry and society.*	*Understand*

UNIT – I INTRODUCTION [09]

Nano science - Evolution - Electron microscopes - Scanning probe microscopes - Optical microscopes for nanotechnology - X ray diffraction - Associated techniques.

UNIT – II DIVERSITY IN NANO SYSTEMS [09]

Fullerenes - Synthesis and purification - Mass spectrometry and ion/molecule reactions - Chemistry of fullerenes - Endohedral chemistry - Conductivity and super conductivity in doped fullerenes - Carbon nanotubes - Synthesis and purification - Electronic structure - Transport - Mechanical - Physical properties applications - Semiconductor quantumdots - Synthesis and applications.

UNIT – III METAL NANO PARTICLES AND NANO SHELLS [09]

Method of preparation - Characterization - Functions and applications - Core shell nanoparticles: Types of system - Characterization - Functions and applications - Nano shells: Types, characterization, properties and applications.

UNIT – IV EVOLVING INTERFACES IN NANO [09]

Nano biology - Interaction between bio molecules and nano particle surfaces - Applications of nano in biology -Microprobes for medical diagnosis and biotechnology - Current status - Nano sensors - Order from chaos - Applications - Smart dust sensors - Nano medicines various kinds - Future directions.

UNIT – V IMPACT OF NANO TECHNOLOGY ON SOCIETY [09]

Introduction - Industrial revolution to Nano revolution - Implications of Nano sciences and Nano technology on society - Issues - Nano policies and institutions - Nanotech and war - Nano arms race - Harnessing nano technology for economic and social development.

Total = 45 Periods

Text Books :

1 PradeepT, Nano: The Essentials, Understanding Nano Science and Nano technology,TMH, New Delhi, FirstEdition, 2007.
2 Mick Wilson, Kamali Kannargare., Geoff Smith, Nano technology: Basic Science and Emerging technologies, Overseas Press, New Delhi,FirstEdition, 2005.

Reference Books :

1 Nalwa H S, Encyclopedia of Nanoscience and Nanotechnology, Vol 1-10, American Scientific Publishers, California,FirstEdition 2004.
2 Rao C N R and Govindaraj A, Nanotubes and Nanowires, Royal Society of Chemistry, London,Third Edition, 2005.
3 Richard A L Jones, Soft Machines: Nanotechnology and Life, Oxford University Press, Oxford, FirstEdition,2007
4 Charles P. Poole, Frank J. Owens, Introduction to Nanotechnology, Wiley Inter science, New Jersey, First Edition, 2003.
5 Mark A. Ratner, Daniel Ratner, Nanotechnology: A gentle introduction to the next Big Idea, Pearson Education, London, 2003.

Course Faculty **Module Coordinator** **Chairman BoS / ECE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
CO PO MAPPING

Regulation: R 2020

Course Code: 20EC902 **Course Name: NANO Technology**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	*Describe the evolution and associated techniques of Nano science.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
2	*Interpret the diversities in Nano systems.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
3	*Classify different Nano particles, shells and their Characterization.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
4	*Illustrate the importance of nanotechnology in biotechnology.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
5	*Outline the applications of nanotechnology in industry and society.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / ECE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EC903	**ELECTRONICS AND MICROPROCESSOR** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes: On the successful completion of the course, students will be able to		***Cognitive Level***
CO1	*Interpret the fundamental concepts of semiconductor device.*	*Understand*
CO2	*Explain the various characteristics of amplifiers.*	*Understand*
CO3	*Outline the fundamental concepts of Digital Electronics*	*Understand*
CO4	*Describe about 8085 microprocessors*	*Understand*
CO5	*Explain the applications using microprocessor*	*Understand*

UNIT – I SEMICONDUCTORS AND RECTIFIERS [09]

Classification of solids based on energy band theory - Intrinsic semiconductors - Extrinsic semiconductors - PN junction diode: Characteristics - Half wave and full wave rectifiers - Zener diode: Characteristics - Voltage regulator.

UNIT – II TRANSISTORS AND AMPLIFIERS [09]

Bipolar junction transistor: Construction and characteristics - CE configuration and characteristics - Transistor biasing: Fixed and voltage divider biasing - Construction and characteristics: FET, SCR and UJT - Concept of feedback: Negative feedback – Application in temperature and motor speed control - Common Emitter Amplifier (Qualitative treatment only).

UNIT – III DIGITAL ELECTRONICS [09]

Number system: Binary, Octal, Hexadecimal - Boolean algebra - Logic gates - Half adder and full adder - Flip flops - Shift Registers: SISO, SIPO, PISO, PIPO - Counters: 3-bit Synchronous up & down, 3-bit Asynchronous up & down - A/D conversion: Single slope, Successive approximation - D/A conversion: Binary weighted resistor type.

UNIT – IV 8085 MICROPROCESSOR [09]

Block diagram of Microcomputer – 8085: Architecture, Pin configuration, Addressing modes, Instruction set and Simple programs using arithmetic and logical operations.

UNIT – V INTERFACING AND APPLICATIONS OF MICROPROCESSOR [09]

Basic interfacing concepts - Interfacing of Input and Output devices - Applications of microprocessor: Temperature control, Stepper motor control, Traffic light control - Case study: Mining problem, Turbine monitor using 8085.

Total (L: 45) = 45 Periods

Text Books :

1. Jacob Millman and Christos C. Halkias, Integrated Electronics, Tata McGraw-Hill publishers, US, Second Edition, 2011.
2. Ramesh Gaonkar, Microprocessor Architecture ll, Programming and Applications with 8085, Penram International Publishing, USA, Sixth Edition, 2013.

Reference Books :

1. Malvino Leach and Saha, Digital Principles and Applications, Tata McGraw-Hill Education, New Delhi, Eighth Edition, 2014.
2. Mehta V.K, Principles of Electronics, S. Chand and Company Ltd., New Delhi, Seventh Edition, 2014.
3. Salivahanan S, Suresh Kumar N, Vallavaraj A, Electronic Devices and Circuits, Tata McGraw-Hill Education, New Delhi, Third Edition, 2012.
4. Krishna Kant, Microprocessors and Microcontrollers, PHI Learning Private Ltd., New Delhi, Second Edition, 2013.

Course Faculty **Module Coordinator** **Chairman BoS / ECE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
CO PO MAPPING

Regulation: **R 2020**

Course Code: 20EC903 **Course Name:** **Electronics and Microprocessor**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	*Interpret the fundamental concepts of semiconductor device.*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
2	*Explain the various characteristics of amplifiers.*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
3	*Outline the fundamental concepts of Digital Electronics*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
4	*Describe about 8085 microprocessors*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
5	*Explain the applications using microprocessor*	3	3	2	-	-	-	-	-	-	-	-	-	-	-
	Average	3	3	2	-	-	-	-	-	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / ECE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20EC904	**ANALOG AND DIGITAL COMMUNICATION** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes: On the successful completion of the course, students will be able to		***Cognitive Level***
CO1	*Describe analog communication techniques*	*Understand*
CO2	*Describe Digital communication techniques*	*Understand*
CO3	*Use data and pulse communication techniques*	*Understand*
CO4	*Explain Source and Error control coding*	*Understand*
CO5	*Utilize multi-user radio communication*	*Understand*

UNIT – I ANALOG COMMUNICATION [09]

Noise: Source of Noise – External Noise- Internal Noise- Noise Calculation. Introduction to Communication Systems: Modulation – Types – Need for Modulation. Theory of Amplitude Modulation – Evolution and Description of SSB Techniques – Theory of Frequency and Phase Modulation – Comparison of various Analog Communication System (AM – FM – PM).

UNIT – II DIGITAL COMMUNICATION [09]

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) Minimum Shift Keying (MSK) –Phase Shift Keying (PSK) – BPSK – QPSK – 8 PSK – 16 PSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).

UNIT – III DATA AND PULSE COMMUNICATION [09]

Data Communication: History of Data Communication – Standards Organizations for Data Communication- Data Communication Circuits – Data Communication Codes – Error Detection and Correction Techniques – Data communication Hardware – serial and parallel interfaces. Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) – Comparison of various Pulse Communication System (PAM – PTM – PCM).

UNIT – IV SOURCE AND ERROR CONTROL CODING [09]

Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel capacity, channel coding theorem, Error Control Coding, linear block codes, cyclic codes, convolution codes, viterbi decoding algorithm.

UNIT – V MULTI-USER RADIO COMMUNICATION [09]

Advanced Mobile Phone System (AMPS) – Global System for Mobile Communications (GSM) – Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse – Channel Assignment and Hand – Overview of Multiple Access Schemes – Satellite Communication – Bluetooth.

Total (L: 45) = 45 Periods

Text Books :

1 Wayne Tomasi, Advanced Electronic Communication Systems, Pearson Education,London, Sixth Edition 2009.

2 Simon Haykin, Communication Systems, John Wiley & Sons, New Jersy, Fourth Edition,2004.

Reference Books :

1 H.Taub, D L Schilling and G Saha, Principles of Communication, McGraw Hill Education, New York, Fourth Edition, 2017.

2 B. P.Lathi, Modern Analog and Digital Communication Systems, Oxford University Press, Oxford, Third Edition, 2007.

3 Rappaport T.S, Wireless Communications: Principles and Practice, Pearson Education, London, Third Edition 2007.

4 Blake, Electronic Communication Systems, Thomson Delmar Publications, USA, Second Edition, 2001.

Course Faculty **Module Coordinator** **Chairman BoS / ECE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
CO PO MAPPING

Regulation: **R 2020**

Course Code: 20EC904 **Course Name:** **Analog and Digital Communication**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	*Describe analog communication techniques*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
2	*Describe Digital communication techniques*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
3	*Use data and pulse communication techniques*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
4	*Explain Source and Error control coding*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
5	*Utilize multi-user radio communication*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / ECE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EC905	**PRINCIPLES OF COMMUNICATION** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes: On the successful completion of the course, students will be able to		***Cognitive Level***
CO1	Determine the performance of analog modulation schemes in time and frequency domains.	*Understand*
CO2	Determine the performance of systems for generation and detection of modulated analog signals.	*Understand*
CO3	Characterize analog signals in time domain as random processes and in frequency domain using Fourier transforms	*Understand*
CO4	Determine the performance of analog communication systems in the presence of Noise	*Understand*
CO5	Interpret the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems.	*Understand*

UNIT – I AMPLITUDE MODULATION [09]

Introduction, Amplitude Modulation: Time & Frequency – Domain description, Switching modulator, Envelop detector. Time and Frequency – Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing. SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television.

UNIT – II ANGLE MODULATION [09]

Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase–Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Superheterodyne Receiver

UNIT - III RANDOM VARIABLES & PROCESS [09]

Introduction, Probability, Conditional Probability, Random variables, Several Random Variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross–correlation functions

UNIT – IV NOISE IN ANALOG MODULATION [09]

Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth (refer Chapter 5 of Text), Noise Figure. Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM.

UNIT – V DIGITAL REPRESENTATION OF ANALOG SIGNALS [09]

Introduction, Why Digitize Analog Sources?, The Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, The Quantization Process, Quantization Noise, Pulse–Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing.

Total (L: 45) = 45 Periods

Text Books :

1 Wayne Tomasi, Advanced Electronic Communication Systems, Pearson Education, London, Sixth Edition, 2009.

2 Simon Haykin, Communication Systems, John Wiley & Sons, New Jersy, Fourth Edition, 2004.

Reference Books :

1 H.Taub & D.L.Schilling, Principles of Communication Systems**,** TMH, New Delhi, First Edition, 2011.

2 H.Taub, D L Schilling and G Saha, Principles of Communication, Pearson Education, London, Fourth Edition, 2017.

3 B. P.Lathi, Modern Analog and Digital Communication Systems, Oxford University Press, Oxford, Third Edition 2007.

4 Blake, Electronic Communication Systems, Thomson Delmar Publications, USA, First Edition, 2002.

Course Faculty **Module Coordinator** **Chairman BoS / ECE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
CO PO MAPPING

Regulation: **R 2020**

Course Code: 20EC905 **Course Name:** **Principles of Communication**

CO	Course Outcomes	Programme Outcomes												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	Determine the performance of analog modulation schemes in time and frequency domains.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
2	Determine the performance of systems for generation and detection of modulated analog signals.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
3	Characterize analog signals in time domain as random processes and in frequency domain using Fourier transforms	3	3	3	-	-	-	-	-	-	-	-	-	-	-
4	Determine the performance of analog communication systems in the presence of Noise	3	3	3	-	-	-	-	-	-	-	-	-	-	-
5	Interpret the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / ECE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EC906	**FUNDAMENTALS OF ROBOTICS** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes: On completion of this course, the students will be able to		***Cognitive Level***
CO1	*Describe the basis of Robotics*	*Understand*
CO2	*Describe the technologies applicable for Robotics in computer based vision*	*Understand*
CO3	*Interpret the different sensing elements of robot*	*Understand*
CO4	*Develop the algorithms applicable for robotics*	*Apply*
CO5	*Develop 4-axis and 6-axis robot*	*Apply*

UNIT – I INTRODUCTION TO ROBOTICS [09]

Motion - Potential function - Road maps - Cell decomposition sensor and sensor planning - Kinematics - Forward and inverse kinematics - Transformation matrix and DH transformation - Geometric methods and algebraic methods.

UNIT – II COMPUTER VISION [09]

Projection - Optics, projection on the Image plane and radiometry - Image processing - Connectivity - Images - Gray Scale and binary images - Blob filling - Histogram - Convolution - Digital convolution and filtering and Masking techniques - Edge detection - Face detection.

UNIT - III SENSORS AND SENSING DEVICES [09]

Introduction to various types of sensor - Resistive sensors - Range sensors – Radar and Infra-red - Introduction to sensing - Light sensing - Heat sensing - Touch sensing and position sensing.

UNIT – IV ARTIFICIAL INTELLIGENCE [09]

Uniform Search strategies - Breadth first, Depth first, Depth limited - Iterative and deepening depth first search and bidirectional search - The A* algorithm - Planning - State-space planning - Plan - space planning - Graph plan/Sat plan and their comparison - Multi-agent planning 1 and Multi-agent planning 2 - Probabilistic reasoning

UNIT – V INTEGARATION TO ROBOT [09]

Building of 4 axis or 6 axis robot - Vision system for pattern detection - Sensors for obstacle detection - AI algorithms for path finding - Decision making.

Total (L: 45) = 45 Periods

Text Books :

1 Duda, Hart and Stork, Pattern Recognition, Wiley-Inter science, New Jersy, First Edition, 2000.

2 Mallot, Computational Vision: Information Processing in Perception and Visual Behavior, MIT Press,USA, First Edition, 2000.

Reference Books :

1 Stuart Russell and Peter Norvig, Artificial Intelligence-A Modern Approach, Pearson Education Series in Artificial Intelligence, USA,First Edition, 2004.

2 Robert Schilling and Craig., Fundamentals of Robotics, Analysis and control, PHI, New Delhi, First Edition 2003.

3 Forsyth and Ponce, Computer Vision, A modern Approach, Pearson Education, USA, First Edition 2003.

4 https://nptel.ac.in/courses/112/108/112108093/

Course Faculty **Module Coordinator** **Chairman BoS / ECE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
CO PO MAPPING

Regulation: **R 2020**

Course Code: 20EC906 **Course Name:** **Fundamentals of Robotics**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	*Describe the basis of Robotics*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
2	*Describe the technologies applicable for Robotics in computer based vision*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
3	*Interpret the different sensing elements of robot*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
4	*Develop the algorithms applicable for robotics*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
5	*Develop 4-axis and 6-axis robot*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / ECE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20EC907	**INTERNET OF THINGS SENSING AND ACTUATOR DEVICES** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes: On completion of this course, the student will be able to		***Cognitive Level***
CO1	*Describe what IoT is and how it works today.*	*Understand*
CO2	Design and program IoT devices.	*Understand*
CO3	*Describe the functions and characteristics of IoT sensors.*	*Understand*
CO4	*Illustrate the wireless, energy, power, RF and sensing modules.*	*Understand*
CO5	*Describe the applications and technological challenges faced by IoT devices.*	*Understand*

UNIT – I BASICS OF IOT [09]

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security

UNIT – II IOT PROTOCOLS [09]

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BAC Net Protocol – Modbus – KNX – Zigbee Architecture – Network layer – APS layer – Security

UNIT – III IOT SENSORS [09]

Industrial sensors – Description & Characteristics–First Generation – Description &Characteristics– Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics–Polytronics Systems – Description &Characteristics–Sensors' Swarm – Description & Characteristics–Printed Electronics –Description & Characteristics–IoT Generation Roadmap.

UNIT– IV TECHNOLOGICAL ANALYSIS [09]

Wireless Sensor Structure–Energy Storage Module–Power Management Module – RF Module– Sensing Module

UNIT – V APPLICATIONS [09]

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronization and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging

Total = 45 Periods

Text Books:

1 David Easley and Jon Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, London, First Edition, 2010.

2 Guillaume Girardin, Antoine Bonnabel, Dr. Eric Mounier, Technologies & Sensors for the Internet of Things Businesses & Market Trends, First Edition, 2014.

Reference Books:

1 Honbo Zhou, Dieter Uckelmann; Mark Harrison, The Internet of Things in the Cloud: A Middleware Perspective - CRC Press,USA,First Edition,2012.

2 Florian Michahelles, Architecting the Internet of Things –– Springer, Berlin, First Edition, 2011.

3 Ida N, Sensors,Actuators and Their Interfaces, Scitech Publishers, 2014.

4 Olivier Hersent, Omar Elloumi and David Boswarthick, The Internet of Things: Applications to the Smart Grid and Building Automation, Wiley, New Jersy, First Edition, 2012.

Course Faculty **Module Coordinator** **Chairman BoS / ECE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
CO PO MAPPING

Regulation: **R 2020**

Course Code: 20EC907 **Course Name:** **Internet of Things Sensing and Actuator Devices**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Describe what IoT is and how it works today.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	Design and program IoT devices.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	*Describe the functions and characteristics of IoT sensors.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	*Illustrate the wireless, energy, power, RF and sensing modules.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	*Describe the applications and technological challenges faced by IoT devices.*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / ECE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EC908	**CONSUMER ELECTRONICS** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes: On completion of this course, the student will be able to		***Cognitive Level***
CO1	*Describe the evolution and fundamentals of consumer electronics*	*Understand*
CO2	*Discuss various entertainment electronics appliances*	*Understand*
CO3	*Demonstrate various smart home systems*	*Understand*
CO4	*Outline various home appliances*	*Understand*
CO5	*Illustratevarious communication equipment's used In day to day life*	*Understand*

UNIT – I CONSUMER ELECTRONICS FUNDAMENTALS [09]

History of Electronic Devices- Vacuum Tubes, Transistors, Integrated Circuits- Moore's Law, Semiconductor Devices, Diodes, Rectifiers, Transistors, Logic Gates, Combinational Circuits, ADC, DAC and Microprocessors, Microprocessor Vs Microcontrollers, Microcontrollers in consumer electronics, Energy management, Intelligent Building Perspective.

UNIT – II ENTERTAINMENT ELECTRONICS [09]

Audio systems: Construction and working principle of: Microphone, Loud speaker, AM and FM receiver, stereo, 2.1 home theatres, 5.1 home theatres, Display systems: CRT, LCD, LED and Graphics display Video Players: DVD and Blue RAY. Recording Systems: Digital Cameras and Camcorders.

UNIT – III SMART HOME [09]

Technology involved in Smart home, Home Virtual Assistants- Alexa and Google Home. Home Security Systems - Intruder Detection, Automated blinds, Motion Sensors, Thermal Sensors and Image Sensors, PIR, IR and Water Level Sensors.

UNIT– IV HOME APPLIANCES [09]

Home Enablement Systems: RFID Home, Lighting control, Automatic Cleaning Robots, Washing Machines, Kitchen Electronics- Microwave, Dishwasher, Induction Stoves, Smart Refrigerators, Smart alarms, Smart toilet, Smart floor, Smart locks.

UNIT – V COMMUNICATION SYSTEMS [09]

Cordless Telephones, Fax Machines, PDAs - Tablets, Smart Phones and Smart Watches, Introduction to Smart OS - Android and iOS. Video Conferencing Systems - Web/IP Camera, Video security, Internet Enabled Systems, Wi-Fi, IoT, Li-Fi, GPS and Tracking Systems.

Total = 45 Periods

Text Books:

1 Dennis C Brewer, Home Automation, Que Publishing, London, First Edition, 2013.

2 Jordan Frith, Smartphones as Locative Media, Wiley, New Jersy,First Edition, 2014.

Reference Books:

1 Lyla B Das,Embedded Systems-An Integrated Approach, Pearson, London, First Edition, 2013

2 Marilyn Wolf, Computers as Components - Principles of Embedded Computing System Design, Third Edition Morgan Kaufmann Publisher (An imprint from Elsevier), 2012

3 Peckol, Embedded system Design, John Wiley & Sons, USA, First Edition, 2010

4 Thomas M. Coughlin, Digital Storage in Consumer Electronics, Elsevier and Newness, Amsterdam, NetherlandsFirst Edition, 2012.

5 Philip Hoff, Consumer Electronics for Engineers, Cambridge University Press. London, First Edition, 1998.

Course Faculty **Module Coordinator** **Chairman BoS / ECE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
CO PO MAPPING

Regulation: R 2020

Course Code: 20EC908 **Course Name: Consumer Electronics**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Describe the evolution and fundamentals of consumer electronics*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	*Discuss various entertainment electronics appliances*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	*Demonstrate various smart home systems*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	*Outline various home appliances*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	*Illustratevarious communication equipment's used In day to day life*	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / ECE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EE901	**ELECTRICAL DRIVES AND CONTROL** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Categorize and explain the operation of electrical drives*	*Understand*
CO2:	*Explain the characteristics of various electrical drives*	*Understand*
CO3:	*Interpret the operation of starting and braking methods of AC and DC machines*	*Understand*
CO4:	*Choose the appropriate speed control techniques for DC motor drives*	*Understand*
CO5:	*Choose the appropriate speed control techniques for AC motor drives*	*Understand*

UNIT - I INTRODUCTION [09]

Electrical drives – Need – Advantage of electrical drives – Basic elements of electrical drives – Factors influencing the choice of electrical drives – Four quadrant operation of a motor driving a hoist load – Load torques – Selection of motors with regard to thermal overloading – Classes of motor duty.

UNIT - II CHARACTERISTICS OF ELECTRIC DRIVES [09]

DC Motors: DC shunt, DC series, DC compound and Permanent Magnet DC motors – AC Motors: Single phase and three phase Induction motors – Speed–Torque characteristics of various types of loads and drive motors.

UNIT - III MOTOR STARTING AND BRAKING METHODS [09]

Types of Starters: Two Point Starter, Three Point Starter, Four Point Starter, DOL Starter, Y-Δ Starter. Braking of Electrical Motors: Shunt Motor, Series Motor, Single Phase Induction Motor.

UNIT - IV DC DRIVES [09]

Speed control of DC series and shunt motors — Armature and field control – Ward-Leonard control system – Controlled Rectifiers Fed DC motor Drive – Chopper fed DC motor Drive: Buck, Boost and Buck-Boost – Applications.

UNIT - V AC DRIVES [09]

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Inverter and AC Voltage Controller Based Induction Drives – Applications.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Dubey G.K, Fundamentals of Electrical Drives, Narosa Publishing House, New Delhi, Second Edition, 2019.

2 Vedam Subramaniam, Electric Drives: Concepts and Applications, Tata McGraw Hill Publishing Company, New Delhi, Second Edition, 2010.

Reference Books :

1 Krishnan. R, Electric Motor Drives: Modeling, Analysis and Control, Prentice Hall Pvt. Ltd, New Delhi, Second Edition, 2003.

2 Pillai.S.K, A First Course on Electric Drives, Wiley Eastern Limited, New Delhi, Fourth Edition, 2012.

3 Nagrath I.J and Kothari D. P, Electrical machines, Tata McCraw Hill Publishing Company Ltd, New Delhi, Fifth Edition, 2017.

4 M.D. Singh and K.B. Khanchandani, Power Electronics, Tata McGraw Hill Publishing Co Ltd., New Delhi, Second Edition, 2013.

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20EE901 **Course Name: Electrical Drives and Control**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Categorize and explain the operation of electrical drives*	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO2:	*Explain the characteristics of various electrical drives*	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO3:	*Interpret the operation of starting and braking methods of AC and DC machines*	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO4:	*Choose the appropriate speed control techniques for DC motor drives*	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO5:	*Choose the appropriate speed control techniques for AC motor drives*	3	-	1	-	-	2	2	1	-	-	-	2	-	-
	Average	**3**	**-**	**1**	**-**	**-**	**2**	**2**	**1**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EE902	**POWER SEMICONDUCTOR DEVICES** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the power diode characteristics and applications for adjustable speed motor control*	Understand
CO2:	*Infer the static and dynamic characteristics of current controlled power semiconductor devices*	Understand
CO3:	*Realize the static and dynamic characteristics of voltage controlled power semiconductor devices*	Understand
CO4:	*Examine the gate drive requirements for power devices and isolation techniques between the gate and power circuits*	Understand
CO5:	*Discuss the electrical analogy of thermal models and the methods for cooling power devices*	*Understand*

UNIT - I POWER SEMICONDUCTOR DIODES AND CIRCUITS [09]

Power diode: Structure, V-I and reverse recovery characteristics–types of power diodes – Series and parallel connected diodes – Diode rectifiers: Single phase half wave and full wave rectifiers with R,RL load.

UNIT - CURRENT CONTROLLED DEVICES [09]

BJT's: Construction, operation, static and switching characteristics, Negative temperature coefficient and secondary breakdown, on-state losses, safe operating area. Thyristors: Construction, working, Two transistor analogy, V–I and switching characteristics, series and parallel operation; comparison of BJT and Thyristor – Basics of TRIAC, RCT,GTO, MCT.

UNIT - III VOLTAGE CONTROLLED DEVICES [09]

Power MOSFETs and IGBTs – Principle of voltage controlled devices, construction, types, static and switching characteristics, Comparison of Power MOSFET and IGBTs – Applications.

UNIT - IV FIRING AND PROTECTING CIRCUITS [09]

Gate drives circuit: SCR, MOSFET, IGBTs and base driving for power BJT – Necessity of isolation, Isolation of gate and base drives: pulse transformer and optocoupler – Overvoltage and overcurrent protections for power devices – Design of snubber circuits.

UNIT - V THERMAL PROTECTION [09]

Heat transfer – conduction, convection and radiation; Cooling – liquid cooling, vapour and phase cooling; Guidance for heat sink selection – Thermal resistance and impedance – Electrical analogy of thermal components, heat sink types and design – Mounting types- switching loss calculation for power device.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Rashid.M.H, Power Electronics Circuits Devices and Applications, PHI learning private limited, New Delhi, Fourth Edition, 2017.

2 Bimbhra.P.S, Power Electronics, Khanna Publishing, New Delhi, Fifth Edition, 2013.

Reference Books :

1 M.D. Singh and K.B. Khanchandani, Power Electronics, Tata McGraw Hill Publishing Co Ltd., New Delhi, 2013.

2 Ned Mohan Tore. M. Undeland, William. P. Robbins, Power Electronics: Converters, Applications and Design, John Wiley and sons Ltd, United States, Second Edition, 2013.

3 Sen.P.C, Power Electronics, Tata McGraw Hill Publishing Co Ltd., New Delhi, Thirtieth reprint, 2008.

4 Joseph Vithayathil, Power Electronics: Principles and Applications, Delhi, Tata McGraw-Hill, 2010.

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20EE902 **Course Name: Power Semiconductor Devices**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the power diode characteristics and applications for adjustable speed motor control*	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO2:	*Infer the static and dynamic characteristics of current controlled power semiconductor devices*	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO3:	*Realize the static and dynamic characteristics of voltage controlled power semiconductor devices*	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO4:	*Examine the gate drive requirements for power devices and isolation techniques between the gate and power circuits*	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO5:	*Discuss the electrical analog of thermal models and the methods for cooling power devices*	3	2	-	-	-	-	-	-	-	-	-	2	-	-
	Average	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	-	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EE903 **ELECTRICAL POWER GENERATION SYSTEMS** (Open Elective)

L	T	P	C
3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the layout and function of various parts inside the thermal power plant.*	*Remember*
CO2:	*Outline the layout, construction, working of the components inside the hydro power plant.*	*Understand*
CO3:	*Explain the principle of operation, layout and types of nuclear reactor in a nuclear power plant.*	*Understand*
CO4:	*Discuss about the types, performance and layout of gas and diesel power plants.*	*Understand*
CO5:	*Infer the basic concepts of different non-conventional energy sources.*	*Understand*

UNIT - I Thermal power plant [09]

Basic thermodynamic laws - various components of steam power plant – layout - pulverized coal burners - Fluidized bed combustion - coal handling and ash handling systems - Forced draft and induced draft fans – Boilers - feed pumps – superheater - regenerator – condenser – deaerators - cooling tower.

UNIT - II Hydro power plant [09]

Hydel power plant classifications- essential elements, selection of water turbines - selection of site for a hydel power plant - layout – dams – pumped storage power plants - micro hydel developments.

UNIT - III Nuclear power plant [09]

Principles of nuclear energy - nuclear fission - nuclear reactor, types – pressurized water reactor, boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor-nuclear power plants

UNIT - IV Gas and diesel power plant [09]

Fuels - gas turbine material, open and closed cycle gas turbine, work output & thermal efficiency, methods to improve performance - advantages and disadvantages- types of diesel engine power plant- components and layout.

UNIT - V Renewable energy [09]

Solar energy collectors – OTEC - wind power plants, tidal power plants and geothermal resources, fuel cell, MHD power generation principle.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Domkundwa, Arora Domkundwar, A Course in Power Plant Engineering, Dhanpat Rai and Co. Pvt. Ltd., New Delhi, Eighth edition, 2016.

2 P.K. Nag, Power Plant Engineering, Tata McGraw Hill Publishing Co Ltd., New Delhi, Third Edition, 2010.

Reference Books :

1 Philip Kiameh, Power Generation Handbook, Tata McGraw Hill Publishing Co Ltd., New Delhi, Third Edition, 2013.

2 P.C. Sharma, Power Plant Engineering, S.K. Kataria and Sons, New Delhi, First Edition, 2013.

3 Raja, A.K., Amit Prakash Manish Dwivedi, Power Plant Engineering, New Age International, New Delhi, First Edition, 2012.

4 Gupta, Manoj Kumar, Power Plant Engineering, PHI learning private limited, New Delhi, First Edition, 2012.

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20EE903 **Course Name: Electrical Power Generation Systems**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Describe the layout and function of various parts inside the thermal power plant.*	3	1	-	-	-	2	3	2	-	-	-	1	-	-
CO2:	*Outline the layout, construction, working of the components inside the hydro power plant.*	3	2	-	-	-	2	3	1	-	-	-	1	-	-
CO3:	*Explain the principle of operation, layout and types of nuclear reactor in a nuclear power plant.*	3	2	-	-	-	3	3	2	-	-	-	1	-	-
CO4:	*Discuss about the types, performance and layout of gas and diesel power plants.*	3	2	-	-	-	2	3	1	-	-	-	1	-	-
CO5:	*Infer the basic concepts of different non-conventional energy sources.*	3	1	-	-	-	3	3	2	-	-	-	1	-	-
	Average	**3**	**2**	**-**	**-**	**-**	**2**	**3**	**2**	**-**	**-**	**-**	**1**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EE904	**CONTROL ENGINEERING** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: Applied Mathematics

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Obtain the transfer function of electrical and mechanical systems.*	*Apply*
CO2:	*Determine the time-domain response of first and second order systems.*	*Apply*
CO3:	*Examine the stability of open loop system using bode / polar plot.*	*Apply*
CO4:	*Analyze the stability of the system by Root locus and Routh Hurwitz criterion.*	*Apply*
CO5:	*Design lag, lead, lag-lead compensator using bode plot.*	*Apply*

UNIT - I SYSTEM AND THEIR REPRESENTATION [09]

Basic elements in control system – Classification of control systems: Open and closed loop systems– Electrical, Mechanical translational and rotational system – Block diagram reduction techniques – Signal flow graphs.

UNIT - II TIME RESPONSE ANALYSIS [09]

Types and order of systems – Types of test signal – First and second order time response –Time domain specification of second order under damped systems – Generalized error series–Steady state error and error constants.

UNIT - III FREQUENCY RESPONSE ANALYSIS [09]

Frequency response of the system – Bode plot – Polar plot – Constant M and N circles – Determination of closed loop response from open loop response.

UNIT - IV STABILITY OF CONTROL SYSTEM [09]

Characteristics equation – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition.

UNIT - V COMPENSATOR AND CONTROLLER [09]

Lag, lead and lag-lead networks – Lag, lead and lag-lead compensator using bode plots – P, PI, PID controllers.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Nagrath, J., and Gopal,V., Control Systems Engineering, New Age International (p) Limited, Publishers, New Delhi, Fourth Edition, 2007.

2 Benjamin C. Kuo, Automatic Control systems, PHI Learning, New Delhi, Seventh Edition, 2009.

Reference Books :

1 Ogata,K., Modern Control Engineering, PHI, New Delhi, Fifth Edition, 2009.

2 Norman S. Nise, Control Systems Engineering, John Wiley, New Delhi, Seventh Edition, 2014.

3 Smarajit Ghosh, Control systems, Pearson Education, New Delhi, Second Edition, 2009.

4 Roychoudhury,D., Modern control engineering, Prentice Hall of India, Second Edition, 2005.

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20EE904** **Course Name:** **Control Engineering**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Obtain the transfer function of electrical and mechanical systems.*	3	3	2	2	-	-	-	-	-	-	-	2	-	-
CO2:	*Determine the time-domain response of first and second order systems.*	3	3	2	2	-	-	-	-	-	-	-	2	-	-
CO3:	*Examine the stability of open loop system using bode / polar plot.*	3	3	3	2	-	-	2	-	-	-	-	2	-	-
CO4:	*Analyze the stability of the system by Root locus and Routh Hurwitz criterion.*	3	3	3	2	-	-	2	-	-	-	-	2	-	-
CO5:	*Design lag, lead, lag-lead compensator using bode plot.*	3	3	3	2	-	-	2	-	-	-	-	2	-	-
	Average	**3**	**3**	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20EE905	**INDUSTRIAL AUTOMATION** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the major components of Programmable Logic Controller and its applications.*	*Understand*
CO2:	*Summarize the logical functions, timers and counters of PLC*	*Understand*
CO3:	*Discuss the various instructions and modes of operation related to PLC.*	*Understand*
CO4:	*Realize the architecture and various interfacing techniques of Distributed Control Systems*	*Understand*
CO5:	*Examine the different applications of PLC and Distributed Control Systems (DCS).*	*Understand*

UNIT - I INTRODUCTION TO PROGRAMMABLE LOGIC CONTROLLER (PLC) [09]

Introduction - PLC Evolution – PLC Vs Computers – Block Diagram of PLC – Parts of a PLC- Principles of Operation- Modifying the Operation**-** PLC Hardware Components: I/O modules, Power Supply, CPU – PLC size and Applications.

UNIT - II LOGIC FUNDAMENTALS, TIMER AND COUNTER [09]

Logic functions – Boolean instructions and functions – Hardwired logic Vs Programmed Logic - Developing circuits from Boolean instructions **–** PLC timer: classification and instructions – PLC counter: classification, instructions and applications

UNIT - III PLC PROGRAMMING [09]

PLC-memory map - Program scan – Relay type instructions – Instruction addressing - Branch instructions - Internal relay instructions - EXAMINE IF CLOSED and EXAMINE IF OPEN instructions - Modes of operation – Basic relay ladder logic and its control flow chart

UNIT - IV DISTRIBUTED CONTROL SYSTEM [09]

Distributed control system : Evolution – Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities – HMI Interface – Low and high level operator interfaces – Operator displays – Low and high level engineering interfaces – Introduction to SCADA.

UNIT - V APPLICATIONS OF PLC AND DCS [09]

PLC applications: Automatic Control of WareHouse Door – Automatic Lubricating Oil Supplier – Conveyor Belt motor Control – Automatic Car Washing Machine – DCS applications: Pulp and paper environment, Petroleum and refining environment.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Frank D. and Petruzella, Programmable Logic controllers,Tata McGraw Hill Publishing Company Limited, New Delhi, Fifth Edition,2017

2 Lucas ,M.P., Distributed Control System, Van Nostrand and Reinhold Co., New york, First Edition, 1986.

Reference Books :

1 Gary Dunning, Introduction to Programmable Logic Controllers, Delmar Thomson Learning, New york, Third Edition, 2010

2 John W.Webb and Ronald A.Reis, Programmable Logic Controllers: Principles and Applications, PHI Private Ltd., New Delhi, Fifth Edition, 2003

3 Krishna Kant, “Computer - Based Industrial Control”, Prentice Hall, New Delhi, Second Edition(Revised), 2011

4 Madhuchhanda Mitra and Smarajit Sen Gupta, Programmable Logic Controllers and Industrial Automation, Penram International Publishing (India) Pvt. Ltd, Mumbai, Second Edition, 2009

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**
Course Code: **20EE905** **Course Name:** **Industrial Automation**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the major components of Programmable Logic Controller and its applications.*	3	2	3		2	-	-	-	-	-	-	1	-	-
CO2:	*Summarize the logical functions, timers and counters of PLC*	3	2	3		2	-	-	-	-	-	-	1	-	-
CO3:	*Discuss the various instructions and modes of operation related to PLC.*	3	2	3		2	-	-	-	-	-	-	1	-	-
CO4:	*Realize the architecture and various interfacing techniques of Distributed Control Systems*	3	2	3		1	-	-	-	-	-	-	1	-	-
CO5:	*Examine the different applications of PLC and Distributed Control Systems (DCS)*	3	2	3		2	-	-	-	-	-	-	1	-	-
	Average	**3**	**2**	**3**		**2**	**–**	**-**	**-**	**-**	**-**	**-**	**1**	-	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20EE906	**ELECTRICAL INSTRUMENTS AND MEASUREMENTS** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the construction and calibration of moving coil and Moving iron meters*	*Understand*
CO2:	*Discuss the operation and error correction method of wattmeter and Energy meter.*	*Understand*
CO3:	*Describe the various types of potentiometer and their limitations*	*Understand*
CO4:	*Determine the values of resistor, inductor, capacitor and frequency using bridges.*	*Understand*
CO5:	*Explain the concepts of storage and display devices.*	*Understand*

UNIT - I MEASUREMENT OF VOLTAGE AND CURRENT [9]

Galvanometers – Ballistic, D'Arsonval galvanometer – Principle, construction, operation and comparison of moving coil, moving iron meter – Extension of range and calibration of voltmeter and ammeter – Errors and compensation.

UNIT - II MEASUREMENT OF POWER AND ENERGY [9]

Wattmeters: Induction, Electro-dynamometer - Theory & its errors - Methods of correction – Calibration of wattmeter – Energy meter: Single Phase Energy Meter - Construction, Theory, Errors - Adjustment of Errors – Construction and principle of working of single phase dynamometer type power factor meter.

UNIT - III POTENTIOMETERS & INSTRUMENT TRANSFORMERS [9]

DC potentiometer – Basic circuit, standardization – Laboratory type (Crompton's) – AC potentiometer – Drysdale (polar type) type – Gall-Tinsley (coordinate) type – Limitations & applications – C.T and P.T construction, theory, operation, phasor diagram – Applications.

UNIT - IV BRIDGE MEASUREMENT [9]

Measurement of resistance : Wheatstone bridge, Kelvin double bridge, Megger – Measurement of Inductance : Maxwell Bridge, Anderson bridge – Measurement of Capacitance: Schering bridge, Desauty's Bridge – Determination of frequency using Wein Bridge.

UNIT - V STORAGE AND DISPLAY DEVICES [9]

Recorders: Strip Chart, X-Y Recorders – Digital Plotters – Digital Storage Oscilloscope – Digital multimeters – LED – DLP – Dot Matrix Display – Data Loggers

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Golding, E.W and Widdis F.C, Electrical Measurements & Measuring Instruments, A.H.Wheeler & Co, Allahabad, India, Sixth Edition,2019.
2. Sawhney, A.K., A course in Electrical & Electronic Measurements and Instrumentation, Dhanpat Rai & Co (P) Ltd, Delhi, Nineteenth Edition, 2021.

Reference Books :

1. Gupta, J.B, Electrical Measurements and Measuring Instruments, S.K. Kataria & Sons, Delhi, Third edition, 2012.
2. Singh, S.K, Industrial Instrumentation and control, Tata McGraw Hill, New york, Second Edition, 2003.
3. Kalsi H.S, Electronic Instrumentation, Tata McGraw Hill, New york, Second Edition, 2004.
4. Martia U. Reissland, Electrical Measurement, New Age International (P) Ltd., New Delhi, Second Edition, 2001.

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**
Course Code: **20EE906** **Course Name:** **Electrical Instruments and Measurements**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the construction and calibration of moving coil and Moving iron meters*	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO2:	*Discuss the operation and error correction method of wattmeter and Energy meter.*	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO3:	*Describe the various types of potentiometer and their limitations*	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO4:	*Determine the values of resistor, inductor, capacitor and frequency using bridges.*	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO5:	*Explain the concepts of storage and display devices.*	3	3	2	-	-	1	1	-	-	-	-	3	2	3
	Average	**3**	**3**	**2**	**-**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**3**	**2**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EE907 **ENERGY CONSERVATION AND MANAGEMENT** L T P C

(Open Elective) 3 0 0 3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Give the introduction about energy conservation principle and practices*	*Remember*
CO2:	*Describe the concept of energy efficiency in the building.*	*Understand*
CO3:	*Explain the concept of energy efficiency in the industry*	*Understand*
CO4:	*Illustrate the concept of energy efficiency in the power plant*	*Understand*
CO5:	*Describe the importance energy management and Demand Control Techniques*	*Understand*

UNIT - I ENERGY CONSERVATION PRINCIPLES AND PRACTICES [09]

Energy scenario – Principles and imperatives of energy conservation – Energy consumption pattern – Resource availability – Need for energy saving – Overview of energy consumption and its effects –Energy Monitoring, targetng and reporting - Role of Bureau of Energy Efficiency - Standards and labeling.

UNIT - II ENERGY EFFICIENCY IN BUILDINGS [09]

Introduction, definition and concepts – Energy and water as a resource – Electrical energy conservation: Opportunities and techniques for energy conservation in buildings – Green buildings, Intelligent buildings, Rating of buildings, Efficient use of buildings – Solar passive architecture – Eco-housing concepts.

UNIT - III ENERGY EFFICIENCY IN INDUSTRIES [09]

Potential areas for electrical energy conservation in various industries – Conservation methods – Energy management opportunities in electrical heating, cable selection – Energy efficient motors – Adjustable AC drives – Application and its use – Energy efficiency in lighting.

UNIT - IV ENERGY EFFICIENCY IN POWER PLANTS [09]

Captive power generation systems – Sequence operation of power plants – Gas Insulated Substation – Bus ducts – Types and working principle - Energy management opportunities in transformer – Power transformer – Types of switchgear (HT and LT switchgear) GCB and generator.

UNIT - V ENERGY MANAGEMENT AND AUDIT [09]

Energy Management : Definition, Objective, Importance of energy management, Load management: Demand control techniques - Utility monitoring control system. Energy Audit: definition, types of energy audit, Methodology, Need for energy Audit, Steps involved in energy auditing.

Total (L= 45, T = 0) = 45 Periods

Text Books :ENERGY MANAGEMENT

1 Mehmet Kanoglu and Yunus A. Cengel Dr, Energy Efficiency and Management for Engineers, Tata Mcgrow Hill, New Delhi, First Edition, 2019

2 Craig B. Smith, Energy Management Principles, Pergamon Press, United Kingdom, Second Edition, 2015.

Reference Books :

1 Wayne C Turner, Energy Management Handbook, The Fairmount Press, Newyork, Eighth Edition, 2006.

2 Bureau of Energy Efficiency Study material for Energy Managers and Auditors Examination: Paper I to IV

3 G. G. Rajan, Optimizing Energy Efficiencies in Industry", Tata McGraw Hill, New Delhi , Fourth Edition, , 2004

4 Frank Kreith and Yogi Goswami D, Energy Management and Conservation Handbook, Taylor & Francis, New Delhi Second Edition, 2016.

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20EE907** **Course Name:** **Energy Conservation and Management**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Give the introduction about energy conservation principle and practices*	2	1	2	-	-	-	1	3	1	-	-	3	-	-
CO2:	*Describe the concept of energy efficiency in the building.*	2	2	2	-	-	-	1	3	1	-	-	3	-	-
CO3:	*Explain the concept of energy efficiency in the industry*	2	2	2	-	-	-	1	3	1	-	-	3	-	-
CO4:	*Illustrate the concept of energy efficiency in the power plant*	2	2	2	-	-	-	1	3	1	-	-	3	-	-
CO5:	*Describe the importance energy management and Demand Control Techniques*	2	2	2	-	-	-	1	3	-	-	-	3	-	-
	Average	**2**	**2**	**2**	**-**	**-**	**-**	**1**	**3**	**1**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EE908	**ELECTRICAL WIRING, ESTIMATION AND COSTING** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the various wiring materials and protective devices.*	Understand
CO2:	*Discuss the internal wiring system and illumination.*	Understand
CO3:	*Outline the external wiring system and installations.*	Understand
CO4:	*Apply the knowledge to prepare electrical estimation for domestic installation.*	Apply
CO5:	*Apply the knowledge to prepare the electrical estimation details for industrial installation.*	Apply

UNIT - I INTRODUCTION TO WIRING AND PROTECTIVE DEVICES [09]

Wiring accessories – main switch – isolator and load break duty – classification of main switches – functional switches – one way, two way, intermediate switches – knife switches – specification of switches – function and specification of socket outlets, ceiling roses, fan regulators – Fuses, need, classification, Neutral link – Miniature circuit breaker, classification, function and specification – ELCB – RCCB.

UNIT - II INTERNAL WIRING SYSTEM [09]

Design and Drawing of Internal wiring system for various types of Residential, Commercial and Industrial buildings – Electrical layout – Clearance of line – Different types of circuits, Light circuit, Power circuit, Sub-main wiring, Main wiring, Single Line diagram – Different types of Lamps used in Residential, Commercial and Industrial buildings.

UNIT - III EXTERNAL WIRING SYSTEM AND EARTHING [09]

Different types of Under Ground (UG) Cables – Cable Laying – Electrical Control Panels – External Electrical Distribution System – Single Line Diagram – Load Calculations – General Specifications of Generating Set, Transformer – Street Lighting – Earthing, Different types of earthing system – Plate earthing, Pipe Earthing.

UNIT - IV ESTIMATION OF DOMESTIC INSTALLATION [09]

Selection of cables for internal wiring – Cable size calculation – Selection criteria for control switches – main switch – size of earth continuity conductor and earthing conductor – Preparation of schematic diagrams and wiring diagrams – Estimation problems regarding Electrification of domestic buildings – Relevant rules regarding electrification of high rise buildings.

UNIT - V ESTIMATION OF INDUSTRIAL INSTALLATIONS [09]

Installation of motor pump set – Estimation problem regarding domestic and irrigation pump sets – Estimation problems in small workshops below 50kW connected load – Service connection, definition, classification – use of weather proof cables – estimation problems for single phase and three phase overhead service connections.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Raina, K.B. and Bhattacharya, S.K., Electrical Design Estimating and Costing, New Age International, Bengaluru, Second Edition, 2017.

2 Gupta, J.B., A Course in Electrical Installation Estimating and Costing, S K Kataria & Sons,New Delhi, First Edition Reprint, 2013.

Reference Books :

1 Surjith Singh, Electrical estimating and costing, Dhanpat Rai Publishing Company, New Delhi, First Edition,2016.

2 Uppal, S.L., Electrical Wiring, Estimating and Costing, Khanna Publisher, New Delhi, Sixth Edition, 1987.

3 Soni, P.M. and Upadhyay, P.A.,Wiring, Estimating, Costing & Contracting, ATUL PRAKASHAN, Gujarat, First Edition, 2017.

4 Bureau of Indian Standards, I.E. rules for wiring, Electricity Supply Act-1948.

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20EE908** **Course Name:** **Electrical Wiring, Estimation and Costing**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Describe the various wiring materials and protective devices.	3	-	1	-	-	-	-	-	-	-	-	-		
CO2:	Discuss the internal wiring system and illumination.	3	-	1	-	-	-	-	-	-	-	-	-		
CO3:	Outline the external wiring system and installations.	3	-	1	-	-	-	-	-	-	-	-	-		
CO4:	Explain the electrical estimation for domestic installation.	3	2	1	-	1	-	-	-	-	-	-	-		
CO5:	Describe the electrical estimation details for industrial installation.	3	2	1	-	1	-	-	-	-	-	-	-		
	Average	**3**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EE909 **FUNDAMENTALS OF ELECTRICAL MACHINERY** (Open Elective)

L	T	P	C
3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Discuss fundamentals in various electrical circuits.*	Understand
CO2:	*Explain the operation and characteristics of DC machines.*	Understand
CO3:	*Determine the efficiency and regulation of the transformer.*	Understand
CO4:	*Explain the operation and starting methods of Induction Motors.*	Understand
CO5:	*Describe the applications of Synchronous Machines.*	Understand

UNIT - I INTRODUCTION [09]

Electromagnetic Induction– Faraday's Laws – Series and Parallel circuits – Self and Mutual Inductance-Numerical problems – Purpose of Earthing – Methods of Earthing – Merits of Earthing – Different types of Electrical Machines.

UNIT - II DC MACHINES [09]

Principle of operation of DC generator – Types of DC machines – EMF equation – Open Circuit Characteristics – Principle of operation of DC Motor – Torque Equation – Speed control methods of DC motor – Losses in DC machines – Performance Characteristics.

UNIT - III TRANSFORMERS [09]

Principle of operation and construction Details – Classification of Transformers – EMF equation – Losses in a Transformer – Calculation of efficiency and regulation – Autotransformer.

UNIT - IV INDUCTION MOTORS [09]

Principle of operation – Constructional Details – Classification – Revolving Magnetic Fields – Starting Methods – Principle of operation of Single Phase Induction Motor – Starting Methods – Applications.

UNIT - V SYNCHRONOUS MACHINES [09]

Principle of operation and construction of alternators – EMF Equation – Regulation of alternator by Synchronous Impedance Method – Principle of operation of synchronous motor – Synchronous Condenser – Applications.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Rajendra Prasad, Fundamentals of Electrical Engineering, PHI Publications, New Delhi, Second Edition, 2005

2 B L Theraja and AK Theraja, A Textbook of Electrical Technology: Volume 2 AC and DC Machines, S. Chand & Co Ltd, New Delhi, Twenty Third Edition, 2006

Reference Books :

1 D. P. Kothari and I. J. Nagrath, Electric Machines, Tata McGraw Hill Publishing Company Ltd, Noida, Fourth Edition, 2017

2 Stephen J.Chapman, Electric Machinery Fundamentals, Tata McGraw Hill, New Delhi, Fourth Edition, 2018.

3 P. S. Bimbhra, Electrical Machinery, Khanna Publishers, New Delhi, Seventh Edition, 2018

4 J.B. Gupta, Theory & Performance of Electrical Machines, S.K. Kataria & Sons, New Delhi, First Edition Reprint, 2013.

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20EE909** **Course Name:** **Fundamentals of Electrical Machinery**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Discuss fundamentals in various electrical circuits.*	3	1	-	-	-		-	-	-	-	-	-	-	-
CO2:	*Explain the operation and characteristics of DC machines.*	3	1	-	-	-		2	-	-	-	-	-	-	-
CO3:	*Determine the efficiency and regulation of the transformer.*	3	1	-	-	-		2	-	-	-	-	-	-	-
CO4:	*Explain the operation and starting methods of Induction Motors.*	3	1	-	-	-		2	-	-	-	-	-	-	-
CO5:	*Describe the applications of Synchronous Machines.*	3	1	-	-	-		2	-	-	-	-	-	-	-
	Average	**3**	**1**	**-**	**-**	**-**		**2**	**-**	**-**	**-**	**-**	**-**	-	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EE910	**PRINCIPLES OF SOFT COMPUTING TECHNIQUES** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the concepts of artificial neural network*	*Understand*
CO2:	*Summarize the various types of neural network*	*Understand*
CO3:	*Discuss the basic concepts of fuzzy logic system*	*Understand*
CO4:	*Illustrate various methods used in fuzzy systems*	*Understand*
CO5:	*Outline the genetic algorithm and hybrid genetic algorithm concepts*	*Understand*

UNIT - I Introduction artificial neural network [09]

Artificial neural networks - biological neurons, Basic models of artificial neural networks – Connections, Learning, Activation Functions, McCulloch and Pitts Neuron, Hebb network.

UNIT - II Neural network architecture and algorithms [09]

Perceptron networks – Learning rule – Training and testing algorithm, Adaptive Linear Neuron, Back propagation Network – Architecture, Training algorithm.

UNIT - III Introduction to fuzzy logic [09]

Fuzzy logic - fuzzy sets - properties - operations on fuzzy sets, fuzzy relations - operations on fuzzy relations.

UNIT - IV Fuzzy logic system [09]

Fuzzy membership functions, fuzzification, Methods of membership value assignments – intuition – inference – rank ordering, Lambda –cuts for fuzzy sets, Defuzzification methods.

UNIT - V Genetic and hybrid algorithms [09]

Introduction to genetic algorithm, operators in genetic algorithm - coding - selection - crossover – mutation, Stopping condition for genetic algorithm , Genetic neuro hybrid systems, Genetic-Fuzzy rule based system

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 S.N.Sivanandam and S.N.Deepa, Principles of soft computing, Wiley India, New Delhi, Third edition, 2011.

2 Timothy J. Ross, Fuzzy Logic with engineering applications, Wiley India, New Delhi, Third edition, 2010.

Reference Books :

1 N. K. Sinha and M. M. Gupta, Soft Computing & Intelligent Systems: Theory & Applications, Academic Press /Elsevier, Massachusetts, First edition, 2009.

2 Simon Haykin, Neural Network, A Comprehensive Foundation, Prentice Hall International, New Jersey, Third edition, 2009.

3 Bart Kosko, Neural Network and Fuzzy Systems, Prentice Hall, New Jersey, First edition,1992.

4 Goldberg D.E., Genetic Algorithms in Search, Optimization, and Machine Learning, Addison Wesley, Boston ,First edition,1989

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20EE910 **Course Name: Principles of Soft Computing Techniques**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Describe the concepts of artificial neural network*	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO2:	*Summarize the various types of neural network.*	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO3:	*Discuss the basic concepts of fuzzy logic system.*	3	2	-	-	3	-	-	-	-	-	-	1	-	-
CO4:	*Illustrate various methods used in fuzzy systems*	3	2	-	-	3	-	-	-	-	-	-	1	-	-
CO5:	*Outline the genetic algorithm and hybrid genetic algorithm concepts*	3	2	-	-	3	-	-	-	-	-	-	1	-	-
	Average	**3**	**2**	-	-	**3**	-	-	-	-	-	-	1	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EE911	**EMBEDDED SYSTEM TECHNOLOGY** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Illustrate the fundamentals of embedded systems.*	*Understand*
CO2:	*Outline the various types of embedded communication protocols*	*Understand*
CO3:	*Explain the concept of software development process and tools*	*Understand*
CO4:	*Describe the functions of real time operating systems*	*Understand*
CO5:	*Discuss the applications of real time embedded systems*	*Understand*

UNIT – I INTRODUCTION TO EMBEDDED SYSTEMS [09]

Embedded System Vs General Computing System – Classification of embedded systems – Functional building blocks of embedded systems – Structural units in embedded processor – Selection of processor & memory devices – Processor interfacing with memory and I/O units – Embedded hardware unit.

UNIT - II EMBEDDED NETWORKS [09]

Introduction to I/O device ports & buses – Serial communication using I^2C,CAN,SPI and USB bus – Parallel communication using PCI, PCI-X buses, ARM bus.

UNIT – III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT [09]

Introduction to embedded software development process and tools – Host and target machines – linking and locating software – Embedded Product Development Life Cycle – objectives, different phases of EDLC, Modeling of EDLC.

UNIT – IV REAL TIME OPERATING SYSTEMS [09]

Introduction to basic concepts of RTOS – Task, process & threads – Context switching – Multiprocessing and Multitasking – Preemptive and nonpreemptive scheduling – Round Robin scheduling – Task communication – shared memory, message passing – Interprocess communication – semaphores, Message queue, Mailbox, pipes.

UNIT – V RTOS BASED EMBEDDED SYSTEM DESIGN [09]

Basic Functions and Types of RTOS – Interrupt routines in RTOS – Case Study of Washing Machine – Automotive Application – Smart card system – ATM machine – Digital camera.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Rajkamal.P, Embedded System – Architecture, Programming, Design, Tata McGraw Hill Education Private Limited, New Delhi, Third Edition, 2016.

2 John B.Peatman, Design With PIC microcontroller, Pearson Education, India, First Edition, 2009.

Reference Books :

1 Frank Vahid and Tony Givargi, Embedded System Design - A Unified Hardware & Software Introduction, John Wiley, New Jersey, Third Edition, 2011.

2 David E.Simon, An Embedded software primer, Pearson Education, India, First Edition, 2007.

3 Steve Heath, Embedded System Design, Elsevier, India, Second Edition, 2003.

4 Wayne wolf, Computers as components: Principles of embedded computing system design, Morgan Kaufmann publishers, USA, Third Edition, 2012.

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20EE911 **Course Name: Embedded System Technology**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Illustrate the fundamentals of embedded systems*	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO2:	*Outline the various types of embedded communication protocols*	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO3:	*Explain the concept of software development process and tools.*	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO4:	*Describe the functions of real time operating systems.*	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO5:	*Discuss the applications of real time embedded systems*	3	2	3	-	3	3	-	-	-	-	-	3	-	-
	Average	**3**	**2**	**3**	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / EEE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20IT901	**DATA SCIENCE USING R** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Explain the life cycle of data science.	*Understand*
CO2:	Interpret the data manipulation statements and functional programming in R.	*Understand*
CO3:	Outline the packages to implement machine learning techniques.	*Understand*
CO4:	Explore the concepts of object-oriented programming in R.	*Understand*
CO5:	Discuss the data visualization packages in R.	*Understand*

UNIT – I DATA SCIENCE [9]

Data Science : Data Science Lifecycle – Dealing with Missing Values – Using R Packages – Expression – Data Types – Control Structures – Functions – Recursive Functions – Simple Programs.

UNIT – II DATA MANIPULATION AND FUNCTIONAL PROGRAMMING [9]

Data Manipulation – Data Import and Export – Manipulation Data – Vectoring Functions – Infix Operator – Replacement Functions – Function with arguments and return statement.

UNIT – III MACHINE LEARNING [9]

Dealing with large Dataset – Sampling – Supervised Learning Methods: Linear Regression – Logistic Regression – Evaluating and Validating Models – Decision Trees – Neural Network – Support Vector Machine – Unsupervised Learning – Clustering – Association Rule Mining.

UNIT – IV CLASS AND OBJECTS [9]

Immutable objects and Polymorphic functions – Data structures – Classes – Programming with New Classes – Inheritance and Inter-Class Relations – Virtual Classes – Creating and Validating Objects.

UNIT – V DATA VISUALIZATION AND PACKAGES [9]

Data Visualization**:** XY Plot – Graphics Package – ggplot2 – Package concept and tools – Creating R package – Namespace – R Oxygen – Adding data to Package – Documentation for Packages.

Total (L= 45, T = 0) = 45 Periods

Text Book:

1 Thomas Mailund, Beginning Data Science in R – Data Analysis, Visualization and Modeling for the Data Scientist, Apress Publication, New York, First Edition, 2017.

2 Hadley Wickham and Garrett Grolemund ,R for Data Science,Import, Tidy, Transform, Visualize, and Model Data, O'Reilly, India, First Edition ,2017.

Reference Books :

1 Nicholas J. Horton, Ken Kleinman,Using R and R Studio for Data Management, Statistical Analysis, and Graphics, CRC Press, United States , Second Edition, 2015.

2 Sara Baase and Allen Van Gelder, Computer Algorithms - Introduction to Design and Analysis, Pearson Education, India , Third Edition, 2010.

3 K.G.Srinivasa, G M Siddesh, Chetan Shetty, Statistical Programming in R, Oxford University Press, New Delhi, First Edition , 2017.

4 John Maindonald, W. John Braun,Data Analysis and Graphics Using R: An Example-Based Approach, University Press, Cambridge, Third Edition, 2010.

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF INFORMATION TECHNOLOGY
CO-PO MAPPING

Regulation: R 2020

Course Code: 20IT901 **Course Name: DATA SCIENCE USING R**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Explain the life cycle of data science.	3	2	3	-	2	-	-	-	-	-	-	3	-	-
CO2:	Interpret the data manipulation statements and functional programming in R	3	2	3	-	2	-	-	-	-	-	-	3	-	-
CO3:	Outline the packages to implement machine learning techniques	3	2	3	-	2	-	-	-	-	-	-	3	-	-
CO4:	Explore the concepts of object-oriented programming in R	3	2	3	-	2	-	-	-	-	-	-	3	-	-
CO5:	Discuss the data visualization packages in R	3	2	3	-	2	-	-	-	-	-	-	3	-	-
Average		3	2	3	-	2	-	-	-	-	-	-	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20IT902 **PRINCIPLES OF CYBER SECURITY** (Open Elective)

L	T	P	C
3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the basic concepts in cyber security and cybercrime.*	*Remember*
CO2:	*Explore about classification of cyber forensics.*	*Understand*
CO3:	*Summarize the latest trends in ethical hacking.*	*Understand*
CO4:	*Discuss the fundamentals of computer forensics and evidence collection.*	*Understand*
CO5:	*Describe the vulnerabilities in cyber security.*	*Remember*

UNIT – I CYBER CRIME **[9]**

Cyber Crime – Types of Cyber Crime – Classification of Cyber Criminals – Tools used in Cyber Crime – Challenges – Strategies – Crypto Currency – Bitcoin and Block chain – Ransomware.

UNIT – II CYBER FORENSICS **[9]**

Cyber Forensics: Definition – Disk Forensics – Network Forensics – Wireless Forensics – Database Forensics – Malware Forensics – Mobile Forensics – Email Forensics.

UNIT – III ETHICAL HACKING **[9]**

Ethical Hacking– Hacking Windows – Network Hacking – Web Hacking – Password Hacking – Malware – Scanning – Cracking.

UNIT – IV DIGITAL EVIDENCE IN CRIMINAL INVESTIGATIONS **[9]**

Digital Evidence in Criminal Investigations: The Analog and Digital World – Training and Education – Evidence Collection and Data Seizure: Collection Options Obstacles – Types of Evidence –Rules of Evidence –Volatile Evidence.

UNIT – V CYBER SECURITY VULNERABILITIES **[9]**

Vulnerabilities in software – System administration – Complex Network Architectures – Open Access to Organizational Data –— Unprotected Broadband communications – Poor Cyber Security Awareness – Encryption Tool: KeePass.

Total (L= 45, T = 0) = 45 Periods

Text Books:

1 Dejey, Dr.Murugan, Cyber Forensics, Oxford University Press, India, First Edition, 2018.

2 William Stallings and Lawrie Brown, Computer Security: Principles and Practice, Prentice Hall, United States, Third Edition, 2017.

Reference Books :

1 John W. Rittinghouse, William M. Hancock,Cyber Security Operations Handbook, Elsevier Publications , India ,First Edition,2008

2 Deborah G Johnson, Computer Ethics, Pearson Education Publication, India ,Fourth Edition , 2014

3 https://onlinecourses.swayam2.ac.in/cec20_cs15/preview

4 https://www.simplilearn.com/tutorials/cyber-security-tutorial/cyber-security-for-beginners

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF INFORMATION TECHNOLOGY
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20IT902** **Course Name:** **PRINCIPLES OF CYBER SECURITY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Describe the basic concepts in cyber security and cybercrime.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO2:	*Explore about classification of cyber forensics.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO3:	*Summarize the latest trends in ethical hacking.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO4:	*Discuss the fundamentals of computer forensics and evidence collection.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO5:	*Describe the vulnerabilities in cyber security.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
	Average	3	3	3	-	2	-	-	-	-	-	-	3	-	-

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20IT903	**FUNDAMENTALS OF BUSINESS INTELLIGENCE** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the nuances of extracting information from the various sources of digital data*	*Understand*
CO2:	*Infer the techniques involved in Online Transaction Processing and Online Analytical processing systems.*	*Understand*
CO3:	*Discuss the concept of data integration.*	*Remember*
CO4:	*Summarize the various methods of data integration.*	*Understand*
CO5:	*Describe the various process involved in the Enterprise Reporting.*	*Understand*

UNIT – I DIGITAL DATA [09]

Digital Data: Sources and Characteristics –Structured– Unstructured– Semi-Structured – Business Intelligence(BI) : Definition – BI Component Framework – BI Users – BI Applications – BI Tools.

UNIT – II OLTP AND OLAP [09]

OLTP: Advantages – Challenges – OLAP: Types of Data – OLAP Architectures: MOLAP – ROLAP – HOLAP – OLAP and OLTP – Data models for OLTP – Data models for OLAP.

UNIT – III DATA INTEGRATION [09]

Data Integration : Approaches and Advantages – Technologies – Data Quality – Data Profiling – Data Warehouse : Goals and Sources – Data Mart –Operational Data Store – Ralph Kimball's Approach– Data Mapping –Staging.

UNIT – IV MULTIDIMENSIONAL DATA MODELING [09]

Data Modeling: Entity and Attribute – Cardinality of Relationship – Types of Data Model – Data Modeling Techniques – Fact Table – Dimension table – Dimensional Models –Dimensional Modeling Life Cycle.

UNIT – V ENTERPRISE REPORTING [09]

Enterprise Reporting: Reporting Perspectives– Report Standardization and Presentation Practices – Enterprise Reporting Characteristics in OLAP –Balanced Scorecards – Create Dashboards – Scorecards Vs Dashboards.

Total (L= 45, T = 0) = 45 Periods

Text Books:

1 R. N. Prasad, Seema Acharya,Fundamentals of Business Analytics, Wiley Publication Hoboken, New Jersey, Second Edition, 2016.

2 Regi Mathew, Business Analytics for Decision Making, Pearson Education, India , First Edition,2020.

Reference Books :

1 David Stephenson, Big Data Demystified, FT Publishing International, United States, First Edition, 2018.

2 Wayne Winston, Microsoft Excel 2019 Data Analytics and Business Modeling, Microsoft Press, United States, Sixth Edition, 2019.

3 SoheilBakhshi, Expert Data Modelling with Power BI,Packt Publishing , Mumbai, First Edition, 2021.

4 https://nptel.ac.in/courses/110107092

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF INFORMATION TECHNOLOGY
CO-PO MAPPING

Regulation: R 2020

Course Code: 20IT903 **Course Name: FUNDAMENTALS OF BUSINESS INTELLIGENCE**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Summarize the nuances of extracting information from the various sources of digital data*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO2:	*Infer the techniques involved in Online Transaction Processing and Online Analytical processing systems.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3:	*Discuss the concept of data integration.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO4:	*Summarize the various methods of data integration.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO5:	*Describe the various process involved in the Enterprise Reporting.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
	Average	3	2	3	-	-	-	-	-	-	-	-	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20IT904	**BLOCKCHAIN TECHNOLOGIES** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Infer the theoretical aspects of blockchain and apply in real casescenarios.*	*Understand*
CO2:	*Discuss the core components and working of blockchain.*	*Remember*
CO3:	*Explain the technical concepts of bit coin.*	*Understand*
CO4:	*Interpretthe Ethereum blockchain for different use cases.*	*Understand*
CO5:	*Outline the end-to-end development of a decentralized application.*	*Understand*

UNIT – I BLOCKCHAIN ARCHITECTURE [9]

History –Blockchain –Centralized vs. Decentralized Systems–Layers of Blockchain–Versions of Blockchain:3.0 and 4.0 –Blockchain Uses and Use Cases –Laying the Blockchain Foundation – Cryptography.

UNIT – II WORKING OF BLOCKCHAIN [9]

Game Theory –Prisoner's Dilemma –Byzantine Generals' Problem – The Blockchain – Merkle Trees – Properties of BlockchainSolutions – Blockchain Transactions – Distributed consensus mechanisms – Blockchain applications.

UNIT – III BITCOIN [9]

History of Money – Working with Bitcoins –Bitcoin Blockchain – The Bitcoin Network – Bitcoin Scripts – Full NodesvsSPVs – Bitcoin Wallets.

UNIT – IV ETHEREUM AND HYPERLEDGER [9]

Bitcoin to Ethereum – Ethereum Blockchain – Ethereum Smart Contracts – Ethereum Virtual Machine and Code Execution–Ethereum Ecosystem – Swarm – Whisper – DApp – Development components – Hyperledger: Iroha – Blockchain Explorer – Fabric Chain tool.

UNIT – V APPLICATIONS OF BLOCKCHAIN [9]

Decentralized Applications – Blockchain Application Development – Interacting with Bitcoin Blockchain – Sending Transactions–Creating a Smart Contract – Executing Smart Contract Functions – Public vs. Private Blockchains.

Total (L= 45, T = 0) = 45 Periods

Text Books:

1. Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Beginning Blockchain: A Beginner's Guide to BuildingBlockchain Solutions, APress, New York, First Edition, 2018.
2. Brenn Hill, Samanyu Chopra, Paul Valencourt, Blockchain Quick Reference: A guide to exploring decentralized blockchainapplication development, Packt Publishing,Mumbai, First Edition, 2018.

Reference Books :

1. Imran Bashir, Mastering Blockchain Distributed Ledgers, Decentralization and Smart Contracts Explained, Packt Publishing,Mumabi , First Edition, 2017.
2. Pethuru Raj, ChellammalSuriaNarayanan, Kavita Saini, Blockchain Technology and Applications, CRC Press, United States, First Edition ,2021.
3. E. Golden Julie, J. Jesu VedhaNayahi, Noor Zaman Jhanjhi, Blockchain TechnologyFundamentals, Applications, and Case Studies, CRC Press , United States, First Edition, 2021.
4. https://onlinecourses.nptel.ac.in/noc20_cs01/preview

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF INFORMATION TECHNOLOGY
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20IT904** **Course Name:** **BLOCKCHAIN TECHNOLOGIES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Infer the theoretical aspects of blockchain and apply in real case scenarios.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO2:	*Discuss the core components and working of blockchain.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3:	*Explain the technical concepts of bit coin.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO4:	*Interpret the Ethereum blockchain for different use cases.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO5:	*Outline the end-to-end development of a decentralized application.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
	Average	3	2	3	-	-	-	-	-		-	-	3	-	-

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20IT905	**INTERNET OF THINGS AND APPLICATIONS** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the physical and logical design of IoT.*	*Understand*
CO2:	*Summarize the various design methodologies of IoT.*	*Understand*
CO3:	*Outlinethe various packages in Python for IoT real world application.*	*Understand*
CO4:	*Discuss IoT applications using Raspberry PI and Python.*	*Remember*
CO5:	*Infer the knowledge on design of smart IoT applications.*	*Understand*

UNIT–I FUNCTIONAL BLOCKS OF IoT [09]

Definition and Characteristics of IoT – Physical Design: Layers and Protocols – Logical Design: IoT Functional Blocks – IoT Communication models and APIs – IoT Enabling Technologies –IoT Levels and Deployment Templates.

UNIT–II IoT DESIGN METHODOLOGY [09]

M2M – M2M Vs IoT – Software Defined Networks – Network function Virtualization – IoT Platform Design Methodologies – Domain Specific IoT.

UNIT – III PYTHON PACKAGES FOR IOT AND RASPBERRY PI [09]

JSON – XML – HTTPLib and URLLib – SMTPLib. Raspberry Pi : Pin Configurations – Interfaces : Serial, SPI, 12C Programming – Python program with Raspberry Pi –Controlling Output – Reading input from pins.

UNIT –IV IoT APPLICATIONS USING RASPBERRY PI [09]

LED Controlling – Traffic Light controller – Integrating Sensors – Developing web application to control IoT device – Uploading the sensor values onto the cloud for analysis – Sending SMS – Sending images and video via mail.

UNIT–V IoT USE CASES [09]

Smart and Connected Cities – An IoT Strategy for Smarter Cities – Architecture – Use Cases: Street Lighting – Smart Parking – Smart Traffic – Smart Home Automation – Smart Agriculture– Weather Monitoring.

Total (L= 45, T = 0) = 45 Periods

Text Books:

1 ArshdeepBahga and Vijay Madisetti, Internet of Things –A Hands-on Approach, Orient Blackswan Private Limited, New Delhi,First Edition, 2015.

2 David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Pearson Education, First Edition, 2017.

Reference Books :

1 Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Apress Publications, New York,First Edition, 2013.

2 Rajkamal, Internet of Things: Architecture, Design Principles And Applications, McGraw Hill Education, New York, First Edition, 2017.

3 Olivier Hersent, DavidBoswarthick, Omar Elloumi, The Internet of Things – Key Applications and Protocols, Wiley, New York, 2015.

4 https://onlinecourses.nptel.ac.in/noc22_cs53/preview

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215

DEPARTMENT OF INFORMATION TECHNOLOGY

CO-PO MAPPING

Regulation: R 2020

Course Code: 20IT905 **Course Name: INTERNET OF THINGS AND APPLICATIONS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the physical and logical design of IoT.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO2:	*Summarize the various design methodologies of IoT.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3:	*Outline the various packages in Python for IoT real world application.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO4:	*Discuss IoT applications using Raspberry PI and Python.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO5:	*Infer the knowledge on design of smart IoT applications.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
	Average	3	2	3	-	-	-	-	-	-	-	-	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20IT906	**PRINCIPLES OF SOFTWARE TESTING** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline the strategies for software testing.*	*Understand*
CO2:	*Infer the need and conduct of testing levels.*	*Understand*
CO3:	*Discuss the various techniques used in testing.*	*Understand*
CO4:	*Interpret the various types of testing used in real world application.*	*Understand*
CO5:	*Explain the test case templates and reviews process.*	*Understand*

UNIT - I SOFTWARE TESTING **[9]**

Software Testing – Definition of Software Testing – Objective and limits of testing – Testing Strategy – Roles and Responsibilities of a Software Tester – Independent Verification and Validation.

UNIT - II SOFTWARE TESTING REQUIREMENTS **[9]**

Software Testing Requirements – Analyzing the requirements –Functional and Non-Functional Requirements. Software Testing Review Process – Types of Reviews: Peer Review – Walkthrough – Inspection – Checklists of Review Process.

UNIT - III WHITE AND BLACK BOX TESTING **[9]**

White Box Testing Techniques: Decision/Branch Coverage – Basic Path Testing – Control Flow Graph Coverage – Conditional Coverage.Black Box Test Techniques: Boundary Value Analysis – Equivalent Class Partition – Cause-Effect Analysis – State Transition Table.

UNIT - IV TESTING TECHNIQUES **[9]**

Functional Testing: Smoke Testing – Integration and System Testing User Acceptance Testing – Non-Functional Testing: – Performance Testing – Recovery Testing – Security Testing – Compatibility Testing – Usability Testing – Ad Hoc Testing.

UNIT - V TEST CASE DESIGN **[9]**

Test Case :Standards, Characteristics , Guidelines and Naming Conventions – Test Case Templates – Creation of Test Case – Requirement Coverage –Traceability Matrix – Test Case Review Process – Test Execution – Test Log – Reporting of Test Execution

Total (L= 45, T = 0) = 45 Periods

Text Books:

1 S.Subashni, N.Satheesh Kumar, Dr.B.G.Geetha, Dr.G.Singaravel, Software Testing, Umayam Publications, First Edition, 2013.

2 Srinivasan Desikan, Gopalaswamy Ramesh, Software Testing: Principles and Practice, Pearson Education, India, Second Edition , 2017.

Reference Books :

1 MarnieL.Hutchson**,**Software Testing Fundamentals Methods and Metrics, Wiley, India, Second Edition,2003.

2 GlenfordJ.Myess**,**The Art of Testing, Wiley, India, Third Edition, 2003.

3 https://onlinecourses.nptel.ac.in/noc22_cs12/preview

4 https://www.digimat.in/nptel/courses/video/106105150/L01.html

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF INFORMATION TECHNOLOGY
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20IT906** **Course Name:** **PRINCIPLES OF SOFTWARE TESTING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Outline the strategies for software testing.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO2:	*Infer the need and conduct of testing levels.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3:	*Discuss the various techniques used in testing.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO4:	*Interpret the various types of testing used in real world application.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO5:	*Explain the test case templates and reviews process.*	3	2	3	-	-	-	-	-	-	-	-	3	-	-
	Average	3	2	3	-	-	-	-	-		-	-	3	-	-

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20IT907	**FOUNDATION SKILLS IN LOGIC BUILDING** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the various approaches in problem solving.*	*Understand*
CO2:	*Discuss the different algorithm design techniques.*	*Remember*
CO3:	*Demonstrate the various array based problem.*	*Understand*
CO4:	*Summarize the concept of sorting and searching.*	*Understand*
CO5:	*Outline the various methods to solve number based problem.*	*Understand*

UNIT – I PROBLEM SOLVING PROCESS [9]

Problem Solving Process –Approaches in Problem Solving: System Centric– Problem Centric– Solution Centric and Solver Centric Approach – Algorithm– Pseudocode – Flowchart– Important Problem Types.

UNIT – II ALGORTHMIC PROBLEM SOLVING [9]

Notion of the Algorithm – AlgorithmDesign and Analysis Process – Time and Space Complexity – Algorithm Design Techniques: Divide and Conquer – Dynamic Programming – Greedy Technique – Backtracking.

UNIT – III ARRAY BASED PROBLMES [9]

Array Order Reversal – Array Counting – Removal duplicates – Finding the kth smallest element – Swapping of elements – Subarray with given Sum – Find the longest consecutive subsequence.

UNIT – IV SORTING AND SEARCHING [9]

Searching: Linear Search – Binary Search. Sorting: Bubble Sort– Selection Sort– Insertion Sort– Merge Sort– Quicksort – Heap Sort.

UNIT – V NUMBER BASED PROBLEMS [9]

Swapping the values –Summation of Set of Number – Fibonacci Sequence and Factorial Computation –Integer Reversal – Euclid's algorithm – Prime Numbers Generation.

Total (L= 45, T = 0) = 45 Periods

Text Books:

1 R.G.Dromey, How to Solve it by Computer, Pearson Education, India, Fifth Edition, 2008.

2 ISRD GROUP, Programming and Problem Solving Using C Language, McGraw Hill Education, India , First Edition 2017.

Reference Books :

1 ITL Educational Solutions Limited, Introduction to Information Technology, Pearson Education, India, Second Edition, India, 2012.

2 G. Polya, How to Solve It : A New Aspect of Mathematical Method, Princeton University Press, New Jersey, Second Edition, 2008

3 Ellis Horowitz, Fundamentals of Programming languages, Galgotia Publications, New Delhi, Second Edition, 2012.

4 www.nptel.ac.in/courses/106104074

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF INFORMATION TECHNOLOGY
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20IT907** **Course Name:** **FOUNDATION SKILLS IN LOGIC BUILDING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Summarize the various approaches in problem solving.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2:	*Discuss the different algorithm design techniques.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3:	*Demonstrate the various array based problem.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4:	*Summarize the concept of sorting and searching.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5:	*Outline the various methods to solve number based problem.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
	Average	3	3	3	-	-	-	-	-	-	-	-	3	-	-

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20IT908	**PRINCIPLES OF CLOUD COMPUTING** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the characteristics of cloud computing.*	*Understand*
CO2:	*Interpret the performance of cloud computing in various computing environment.*	*Understand*
CO3:	*Discuss the concept of cloud architecture.*	*Understand*
CO4:	*Infer the knowledge on cloud simulators.*	*Understand*
CO5:	*Outline the usage of simulators like VMWare simulator.*	*Understand*

UNIT – I **CLOUD COMPUTING** **[9]**

Origins of Cloud Computing – Cloud Components – Essential Characteristics — Broad Network Access – Location Independent Resource Pooling – Rapid Elasticity – Measured Service – Roots of Cloud Computing.

UNIT – II **CLOUD INSIGHTS** **[9]**

Architectural Influences – High-Performance Computing – Utility and Enterprise Grid Computing – Cloud Scenarios – Benefits– Application Development – Security level of Third Party – Security Benefits – Regularity Issues.

UNIT – III **CLOUD ARCHITECTURE** **[9]**

Layers in Cloud Architecture – Software as a Service– Features of SaaS and benefits– Platform as a Services – Features of PaaS and benefits– Infrastructure as a Service– Features of IaaSand benefits– Cloud Service Providers – Challenges and risks in cloud adoption –Types of Cloud.

UNIT – IV **CLOUD SIMULATORS** **[9]**

CloudSim Simulator –Architecture– User code–CloudSim– GridSim– SimJava –Working platform for CloudSim– GreenCloud.

UNIT-V **VMWARE SIMULATOR** **[9]**

VMWare– Advantages of VMWare virtualization–VMWare workstation–Virtual Machines – Create a new virtual machine on local host – Cloning virtual machine – Recent Trends.

Total (L= 45, T = 0) = 45 Periods

Text Book:

1 Anthony T.Velte , Toby J. Velte Robert Elsenpeter, Cloud computing : A Practical Approach, Tata McGraw- Hill , New Delhi ,Second Edition, 2017.

2 Dan C Marinescu,Cloud Computing: Theory and Practice, MK Elsevier, Second Edition,United States,2017.

Reference Books :

1 Judith Hurwitz,Robin Bloor, Marcia Kaufman, Fern Halper,Cloud computing for Dummies, Wiley, India,Second Edition,2020.

2 Rajkumar Buyya, James Broberg,Andrzej Goscinski,Cloud Computing:Principles and Paradigms, Wiley, India,First Edition,2011.

3 https://onlinecourses.nptel.ac.in/noc22_cs20/preview

4 https://archive.nptel.ac.in/courses/106/105/106105167/

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF INFORMATION TECHNOLOGY
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20IT908** **Course Name:** **PRINCIPLES OF CLOUD COMPUTING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the characteristics of cloud computing.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO2:	*Interpret the performance of cloud computing in various computing environment.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO3:	*Discuss the concept of cloud architecture.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO4:	*Infer the knowledge on cloud simulators.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO5:	*Outline the usage of simulators like VMWare simulator.*	3	3	3	-	2	-	-	-	-	-	-	3	-	-
	Average	3	3	3	-	2	-	-	-	-	-	-	3	-	-

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20IT909	**OPEN SOURCE TECHNOLOGIES** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline the need and importance of Linux Open Source Software.*	*Understand*
CO2:	*Discuss the manipulations on Array and String using PHP.*	*Remember*
CO3:	*Summarize various functions in String and Date object*	*Understand*
CO4:	*Describe simple code segment using list and tuple in Python.*	*Understand*
CO5:	*Outline the usage of decision and looping statements in PERL.*	*Remember*

UNIT – I LINUX **[09]**

Open Sources: Need,Advantages and Applications – Open Source Operating Systems : LINUX – Kernel Mode and – Process – Scheduling – Personalities – Cloning and Signals.

UNIT – II PHP **[09]**

PHP :Syntax of PHP –Common PHP Script Elements –Variables and Constants – Data types – Operators and Statements –Arrays and Functions –String Manipulations– Regular Expression.

UNIT – III MySQL **[09]**

Setting up an account – Starting, Terminating and writing your own MySQL Programs – Record Selection Technology – Strings – Date and Time – Sorting Query Results module – DDL – DDL –DCL –TDL.

UNIT – IV PYTHON **[09]**

Syntax and Style – Python Objects – Numbers – Sequences – Strings – Lists and Tuples – Dictionaries – Decision and Loops – Files – Input and Output Statements – Errors and Exceptions – Functions.

UNIT – V PERL **[09]**

Perl : Perl Parsing Rules – Variables and Data – Statements and Control Structures – Subroutines – Packages and Modules – Files and Data Manipulation.

Total (L= 45, T = 0) = 45 Periods

Text Book:

1 Martin C.Brown, Python: The Complete Reference, McGraw Hill Education, India, Fourth Edition, 2018.
2 Richard Petersen, The Complete Reference Linux, TataMcGraw Hill, New Delhi, Sixth Edition, 2017.

Reference Books :

1 Frank M. Kromann, Beginning PHP and MySQL, Apress , New York , Fifth Edition ,2018.
2 Martin C. Brown, Perl: The Complete Reference, Tata McGraw-Hill,New Delhi, Fifth, 2017.
3 Steven Holzner, PHP: The Complete Reference, Tata McGraw-Hill, New Delhi, Sixth Edition, 2017.
4 https://nptel.ac.in/courses/106106145

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF INFORMATION TECHNOLOGY
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20IT909** **Course Name:** **OPEN SOURCE TECHNOLOGIES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Outline the need and importance of Linux Open Source Software.*	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO2:	*Discuss the manipulations on Array and String using PHP.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3:	*Summarize various functions in String and Date object*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4:	*Describe simple code segment using list and tuple in Python.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5:	*Outline the usage of decision and looping statements in PERL.*	3	3	3	-	-	-	-	-	-	-	-	3	-	-
	Average	3	3	3	-	-	-	-	-	-	-	-	3	-	-

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20IT910	**PRINCIPLES OF SOFTWARE ENGINEERING** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the software engineering process and its various models*	*Understand*
CO2:	*Summarize how requirements may be organized in software requirements document*	*Understand*
CO3:	*Illustrate the architectural design decisions and apply real time systems.*	*Understand*
CO4:	*Outline the methods rely on documented specifications and Design.*	*Understand*
CO5:	*Discuss the process involved in verification and validation.*	*Understand*

UNIT - I SYSTEMS ENGINEERING [9]

Professional and Ethical Responsibility - Systems Engineering – Legacy Systems – Critical System – Software Process Models – Process Iteration – The Rational Unified Process – Project Planning – Project Scheduling.

UNIT - II REQUIREMENTS ANALYSIS [9]

Software Requirements: Functional and Non-Functional Requirements - User Requirements - System Requirements – Requirements Validation – Requirements Management – System Models: Context Models, Behavioral Models, Data Models ,Object Models, Structured Methods– Risk-Driven Specification, Safety Specification.

UNIT - III ARCHITECTURAL DESIGN [9]

Architectural Design Decisions – System Organization – Multiprocessor Architectures – Client – Server Architectures – Data Processing Systems – Objects and Object Classes – Real–Time Operating Systems – Monitoring and Control Systems – User Interface Design : Issue, Process, Analysis.

UNIT - IV CRITICAL SYSTEMS [9]

Agile Methods – Rapid Application Development – Software Prototyping – Components and Component Models – Fault Tolerance – Fault-Tolerance Architectures – Software Maintenance – Evolution Processes – Legacy System Evolution .

UNIT - V VERIFICATION AND VALIDATION [9]

Planning Verification and Validation – Software Inspections – Verification and Formal Methods – Systems Testing – Component Testing – Test Case Design – Test Automation – Safety Assurance – Security Assessment.

Total (L= 45, T = 0) = 45 Periods

Text Books:

1 Lan Sommerville, Software Engineering, Pearson Education, India , Tenth Edition, 2017.

2 Roger Pressman, Software Engineering: A Practitioner's Approach, McGraw Publications , India , Seventh Edition ,2017

Reference Books :

1 Jalote P,An Integrated Approach to Software Engineering,Narosa Publishers,New Delhi, Third Edition, 2015.

2 Mark Richards and Neal Ford, Fundamentals of Software Architecture: An Engineering Approach, O'Relly, First Edition, 2020.

3 Rajib Mall, Fundamentals of Software Engineering, PHI Learning,India ,Fifth Edition,2018.

4 https://nptel.ac.in/courses/106105087

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF INFORMATION TECHNOLOGY
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20IT910** **Course Name:** **PRINCIPLES OF SOFTWARE ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the software engineering process and its various models*	3	2	3	-		-	-	-		-	-	3	-	-
CO2:	*Summarize how requirements may be organized in software requirements document*	3	2	3	-		-	-	-		-	-	3	-	-
CO3:	*Illustrate the architectural design decisions and apply real time systems.*	3	2	3	-		-	-	-		-	-	3	-	-
CO4:	*Outline the methods rely on documented specifications and Design.*	3	2	3	-		-	-	-		-	-	3	-	-
CO5:	*Discuss the process involved in verification and validation.*	3	2	3	-		-	-	-		-	-	3	-	-
	Average	3	2	3	-		-	-	-		-	-	3	-	-

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS / IT**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

		L	T	P	C
20ME901	**BASIC MECHANICAL ENGINEERING**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explore the fundamental knowledge on basics of mechanical engineering*	*Understand*
CO2:	*Demonstrate the concepts of manufacturing technology.*	*Understand*
CO3:	*Describe the knowledge of power plants and pumps.*	*Understand*
CO4:	*Interpret the basic concepts of IC Engines.*	*Understand*
CO5:	*Analyze the Refrigeration and air conditioning systems*	*Analyze*

UNIT - I FUNDAMENTALS [09]

Introduction to mechanical engineering, concepts of thermal engineering, mechanical machine design, industrial engineering, and manufacturing technology.

UNIT - II MANUFACTURING TECHNOLOGY [09]

Manufacturing, classification, lathe, drilling machines, milling machines, metal joining, metal forming, casting, forging, and introduction to powder metallurgy.

UNIT - III POWER PLANT ENGINEERING [09]

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT - IV I C ENGINES [09]

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines.

UNIT - V REFRIGERATION AND AIR CONDITIONING SYSTEM [09]

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system–Layout of typical domestic refrigerator–Window and Split type room Air condition.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Shantha Kumar S R J., Basic Mechanical Engineering, Hi-tech Publications, Mayiladuthurai, Second Edition, 2000.

2 Venugopal K and Prahu Raja V, Basic Mechanical Engineering, Anuradha Publishers, Kumbakonam , Fourth Edition 2000.

Reference Books :

1 Lecture notes prepared by Department of Mechanical Engineering, NITT, 2020.

2. R. K. Rajput,Manufacturing Processes, University Science Press, New Delhi, Fourth Edition, 2020.

3 Hajra Choudry, S. K., Elements of Work Shop Technology – Vol. I, Media Promoters, New Delhi, Fourth Edition, 2010.

4 Ramesh Babu, Basic civil and Mechanical Engineering, VRB Publishers, Chennai, Fourth Edition, 2017.

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME901 **Course Name : BASIC MECHANICAL ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Explore the fundamental knowledge on basics of mechanical engineering	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO2:	Demonstrate the concepts of manufacturing technology	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO3:	Describe the knowledge of power plants and pumps.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO4:	Interpret the basic concepts of IC Engines.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO5:	Analyze the Refrigeration and air conditioning systems	3	3	3	-	-	2	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

20ME902	**SOLAR ENERGY UTILIZATION**	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Explore the measurement of solar radiation and their application to various systems.	Understand
CO2:	Illustrate the principles of non-concentrating collectors and apply the principles in various real time applications.	Apply
CO3:	Describe the concept of concentrating collectors and their application to a wide range of systems.	Apply
CO4:	Analyze the various material characteristics of solar cell and determine maximum efficiency of solar cells.	Analyze
CO5:	Demonstrate the solar storage equipment and evaluate the economic analysis of various solar equipment.	Understand

UNIT - I INTRODUCTION TO SOLAR ENERGY [09]

Introduction - Sun-Earth relationships- solar constant- solar radiation at the earth surface- depletion of solar radiation- measurement of solar radiation- solar radiation data- solar time- solar radiation geometry- solar radiation on tilted surfaces-Sun as the source of energy sun angles - overview of applications.

UNIT - II NON CONCENTRATING COLLECTORS [09]

Types and classification of solar collectors - terminology related to flat plate collectors - evacuated collectors-Heat transfer processes and efficiency of a solar collector -solar drying- solar desalination- solar mechanical cooling- solar desiccant cooling- detailed study on heat pump – it needed.

UNIT - III CONCENTRATING COLLECTORS [09]

Tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats- comparison of various designs - central receiver systems - parabolic trough systems - solar performance analysis - solar power plant - solar furnace.

UNIT - IV SOLAR PHOTOVOLTAIC [09]

Fundamentals of solar cells- - types of solar cell- P-N junction photodiode- description and principle of working of a solar cell- cell structure- solar module and panel- I-V characteristics of a PV module- maximum power point- cell efficiency- fill factor- Manufacturing of solar cell.

UNIT - V SOLAR ENERGY STORAGE AND ECONOMIC ANALYSIS [09]

Storage of solar energy - thermal storage-sensible and latent heat storage-Economic Analysis: Initial and annual costs-definition of economic terms for a solar system- present worth calculation-repayment of loan in equal annual installments- annual savings- cumulative savings and life cycle savings- payback period- clean development mechanism -solar vehicle -BIPV(Building Integrated photo voltaic) - house hold appliances.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Garg H P and Prakash J, Solar Energy: Fundamentals & Applications, McGraw Hill, New Delhi, First Revised Edition 2014 .

2 Duffie.J.A and Beckman W.A, Solar Engineering of Thermal processes, John Wiley And Sons, New York, Fourth Edition,2013 .

Reference Books :

1 Sukhatme. K and Sukhatme S.P., Solar Energy principles of thermal collection and storage, Tata McGraw Hill education, New Delhi, Third Edition,2008.

2 Rai G.D., Solar energy Utilization, Khanna Publishers, New Delhi, Fifth Edition, 2020.

3 Bhattachariya.T , Terrestrial Solar Photovoltaic, Narosa Publishers, New Delhi, Fourth Edition,2008.

4 Sukhatme S.P., Solar Energy, Tata McGraw Hills P Co., Third Edition, 2008.

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME902 **Course Name : SOLAR ENERGY UTILIZATION**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Evaluate the measurement of solar radiation and their application to various systems.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO2:	Illustrate the principles of non-concentrating collectors and apply the principles in various real time applications.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO3:	Describe the concept of concentrating collectors and their application to a wide range of systems.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO4:	Analyze the various material characteristics of solar cell and determine maximum efficiency of solar cells.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO5:	Demonstrate the solar storage equipment and evaluate the economic analysis of various solar equipment.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	2	-	-	-	-	-	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

		L	T	P	C
20ME903	**PRODUCTION TECHNOLOGY OF AGRICULTURAL MACHINERY**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Acquire various engineering materials, classifications, compositions and properties	Understand
CO2:	Explore the concept and basic mechanics of metal cutting, working of standard machine tools and allied machines.	Understand
CO3:	Apply the manufacturing process in welding for component production.	Apply
CO4:	Demonstrate various advanced manufacturing process in engineering field.	Understand
CO5:	Describe the basic concepts of Computer Numerical Control (CNC) machine tool and CNC programming.	Understand

UNIT – I ENGINEERING MATERIALS [09]

Engineering materials - their classification - Mechanical properties of materials, strength, elasticity, plasticity, stiffness, malleability, ductility, brittleness, toughness, hardness, resilience, machinability, formability, weldability. Steels and cast irons: Carbon steels, their classification based on percentage of carbon as low, mild, medium & high carbon steel, their properties & applications. Wrought iron, cast iron. Alloy steels: Stainless steel, tool steel.

UNIT - II MACHINING [09]

Basic principles of lathe - machine and operations performed on it. Basic description of machines and operations of Shaper-Planner, Drilling, Milling & Grinding.

UNIT - III WELDING [09]

Introduction, classification of welding processes. Gas welding, types of flames and their applications. Electric Arc welding. Resistance welding, Soldering & Brazing processes and their uses.

UNIT - IV ADVANCED MANUFACTURING PROCESS [09]

Abrasive flow machining - abrasive jet machining - water jet machining - Electro Discharge Machining (EDM) - Wire cut EDM - Electro Chemical Machining (ECM) - Ultrasonic Machining / Drilling (USM / USD) - Electron Beam Machining (EBM) - Laser Beam Machining (LBM).

UNIT - V CNC MACHINE [09]

Numerical control (NC) machine tools - CNC: types, constitutional details, special features – design considerations of CNC machines for improving machining accuracy - structural members – slide ways - linear bearings - ball screws - spindle drives and feed drives. Part programming fundamentals - manual programming.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Kalpakjian and Schmid ,Manufacturing Engineering and Technology, Pearson, New Delhi, Eighth Edition, 2016.

2 Hajra Choudry, Elements of workshop technology - Vol II, Media promoters, New Delhi ,Fourth Edition,2018

Reference Books :

1 Gupta. K.N., and Kaushik, J.P., Workshop Technology Vol I and II, New Heights, Daryaganj, New Delhi, Second Edition, 1998,.

2 Arthur. D., et. al., General Engineering Workshop Practice, Asia Publishing House, Bombay,Third Edition,2001.

3 Chapman W.A.J., Workshop Technology, Part I, II, III, E.L.B.S. and Edward Amold Publishers Ltd, London, First Edition,1992.

4 Dr. P. Kamaraj, Dr. V. R. Ramachandran, Production Technology of Agricultural Machinery,Kerela,First Edition,2020.

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME903 **Course Name : PRODUCTION TECHNOLOGY OF AGRICULTURAL MACHINERY**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Acquire various engineering materials, classifications, compositions and properties	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO2:	Explore the concept and basic mechanics of metal cutting, working of standard machine tools and allied machines.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO3:	Apply the manufacturing process in welding for component production.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO4:	Demonstrate various advanced manufacturing process in engineering field.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO5:	Describe the basic concepts of Computer Numerical Control (CNC) machine tool and CNC programming.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	2	-	-	-	-	-	**-**	**-**	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

		L	T	P	C
20ME904	**SELECTION OF MATERIALS**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to ***Cognitive Level***

CO1:	Explore the classification and properties of engineering materials	Understand
CO2:	Acquire the knowledge on mechanical properties of various metal alloys.	Understand
CO3:	Identify different types of availability materials.	Analyze
CO4:	Examine required materials for engineering applications.	Analyze
CO5:	Select suitable material for various applications	Evaluate

UNIT - I ENGINEERING MATERIALS [09]

Introduction – classification of engineering materials – selection of materials for engineering purposes –selection of materials and shape –classification metal and alloys, polymers, ceramics and glasses, composites, natural materials,- non metallic materials- smart materials - physical, metrical properties of metals.

UNIT - II MATERIAL PROPERTIES [09]

Mechanical properties – fatigue strength – fracture Toughness - Thermal Properties - Magnetic Properties - Fabrication Properties –electrical , optical properties - Environmental Properties , Corrosion properties –shape and size - Material Cost and Availability– failure analysis.

UNIT - III MANUFACTURING PROCESSING AND ECONOMIC ANALYSIS [09]

Interaction of Materials Selection, Design, and Manufacturing Processes - Production Processes and Equipment for Metals - Metal Forming, Shaping, and Casting - Plastic Parts Processing - Composites Fabrication Processes - Advanced Ceramics Processing – surface treatment - Resource -The Price and Availability of Materials.

UNIT - IV MATERIALS SELECTION CHARTS AND TESTING [09]

Ashby material selection charts-Testing of Metallic Materials - Plastics Testing - Characterization and Identification of Plastics - Professional and Testing Organizations - Ceramics Testing - Nondestructive Inspection.

UNIT - V APPLICATIONS AND USES [09]

Selection of Materials for Biomedical Applications - Medical Products - Materials in Electronic Packaging - Advanced Materials in Sports Equipment - Materials Selection for Wear Resistance - Advanced Materials in Telecommunications - Using Composites - Manufacture and Assembly with Plastics, fiber and Diamond Films.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Ashby, M. F. , Materials selection in mechanical design, Elsevier,New Delhi, Third Edition, 2005.

2 Ashby, M. F. and Johnson, K. Materials and design – the art and science of material selection in product design. Elsevier, New Delhi, First Edition, 2002.

Reference Books :

1 Charles, J. A., Crane, F. A. A. and Furness, J. A. G. ,Selection and use of engineering materials, Butterworth-Heinemann, New Delhi, Third Edition, 1997.

2 Handbook of Materials Selection. Edited by Myer Kutz John Wiley & Sons, Inc., New York, Second Edition, 2002.

3 Fisher P.E., Selection of Engineering Materials and Adhesives ,CRC Press, US, First Edition,2020

4 Joseph Datsko ,Materials Selection for Design and Manufacturing theory and practice, CRC Press, US, First edition,2020.

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME904 **Course Name : SELECTION OF MATERIALS**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Explore the classification and properties of engineering materials	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO2:	Acquire knowledge on mechanical properties of various metal alloys.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO3:	Identify different types of availability materials.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO4:	Examine required materials for engineering applications.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO5:	Select suitable material for various applications	3	3	3	-	-	1	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	1	-	-	-	-	-	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

		L	T	P	C
20ME905	**MARINE VEHICLES**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to ***Cognitive Level***

CO1:	Explore the various types of marine vehicles and its applications	Understand
CO2:	Acquire marine vehicle Safety, Operations and controls of bunkering.	Understand
CO3:	Demonstrate remotely operable vehicle design, construction and its components.	Apply
CO4:	Analyze submersible and autonomous under water vehicles.	Analyze
CO5:	Design and operational consideration of manned and un manned submersible.	Create

UNIT - I MARINE VEHICLES [09]

Types – general – by function – commercial marine vehicles- passenger ship, cargo ships, oil and chemical tankers , cattle carriers, harbor crafts, off shore platform, container ships.

UNIT - II REEFERS AND GAS CARRIERS [09]

.Introduction – Types , design considerations, safety – operation and controls, precaution during bunkering.

UNIT - III REMOTELY OPERABLE VEHICLE (ROV), UMS SHIPS [09]

Remotely Operable Vehicles (ROV) – The ROV business – Design theory and standards – control and simulation – design and stability – components of ROV – applications, UMS operation, and controls.

UNIT - IV SUBMERSIBLES AND AUTONOMOUS UNDERWATER VEHICLE (AUV) [09]

submersibles types – applications, AUV – Design and construction considerations – components – sensors – Navigation -control strategies – applications.

UNIT - V MANNED AND UN MANNED SUBMERSIBLE [09]

Introduction – Design and operational consideration – pressure hull exo-structure – ballasting and trim – maneuvering and control – Life support and habitability – emergency devices and equipment's – certification and classification, towed vehicles – gliders – crawler – Design and construction.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Jonathan M. Ross, human factors for naval marine vehicle design and operation, CRC Press, US, Second Edition, 2001.

2 Sabiha A. Wadoo, Pushkin Kachroo, Autonomous underwater vehicles, modeling, control design and Simulation, CRC press,US,Second Edition, 2011.

Reference Books :

1 Ferial L hawry, The ocean engineering handbook, CRC press, US,First Edition, 2000.

2 Richard A Geyer, Submersibles and their use in oceanography and ocean engineering, Elsevier, New Delhi, First Edition, 1997.

3 Robert D. Christ,Robert L. Wernli, Sr., The ROV Manual A User Guide for Remotely Operated Vehicles, Elsevier, New Delhi, second edition, 2014.

4 Frank Busby. R, Manned Submersibles, Office of the oceanographer of the Navy, United states, First Edition, 1976.

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME905 **Course Name : MARINE VEHICLES**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Explore the various types of marine vehicles and its applications	3	3	3	-	-	2	-	-	1	-	-	-	-	-
CO2:	Acquire Safety, Operations and controls of bunkering.	3	3	3	-	-	2	-	-	1	-	-	-	-	-
CO3:	Demonstrate remotely operable vehicle design, construction and its components.	3	3	3	-	-	2	-	-	1	-	-	-	-	-
CO4:	Analyze submersible and autonomous under water vehicles.	3	3	3	-	-	2	-	-	1	-	-	-	-	-
CO5:	Design and operational consideration of manned and un manned submersible.	3	3	3	-	-	2	-	-	1	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	2	-	-	1	-	-	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

		L	T	P	C
20ME906	**SENSORS AND TRANSDUCER**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Explore the basic concepts of various sensors and transducers.	Understand
CO2:	Develop knowledge in mechanical and electromechanical sensor.	Apply
CO3:	Differentiate the types of thermal sensor which are used in various applications.	Apply
CO4:	Identify various types of magnetic sensors and working principles	Analyze
CO5:	Acquire suitable sensors and its applications.	Understand

UNIT - I INTRODUCTION [09]

Definition, classification, static and dynamic parameters, Characterization - Electrical, mechanical, thermal and chemical. Classification of errors - Error analysis, Static and dynamic characteristics of transducers.

UNIT - II MECHANICAL AND ELECTROMECHANICAL SENSORS [09]

Resistive Potentiometer - strain gauge - Inductive sensors and transducer - capacitive sensors – ultrasonic sensors.

UNIT - III THERMAL SENSOR [09]

Gas thermometric sensors - acoustic temperature sensors - magnetic thermometer, resistance change -type thermometric sensors.

UNIT - IV MAGNETIC SENSOR [09]

Force and displacement measurement - Magneto resistive sensors - Hall Effect sensor, Inductance andeddy current sensors - Angular/rotary movement transducer - Electromagnetic flow meter, squid sensor.

UNIT - V SENSORS AND THEIR APPLICATIONS [09]

Automobile sensor - Home appliance sensor - Aerospace sensors - sensors for manufacturing medicaldiagnostic sensors - environmental monitoring.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Ernest O Doebelin, Measurement Systems – Applications and Design, Tata McGraw-Hill, New Delhi, Fourth edition, 2016.

2 Sawney A K and PuneetSawney, A Course in Mechanical Measurements and Instrumentation and Control, DhanpatRai and Co, New Delhi, Fourteenth edition, 2016.

Reference Books :

1 Patranabis D, Sensors and Transducers, PHI, New Delhi, Sixth Edition, 2015.

2 Richard Zurawski, Industrial Communication Technology Handbook, CRC Press, US,Second edition, 2015.

E-Resources :

1 https://nptel.ac.in/courses/108/108/108108147/

2 https://www.youtube.com/watch?v=1uPTyjxZzyo

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME906 **Course Name : SENSORS AND TRANSDUCER**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Explore the basic concepts of various sensors and transducers.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO2:	Develop knowledge in mechanical and electromechanical sensor.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO3:	Differentiate the types of thermal sensor which are used in various applications.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO4:	Identify various types of magnetic sensors and working principles	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO5:	Acquire suitable sensors and its applications.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	1	-	-	-	-	-	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

20ME907	**ENERGY AUDITING**	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Describe the energy crisis & environmental concerns associated with the energy management and the importance of energy auditing.	Understand
CO2:	Identify the tools, techniques, management practices for the audit and management of electrical energy.	Understand
CO3:	Recognize the techniques of energy analysis and the associated energy efficient technologies for the routinely used thermal energy systems.	Apply
CO4:	State about the typical electrical energy powered utilities, services of industrial facilities & organizations and be able to identify the opportunities and options for the conservation & management of electrical energy.	Understand
CO5:	Interpret the basic economic concepts of underlay energy production and end use.	Evaluate

UNIT - I INTRODUCTION [09]

Energy – Power – Past & Present scenario of world; National energy consumption data – Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers. Role of energy managers. Instruments for energy auditing.

UNIT - II ELECTRICAL SYSTEMS [09]

Components of EB billing – HT and LT supply, Transformers, Cable sizing, Concept of capacitors, Power factor improvement, Harmonics, Electric motors – Motors efficiency computation, Energy efficient motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED lighting and scope of economics in illumination – Auditing in electrical systems.

UNIT - III THERMAL SYSTEMS [09]

Stoichiometry, Boilers, Furnaces and Thermal fluid heaters – Efficiency computation and economic measures. Steam: Distribution & usage, Steam traps, Condensate recovery, Flash steam utilization, Insulators & Refractories – Auditing in thermal systems.

UNIT - IV ENERGY CONSERVATION IN MAJOR UTILITIES [09]

Pumps, Fans, Blowers, Compressed air systems, Refrigeration and Air Conditioning systems – Cooling towers – D.G. sets - Auditing and energy conservation.

UNIT - V ECONOMICS [09]

Energy economics – Discount rate, Payback period, Internal rate of return, Net present value, Life cycle costing – ESCO concept – Auditing and Economics.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Energy manager training manual (4 Volumes) available at www.energymanagertraining.com, a website administered by Bureau of energy efficiency (BEE), a statuary body under ministry of power, Government Of India, 2004.

2 Abbi,Y.B , Energy Audit, Open University, The Energy and Resources Institute, Government Of India,2012 .

Reference Books :

1 Witte. L.C., P. S. Schmidt, D.R. Brown, Industrial Energy Management and Utilization, Hemisphere Pub, Washington, First Edition, 1988 .

2 Sonal Desai, Handbook of Energy Audit, Tata McGraw Hill, New Delhi, Second Edition, 2015.

3 Dryden. I.G.C., The Efficient Use Of Energy, Butterworth's, London, Fourth Edition, 2013.

4 Turner W.C., Energy Management Handbook, Wiley, New York, Eighth Edition, 2014.

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME907 **Course Name : ENERGY AUDITING**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Describe the energy crisis & environmental concerns associated with the energy management and the importance of energy auditing.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
CO2:	Identify the tools and techniques, and the management practices for the audit and management of electrical energy.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
CO3:	Recognize the techniques of energy analysis and the associated energy efficient technologies for the routinely used thermal energy systems.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
CO4:	State about the typical electrical energy powered utilities, services of industrial facilities & organizations and be able to identify the opportunities and options for the conservation & management of electrical energy.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
CO5:	Interpret the basic economic concepts of underlay energy production and end use.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**2**	2	-	-	1	-	-	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

20ME908	**FIBRE REINFORCED PLASTICS**	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Select various materials for designing composite structures.	Understand
CO2:	Apply knowledge of fracture mechanics of composites during designing of composite structures.	Apply
CO3:	Analyze critically damping capacity of composite materials.	Analyze
CO4:	Correlate various manufacturing/fabricating techniques for composite structures based on design.	Analyze
CO5:	Explore various composite applications.	Understand

UNIT - I INTRODUCTION [09]

Definition, Reason for composites, Classifications of composites, Thermosets - Epoxy; Unsaturated polyester resin; vinyl ester, polyimides etc.,-preparation, properties, and uses.

UNIT - II REINFORCEMENTS [09]

Types, Properties, chemistry and applications of fillers such as silica, titanium oxide, talc, mica etc., Manufacturing process, Properties, structure and uses of Glass fiber -.Carbon, Aramid, Boron, jute, sisal, cotton.

UNIT - III FABRICATIONS OF THERMOSET COMPOSITES [09]

Hand layup method, compression and transfer moulding, pressure and vacuum bag process, filament winding, protrusion, reinforced RIM, Injection moulding, of thermosets, SMC and DMC, Advantages and disadvantages of each method.

UNIT - IV TESTING OF COMPOSITES [09]

Destructive and non-destructive tests; Destructive-tensile, compression, flexural, impact strength, Hardness–Fatigue-toughness HDT ,basic concepts of fracture mechanisms.

UNIT - V APPLICATIONS OF COMPOSITES [09]

Aerospace, land transport, marine, structural, chemical plants and corrosion resistant products and energy applications sports, electrical, electronic and communication applications.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Chawla, K.K, Composite Material s, Springer Science in progress, USA, Sixth Edition, 2019.
2 Balasubramaniam, Composite Materials, John Wiley & Sons, Indian Ed., New York, Fourth Edition, 2016.

Reference Books :

1 Sharma S.C., Composite materials, Narosa Publications, NewDelhi, Third Edition, 2015.
2 Isaac M. Daniel and Ori Ishai, Engineering Mechanics of Composite Materials, Oxford University Press, UK, Second Edition, 2017.

E-RESOURCES

1 https://nptel.ac.in/courses/112/105/112105232/
2 https://nptel.ac.in/courses/112/107/112107142/

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME908 **Course Name : FIBRE REINFORCED PLASTICS**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Select various materials for designing composite structures.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO2:	Apply knowledge of fracture mechanics of composites during designing of composite structures.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO3:	Analyze critically damping capacity of composite materials.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO4:	Correlate various manufacturing / fabricating techniques for composite structures based on design.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO5:	Explore various composite applications.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	1	-	-	-	-	-	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

		L	T	P	C
20ME909	**LEAN MANUFACTURING**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Demonstrate the lean manufacturing principles to find and eliminate wastes.	Understand
CO2:	Identify the lean manufacturing tools and their potential applications.	Understand
CO3:	Summarize the usage of visual management, TPM and lean practices.	Apply
CO4:	Acquire the technology drivers of lean manufacturing.	Understand
CO5:	Describe technology drivers of lean manufacturing.	Analyze

UNIT - I LEAN MANUFACTURING PRINCIPLES [09]

Lean manufacturing paradigms - lean manufacturing - origin - Toyota Production System - types of wastes -tools and techniques to eliminate wastes - value stream mapping (VSM) - primary icons - secondary icons - developing the VSM.

UNIT - II LEAN MANUFACTURING TOOLS [09]

5S concepts - stages of 5S and waste elimination - Kaizen - steps of Kaizen - lean manufacturing through Kaizen – Single Minute Exchange of Die - theory of SMED - design for SMED - strategic SMED and waste elimination - pull production through Kanban - one piece flow production.

UNIT - III VISUAL MANAGEMENT, TPM AND LEAN IMPLEMENTATION [09]

Visual management - tools for eliminating wastes - overproduction, inventory, delay, transportation, processing, unnecessary motion, defective parts, underutilization of people - implementation - total productive maintenance - implementation of lean practices.

UNIT - IV MANAGEMENT AND TECHNOLOGY DRIVERS OF LEAN MANUFACTURING [09]

Lean manufacturing - twenty criteria model - management driver - organizational structure - devolution of authority - employee status and involvement - nature of management - business and technical processes - time management - agility through technology driver.

UNIT - V MANUFACTURING STRATEGY AND COMPETITIVE DRIVERS OF LEAN MANUFACTURING [09]

Quick manufacturing setups - quick response - product life cycle management - product service elimination - automation - competitive driver - status of quality and productivity - compatible cost accounting system.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Devadasan.S.R, Mohan Sivakumar.V, Murugesh.R and Shalij.P.R, Lean Manufacturing: Theoretical, Practical and Research Futurities, PHI Learning Private Limited, New Delhi, Second Edition, 2012.

2 Pascal Dennis, Lean Production Simplified, Productivity Press, New York, Third Edition, 2007.

Reference Books :

1 Bill Carreira, Lean Manufacturing That Works, PHI Learning Private Limited, New Delhi, Third Edition, 2016.

2 Dennis P. Hobbs, LEAN Manufacturing Implementation, Cengage Learning, New Delhi, Fifth Edition, 2015.

E-RESOURCES

1 https://nptel.ac.in/courses/112/104/112104188/ - (Lean Manufacturing System Technology)

2 https://freevideolectures.com/course/4162/nptel - (Toyota Production system)

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME909 **Course Name : LEAN MANUFACTURING**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Demonstrate the lean manufacturing principles to find and eliminate wastes .	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO2:	Identify the lean manufacturing tools and their potential applications.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO3:	Summarize the usage of visual management, TPM and lean practices.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO4:	Acquire the technology drivers of lean manufacturing.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO5:	Describe technology drivers of lean manufacturing.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	2	-	-	-	-	-	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

		L	T	P	C
20ME910	**SURFACE ENGINEERING**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Demonstrate the various factors influencing wear in materials	Understand
CO2:	Identify wear resistance techniques in engineering materials	Apply
CO3:	Acquire various surface treatment methods for alloy metals	Understand
CO4:	Describe various surface treatment techniques and its applications	Analyze
CO5:	*Explore the corrosion behaviour of engineering materials*	Understand

UNIT - I WEAR [09]

Introduction tribology, surface degradation, wear and corrosion, types of wear, roles of friction and lubrication- overview of different forms of corrosion, introduction to surface engineering, importance of substrate

UNIT - II COATING [09]

Chemical and electrochemical polishing, significance, specific examples, chemical conversion coatings, phosphating, chromating, chemical colouring, anodizing of aluminium alloys, thermochemical processes -industrial practices

UNIT - III SURFACE TREATMENT [09]

Surface pre-treatment, deposition of copper, zinc, nickel and chromium - principles and practices, alloy plating, electrocomposite plating, electroless plating of copper, nickel-phosphorous, nickel-boron; electroless composite plating; application areas, properties, test standards (ASTM) for assessment of quality deposits

UNIT - IV SURFACE TREATMENT TECHNIQUES [09]

Definitions and concepts, physical vapour deposition (PVD), evaporation, sputtering, ion plating, plasma nitriding, process capabilities, chemical vapour deposition (CVD), metal organic CVD, plasma assisted CVD, specific industrial applications

UNIT - V SPRAYING [09]

Thermal spraying, techniques, advanced spraying techniques - plasma surfacing, D-Gun and high velocity oxy-fuel processes, laser surface alloying and cladding, specific industrial applications, tests for assessment of wear and corrosion behaviour

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Stachowiak, G.W &Batchelor A.W, Engineering Tribology, Butterworth-Heinemann, UK, First Edition, 2005.

2 Rabinowicz.E, Friction and Wear of materials, John Willey &Sona ,New York, Second Edition,1995.

Reference Books :

1 Sudarshan T S, Surface modification technologies - An Engineer's guide, Marcel Dekker, New york, First Edition,1989.

2 Varghese C.D, Electroplating and Other Surface Treatments - A Practical Guide, TMH, New Delhi, First Edition,1993.

3 Williama. J.A, Engineering Tribology, Oxboarduniv. Press, UK, Second Edition,1994.

4 Basu S.K,.Sengupta S.N &Ahuja B.P, Fundamentals of Tribology, Prentice-Hall of India Pvt. Ltd, New Delhi, Second Edition,2005.

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R COLLEGE OF ENGINEERING, TIRUCHENGODE-637215

DEPARTMENT OF MECHANICAL ENGINEERING

Regulation : R2020

Course Code : 20ME910 **Course Name : SURFACE ENGINEERING**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Demonstrate the lean manufacturing principles to find and eliminate wastes.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2:	Identify the lean manufacturing tools and their potential applications.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3:	Acquire various surface treatment methods for alloy metals	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4:	Describe various surface treatment techniques and its applications	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5:	Explore the corrosion behaviour of engineering materials	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**3**	**-**	-	-	-	-	-	-	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/ME**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20SF901	OCCUPATIONAL HEALTH AND HYGIENE (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1	*Compare the concept and spectrum of health functional units and activities of occupational health service.*	*Understand*
CO2	*Identify physical chemical and biological hazards in the work environment and its control measures.*	*Apply*
CO3	*Explain the principles of ventilation and its requirements.*	*Understand*
CO4	*Demonstrate about the lighting and its requirements.*	*Understand*
CO5	*Reduce the gas poisoning and its effects.*	*Apply*

UNIT - I **OCCUPATIONAL HEALTH** **[09]**

Concept and spectrum of health - functional units and activities of occupational health services - occupational and work-related disease - Levels of prevention of diseases - notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, anthracosis, aluminosis and anthrax.

UNIT - II **VIBRATION** **[09]**

Recognition, evaluation and control of physical hazards. Vibration - Description and measurement of vibration. Vibration control methods. Effects of whole-body vibration on human body and control measures - Noise - noise measurement, evaluation, noise control methods - hearing loss - causes - Biological effects of noise exposure.

UNIT - III **VENTILATION** **[09]**

Ventilation systems - Purpose of ventilation - General principles ventilation requirements. Physiological and comfort level. Natural ventilation - Dilution ventilation - Mechanical ventilation - Local exhaust ventilation - Ventilation measuring instruments. Fundamentals of hood and duct designs. Standards on ventilation.

UNIT - IV **LIGHTING** **[09]**

Purpose of lighting - Advantages of good illumination - Lighting and the work - Sources and kinds of artificial lighting principles of good illumination. Design of Lighting installation - Maintenance - Lighting and Color Standards on lighting and illuminations.

UNIT - V **GAS POISONING** **[09]**

Lead - Nickel, Chromium and Manganese toxicity - Gas poisoning (such as CO, ammonia, coal and dust) their effects and prevention - Local and systemic and chronic effects - Carcinogens, Mutagens, Teratogens. Personal monitoring devices - Medical support.

Total = 45 Periods

Text Books:

1. Jeanne Mager Stellman(ed) Encyclopedia of Occupational Health and Safety, International Labour Office, Geneva, Fourth Edition, 1998.
2. The Industrial Environment -Its Evaluation and Control, DHHS (NIOSH),1973.

Reference Books:

1. Barbara Cohrssen, Patty´s Industrial Hygiene and Toxicology, Wiley, Inderscience, New York. Seventh Edition, 2021.
2. Yudenich, V.V., Accident First Aid, Mir Publishers, Moscow, 1986.
3. Cantlie, James., First aid to the injured. St John Ambulance Association, 1932.
4. S.K. Halder, Industrial and Occupational Health, Kindle Edition, 2017.

Course Faculty **Module Coordinator** **Chairman BoS/ SFE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF901 **Course Name: Occupational Health and Hygiene**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Compare the concept and spectrum of health functional units and activities of occupational health service.*	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO2	*Identify physical chemical and biological hazards in the work environment and its control measures.*	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO3	*Explain the principles of ventilation and its requirements.*	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO4	*Demonstrate about the lighting and its requirements.*	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO5	*Reduce the gas poisoning and its effects.*	3	2	2	-	-	3	2	2	-	-	-	2	-	-
	Average	**3**	**2**	**2**	**-**	**-**	**3**	**2**	**2**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/SFE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF902	**CONSTRUCTION SAFETY (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1	*List out Hazards from various Construction equipment and activities.*	*Remember*
CO2	*Mention various Control measures adopted in each Construction activity to avoid Incidents.*	*Apply*
CO3	*Demonstrate the safe use of various types of ladders, Hand held power tools, Hydraulic tools used in Construction industry.*	*Understand*
CO4	*Compare various components of cranes, safety features and its function.*	*Understand*
CO5	*Choose the minimum requirements of BOCW act to the Construction site when they work.*	*Apply*

UNIT - I INTRODUCTION [09]

Safety aspects of construction planning- Human factors in construction safety management. Roles of various groups in ensuring safety in construction industry.

UNIT - II SAFETY IN VARIOUS CONSTRUCTION OPERATIONS [09]

Excavation- underwater works- Ladders & Scaffolds - Tunneling- Blasting- Demolition- Pneumatic caissons- Confined Space- Temporary Structures. Indian Standards on construction safety- National Building Code Provisions on construction safety.

UNIT - III SAFETY IN MATERIAL HANDLING EQUIPMENTS [09]

Storage & stacking of construction materials, Safety in the use of construction equipment's - Vehicles, Cranes, Tower Cranes, Lifting gears, Hoists & Lifts, Wire Ropes, Pulley blocks, Temporary power supply, Mixers, Conveyors, Pneumatic and hydraulic tools in construction.

UNIT - IV CONTRACT CONDITIONS ON SAFETY [09]

Health, Welfare, Social Security and Insurance. Application of ergonomics for construction safety.

UNIT - V CONTRACT LABOUR ACT AND CENTRAL RULES [09]

Buildings and other Construction Workers (RE & CS) Act and Central Rules. Provisions regarding Licensing, safety, health, welfare and social security aspects only.

Total = 45 Periods

Text Books:

1. National Building Code of India, Bureau of Indian Standards, New Delhi, 2005.
2. Building & Other Construction Workers (RE &CS) Actand Central Rules, 1966.

Reference Books:

1. V.J. Davies & K. Tomasin, Construction Safety Handbook, Thomas Telford Publishing, London. 1990.
2. K.N. Vaid (Ed.), Construction Safety Management, National Institute of Construction Management and Research, Bombay,1988.
3. James B. Full man, Construction Safety, Security & Loss Prevention, John Wiley & Sons. 1984.
4. R.T. Ratay, Handbook of Temporary Structures in Construction, Mc Graw-Hill, 1984.

Course Faculty **Module Coordinator** **Chairman BoS/SFE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF902 **Course Name: Construction Safety**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*List out Hazards from various Construction equipment and activities.*	3	2	3	-	2	-	3	-	1	-	-	2	-	-
CO2	*Mention various Control measures adopted in each Construction activity to avoid Incidents.*	3	2	3	-	2	-	3	-	1	-	-	2	-	-
CO3	*Demonstrate the safe use of various types of ladders, Hand held power tools, Hydraulic tools used in Construction industry.*	3	2	3	-	2	-	3	-	1	-	-	2	-	-
CO4	*Compare various components of cranes, safety features and its function.*	3	2	3	-	2	-	3	-	1	-	-	2	-	-
CO5	*Choose the minimum requirements of BOCW act to the Construction site when they work.*	3	2	3	-	2	-	3	-	1	-	-	2	-	-
	Average	**3**	**2**	**3**	**-**	**2**	**-**	**3**	**-**	**1**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/SFE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF903	**BUILDING FIRE SAFETY (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1	*Explain the human behaviour under emergency movement and the concept of planning and design of seating arrangements in assembly buildings, evacuation routes and exits.*	*Understand*
CO2	*Outline the general life safety requirements applicable to all buildings and to plan, design and locate exits in buildings.*	*Understand*
CO3	*Illustrate the fire and life safety requirements for buildings of specific occupancy.*	*Understand*
CO4	*Choose and distribute portable and fixed firefighting systems in buildings of different occupancies as per BIS.*	*Apply*
CO5	*Develop the method of carrying out fire investigation, arson identification, fire training, fire safety audit and fire risk assessment.*	*Apply*

UNIT - I BASIC BUILDING PLANNING AND DESIGN [09]

Process of emergency evacuation - special features of personnel movement. Parameter characteristics of the movement of people; Stages of evacuation; Planning and design of evacuation routes and exits; planning of seating arrangements in large assembly buildings.

UNIT - II NBC CODES FOR BUILDINGS [09]

Classification of buildings based on occupancy and type of construction according to fire resistance as per NBC; Fire zone; General fire safety requirements applicable to all individual occupancies. General exit requirements as per NBC; Internal staircases; horizontal exits; fire tower; ramps; fire lifts; external fire escape ladders; Planning of location and calculation of capacity, number and width of exit as per NBC for different occupancy classification.

UNIT - III FIRE PREVENTION AND BIS STANDARD [09]

Fire and life safety requirements in different groups of buildings-Hotel, Schools & Colleges, Hospitals, Theatres, shopping malls, etc., Fire protection and prevention in high rise buildings - Fire protection in underground structures and in buildings under construction. Sitting of detectors as per relevant Indian standard specifications; Selection and planning of alarm system as per relevant standards (BIS).

UNIT - IV FIRE PREVENTION AND BIS STANDARD [09]

Selection and distribution of portable extinguishers (for class A and B fires) and other fire protection equipment and systems for different occupancy classification as per NBC; Planning of fixed fire fighting installation for different occupancy classification-sprinkler system; total flooding system; CO2 system; foam system; Fire Investigation; Detection of arson; Fire training and education - fire drill, fire order; Fire safety audits; Fire risk assessment.

UNIT - V FIRE SAFETY AND CODES [09]

Causes of fire in buildings. Stages of fire and how it spreads. Fire drill. Heat / fire / smoke detection. Alarm and extinguisher systems. Fire safety standards. General guidelines for egress design for multi-storey buildings. Understanding all the above through product literature/ field visits. Exercise on design of fire safety systems for different building types through choice, calculations, layout and drawings.

Total = 45 Periods

Text Books:

1. Butcher, E.G. AndParnell, A.C., Designing of fire safety. John Wiley and Sons Ltd., NewYork,U.S.A, 1983.
2. Roytman, M. Ya., Principles of Fire Safety Standards for Building Construction, AmerindPublishing Co. Pvt. Ltd., New Delhi, 1975.

Reference Books:

1. Barendra Mohan Sen, Fire Protection and Prevention the Essential Handbook, UBSPublishers and Dist., NewDelhi, 2013.
2. Jain, V.K., Fire Safety in Buildings, New Age International (P) Ltd., New Delhi, Second Edition, 2010.
3. Huang, Kai, Population and Building Factors That Impact Residential Fire Rates inLarge U.S. Cities, Applied Research Project, Texas State University.
4. Life Safety Code Handbook, National Fire Protection Association, Lathrop, James K.Ed. NFPA, 1991.

Course Faculty **Module Coordinator** **Chairman BoS/SFE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF903 **Course Name: Building Fire Safety**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain the human behaviour under emergency movement and the concept of planning and design of seating arrangements in assembly buildings, evacuation routes and exits.*	3	3	3	-	-	-	2	-	-	1	-	2	-	-
CO2	*Outline the general life safety requirements applicable to all buildings and to plan, design and locate exits in buildings.*	3	3	3	-	-	-	2	-	-	1	-	2	-	-
CO3	*Illustrate the fire and life safety requirements for buildings of specific occupancy.*	3	3	3	-	-	-	2	-	-	1	-	2	-	-
CO4	*Choose and distribute portable and fixed firefighting systems in buildings of different occupancies as per BIS.*	3	3	3	-	-	-	2	-	-	1	-	2	-	-
CO5	*Develop the method of carrying out fire investigation, arson identification, fire training, fire safety audit and fire risk assessment.*	3	3	3	-	-	-	2	-	-	1	-	2	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**1**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/SFE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20SF904	**SAFETY IN ELECTRICAL ENGINEERING (Open Elective)**	L	T	P	C
		3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1	*Explain the working principles and applications of various kinds of Electrical Machines and/or systems.*	*Understand*
CO2	*Choose & brief the hazards associated with electricity at work place.*	*Apply*
CO3	*Recall human safety aspects over electric and magnetic fields.*	*Remember*
CO4	*Compare various protective equipment and enumerate their working and application.*	*Understand*
CO5	*Identify hazardous areas/locations in a given industrial site for selection, installation, operation and maintenance of electrical equipment.*	*Apply*

UNIT - I **INTRODUCTIONTO ELECTRICAL EQUIPMENTS** **[09]**

Transformers, DC Machines, Alternators, Induction Machines- Characteristics, application Protection Relays: Requirements of relay- types of protection, Classification: Distance Relay, Differential Relay, Static Relay- Definitions and types.

UNIT - II **CIRCUIT BREAKERS** **[09]**

Function switch gear, Arc Phenomenon- Initialization of an Arc, Arc interruption, Recovery voltage, and Restriking voltage classification and working, Working of MCB and ELCB. Faults in Power System: Causes and types, Fuses: Definition, types of fuses, selection of fuses, advantages and disadvantages.

UNIT - III **EFFECT OF ELECTRIC FIELD AND MAGNETIC FIELD** **[09]**

Human Safety Aspects, Effect of Current and Voltage on Human being- distance from the source, Typical V-I characteristics of skin - Nervous System, Electrical Shocks and their prevention, Insulation: Classes of Insulation, FRLS insulation, Continuity test.

UNIT - IV **SAFETY DURING INSTALLATION OF PLANT AND EQUIPMENT** **[09]**

Safe sequences in installation -Risk during installation, Safety during testing and commissioning- steps, Test on relays- Protection and interlock system on safety.

UNIT - V **HAZARDOUS ZONES** **[09]**

Classification of hazardous zones. Intrinsically safe and explosion proof electrical apparatus, Selection of equipment in hazardous area. Electrical Fires: Hazards of static electricity, Safety procedures in electrical maintenance, Statutory requirements from Electrical Inspectorate. Introduction to Indian Electricity Act and Rules.

Total = 45 Periods

Text Books:

1. S. Rao, Electrical Safety, Fire Safety Engineering and Safety Management, Khanna Publishers, New Delhi, Third Edition, 2019.
2. John Cadick, Electrical Safety Hand book, John Cadick, TMH Publishers, Sixth Edition, 2019.

Reference Books:

1. Charles A Gross, Fundamentals of Electrical Engineering, Taylor and Francis Group, 2012.
2. H. Wayne Beaty, Handbook for Electrical Engineers,Mc GrawHill, Fifteenth Edition, 2007.
3. Donald G Fink, Standard Handbook for Electrical Engineers, Mc GrawHill, Twelth Edition,1987.
4. Donald G Fink, Electrical Engineering, Mc Graw Hill, Fifteenth Edition,1907.

Course Faculty **Module Coordinator** **Chairman BoS/SFE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF904 **Course Name: Safety in Electrical Engineering**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain the working principles and applications of various kinds of Electrical Machines and/or systems.*	3	1	2	-	-	2	1	-	-	-	-	-	-	-
CO2	*Choose & brief the hazards associated with electricity at work place.*	3	1	2	-	-	2	1	-	-	-	-	-	-	-
CO3	*Recall human safety aspects over electric and magnetic fields.*	3	1	2	-	-	2	1	-	-	-	-	-	-	-
CO4	*Compare various protective equipment and enumerate their working and application.*	3	1	2	-	-	2	1	-	-	-	-	-	-	-
CO5	*Identify hazardous areas/locations in a given industrial site for selection, installation, operation and maintenance of electrical equipment.*	3	1	2	-	-	2	1	-	-	-	-	-	-	-
	Average	**3**	**1**	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / SFE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF905	**LEGAL ASPECTS OF SAFETY (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

	Course Outcomes: On successful completion of the course, the student will be able to	***Cognitive Level***
CO1	*Describe about the factories act and rules.*	*Understand*
CO2	*Illustrate the legal obligations regarding any injury by gaining knowledge of Workmen's Compensation Act. ESI Act & Rules.*	*Understand*
CO3	*Outline about the legal aspects granting of license for storage, transportation and usage of explosive substance as applicable as per Petroleum Act and Explosive Act.*	*Understand*
CO4	*Explain the Environment (Protection) act and Rules.*	*Understand*
CO5	*Choose the concept, powers and functions of Central, State and Joint Boards, provisions regarding prevention and control of Water & Air pollution, Penalties, Central & State Laboratories.*	*Apply*

UNIT - I FACTORIES ACT [09]

Factories Act- Definitions, Preliminary, inspecting staff, Health, Safety, Provisions relating to hazardous processes, Welfare, Working hours of adults, Employment of young persons, Special provisions - Definitions, Powers of inspectors, Power of Govt. to direct inquiry. Duties of Safety Officers, Reporting of accidents, Emergency Action Plan, Safety Committee.

UNIT - II WORKMEN'S COMPENSATION ACT [09]

Workmen's Compensation Act: Definitions, Employer´s liability for compensation, Calculation of amount of compensation. ESI Act and Rules: Applicability, Definitions and Benefits. Public Liability Insurance Act and Rules- Definitions, Calculation ofamount of relief, Environmental Relief Fund, Advisory Committee, Powers of District Collector, Extent of Liability, Contribution to ReliefFund.

UNIT - III EXPLOSIVES ACT [09]

Explosives Act: Definitions, Categories of Explosives, General Safety Provisions, and Use of Explosives, Grant of license, Notice of Accidents, Inquiry into ordinary and more serious accidents. Extension of definition to other explosive substances. Explosives Rules, SMPV Rules and Gas Cylinder Rules (in brief). Petroleum Act with important rules - definitions, safety in the import, transport, storage, license, exemption, notice of accidents.

UNIT - IV ENVIRONMENT (PROTECTION) ACT [09]

Water Act and Air Act: Definitions, powers and functions of Boards, prevention and control of pollution, consent administration. Environment (Protection) Act and Rules-Definitions, powers of central government, power of giving directions, authorities. MSIHC Rules- Definitions, Duties of authorities, Notification of major accidents, Safety Reports, Safety Audit, On- site &Off-site emergency plans.

UNIT - V POWER TO MAKE RULES [09]

Powers and Functions of Central, State and Joint Boards, Provisions regarding prevention andcontrol of water pollution, Penalties, Central & State Water Laboratories, Power to make rules, Power of supersession and overriding effect. Rules on Consent for Establishment.

Total = 45 Periods

Text Books:

1. S.K.T. Narayanan, Safety, Health and Environment Handbook Hardcover, McGraw Hill Education (India) Private limited, First Edition, 2017.
2. Gayle Wood Side and Dianna Koeurek, Environmental Safety and Health Engineering, JohnWiley & Sons,1997.

Reference Books:

1. Ganguly &Changeriya, Health Safety and Environment, 2016.
2. Explosives Act and Related Rules & The Gas Cylinder Rules, Professional Book Publishers, 2004.
3. James B. Well, Environmental Management Handbook for Hydrocarbon Processing Industries, Factories Act, 1948.
4. Petroleum Act and Rules & The Petroleum Act, Universal Law Publishing, 1934.

Course Faculty **Module Coordinator** **Chairman BoS/SFE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF905 **Course Name: Legal Aspects of Safety**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Describe about the factories act and rules.*	3	-	3	-	-	3	3	2	-	-	-	2	-	-
CO2	*Illustrate the legal obligations regarding any injury by gaining knowledge of Workmen's Compensation Act. ESI Act & Rules.*	3	-	3	-	-	3	3	2	-	-	-	2	-	-
CO3	*Outline about the legal aspects granting of license for storage, transportation and usage of explosive substance as applicable as per Petroleum Act and Explosive Act.*	3	-	3	-	-	3	3	2	-	-	-	2	-	-
CO4	*Explain the Environment (Protection) act and Rules.*	3	-	3	-	-	3	3	2	-	-	-	2	-	-
CO5	*Choose the concept, powers and functions of Central, State and Joint Boards, provisions regarding prevention and control of Water & Air pollution, Penalties, Central & State Laboratories.*	3	-	3	-	-	3	3	2	-	-	-	2	-	-
	Average	**3**	**-**	**3**	**-**	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/SFE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF906	**SAFETY IN INDUSTRIES (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1	*Explain the General safety rules, principles, maintenance, Inspections in Foundry Operations.*	*Understand*
CO2	*Apply the concepts of safety in design of building fire safety.*	*Apply*
CO3	*Develop the safety in industrial operations.*	*Apply*
CO4	*Recall about welding, common hazards in welding, personal protective equipment and safety precautions in welding.*	*Remember*
CO5	*Illustrate on safety in finishing, inspection and testing of machines.*	*Understand*

UNIT - I FOUNDRY OPERATIONS SAFETY [09]

Foundry Operations - Furnace - health hazard - safe methods of operation. Forging operations heat radiation - maintenance of machines - final checking of tools, guards, lubrication, shop equipment and hand tools - safe work practice. Operations in hot and cold rolling mills. Shearing -bending - rolling - drawing - turning - boring - milling - planning - grinding. Selection andcare of tools - health hazards and prevention.

UNIT - II BUILDING FIRE SAFETY [09]

Building Fire Safety Objectives of fire safe building design, Fire load, fire resistant material and fire testing - structural fire protection - structural integrity - concept of exit design -exists width calculations -fire certificates - fire safety requirements for high rise buildings - snookers.

UNIT - III PERSONNEL RISK IN INDUSTRIAL OPERATIONS [09]

Storages and Transportation General consideration, petroleum product storages, storage tanks andvessel-storages layout segregation, separating distance, secondary containment - venting and relief, atmospheric vent, pressure, vacuum valves, flame arrestors, fire relief - fire prevention and protection - LPG storages -underground storages-loading and unloading facilities-drum and cylinder storage ware house, storage hazard assessment of LPG and LNG Hazards during transportation – pipeline transport.

UNIT - IV WORKSHOP PROCESS SAFETY [09]

Workshop Safety Hand tools and Power tools - Safety while using Grinding stone - Welding and gas cutting safety - Identification of Dangerous points - Lubrication Safety-Safety in Cold Forming and Hot Working of Metals.

UNIT - V SAFETY INSPECTION AND AUDIT [09]

Safety Inspections Safety Audit- Safety Survey - Plant safety inspection - Safety tour - Safety samplings - What is safety budget - Direct cost - indirect cost- Safety Equipment's & their budget preparation.

Total = 45 Periods

Text Books:

1. Elahi Naseer, Industrial Safety Management, Kalpaz Publication,2006.
2. Dr. Shailednrakumar U Kale,Dr. Umesh Gramopadhye, Industrial Safety Management.

Reference Books:

1. Guidelines for Hazard Evaluation Procedures,Centre for Chemical Process Safety, Third Edition, AICHE 2008.
2. Guidelines for Chemical Process Quantitative Risk Analysis, Centre for Chemical Process Safety, Second Edition, AICHE, 2000.
3. Methodologies for Risk and Safety Assessment in Chemical Process Industries, Common Wealth Science Council, UK.
4. Trevor A Klett, Hazop and Hazon,Institute of Chemical Engineering.

Course Faculty **Module Coordinator** **Chairman BoS/SFE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF906 **Course Name: Safety in Industries**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain the General safety rules, principles, maintenance, Inspections in Foundry Operations.*	2	3	-	-	-	3	3	2	-	-	-	2	-	-
CO2	*Apply the concepts of safety in design of building fire safety.*	2	3	-	-	-	3	3	2	-	-	-	2	-	-
CO3	*Develop the safety in industrial operations.*	2	3	-	-	-	3	3	2	-	-	-	2	-	-
CO4	*Recall about welding, common hazards in welding, personal protective equipment and safety precautions in welding.*	2	3	-	-	-	3	3	2	-	-	-	2	-	-
CO5	*Illustrate on safety in finishing, inspection and testing of machines.*	2	3	-	-	-	3	3	2	-	-	-	2	-	-
	Average	**2**	**3**	**-**	**-**	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/SFE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF907	**FOOD SAFETY (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1	*Apply the knowledge on food quality in food industry.*	*Apply*
CO2	*Identify the food additives and food contaminants and their chemical and toxicological properties.*	*Apply*
CO3	*Summarize the effects of pests on food and the various methods for controlling them.*	*Understand*
CO4	*Explain about the national and international regulations for biosafety.*	*Understand*
CO5	*Demonstrate an ability to recognize the environmental, social and ethical implications of biotech applications.*	*Understand*

UNIT - I **FOOD QUALITY** **[09]**

Objective and importance of quality control, classification of quality attributes and its role in food quality, quality assessment of food materials (fruits, cereals, milk and meat), types of quality characteristics of food, methods used for determination of the quality in food industry, factors influencing the quality of food, sample and sampling methods of quality evaluation.

UNIT - II **FOOD SANITATION** **[09]**

Factors contributing to physical, chemical and biological contamination in food chain, prevention and control of food borne hazards, definition and regulation of food sanitation, sources of contamination, personal hygiene-food handlers, cleaning compounds, sanitation methods and pest control, sanitation and safety in foodservices.

UNIT - III **FOOD SAFETY** **[09]**

Principles of food safety and quality, quality assurance, Good Agricultural Practices (GAP), Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP), Good Veterinary Practice (GVP), Applications of HACCP in food safety, Current challenges to food safety.

UNIT - IV **FOOD LAWS AND REGULATIONS** **[09]**

Basic concepts of food standards, Role of national regulatory agencies: Food safety and Standards Act: salient provision and prospects, FSSAI, PFA, certification- AGMARK, ISI (BIS). Role of international regulatory agencies: USDA, FDA, BRC, WHO, FAO, Codex Alimentarius commission, TO agreements: SPS and TBT agreements, ISO and its standards for food quality and safety.

UNIT - V **FOOD SAFETY AUDITING** **[09]**

Food surveillance: International and national practices, procedure and protocols, food alerts, traceability and food product recall. Export and import of food in India: introduction, import and export policies, FDA import policy, export-import policy, export control systems. Import intelligence and alert systems, packaging and labelling, specifications and certifications.

Total = 45 Periods

Text Books:

1. Fleming & Hunt, Biological Safety, Principles and Practices, ASM Press, Fourth Edition,2006.
2. Fawatt, H.H. and Wood, W.S., Safety and Accident Prevention in Chemical Operation, Wiley Interscience, 1965.

Reference Books:

1. N.G. Marriott, G.W. Schilling and B. Robert, Principles of Food Sanitation, Springer, Fifth Edition 2018.
2. I. Alli, Food Quality Assurance - Principles & Practices, CRC Press, India, 2018.
3. Cynthia A. Robert, The Food Safety Information HandBook, 2009.
4. Early, Guide to Quality Management Systems for the Food Industry, Springer, First Edition, 2005.

Course Faculty **Module Coordinator** **Chairman BoS/SFE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF907 **Course Name: Food Safety**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Apply the knowledge on food quality in food industry.*	3	3	3	-	-	3	3	3	-	-	-	3	-	-
CO2	*Identify the food additives and food contaminants and their chemical and toxicological properties.*	3	3	3	-	-	3	3	3	-	-	-	3	-	-
CO3	*Summarize the effects of pests on food and the various methods for controlling them.*	3	3	3	-	-	3	3	3	-	-	-	3	-	-
CO4	*Explain about the national and international regulations for biosafety.*	3	3	3	-	-	3	3	3	-	-	-	3	-	-
CO5	*Demonstrate an ability to recognize the environmental, social and ethical implications of biotech applications.*	3	3	3	-	-	3	3	3	-	-	-	3	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/SFE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF908	**SAFETY MANAGEMENT AND ITS PRINCIPLE (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1	*Demonstrate the knowledge and understanding of basic terms in safety management.*	*Understand*
CO2	*Compare safety organizational requirements for effective safety management.*	*Understand*
CO3	*Solve the workplace hazards and apply controls measures using hierarchy of control.*	*Apply*
CO4	*Develop the safety performance of an organization.*	*Apply*
CO5	*Explain accident investigation methodologies and apply systematic procedure to identify and unearth the root cause of the incident and accident.*	*Understand*

UNIT - I INTRODUCTION OF SAFETY [09]

Safety – Goals of safety engineering – Need for safety, Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents, History of safety movement – Theories of accident causation.

UNIT - II SAFETY ORGANIZATION [09]

Objectives, Types, Functions, Role of management, Supervisors, Workmen, Unions, Government and voluntary agencies in safety – Safety policy – Safety Officer – Responsibilities – Safety committee – Need, Types, Advantages.

UNIT - III ACCIDENT PREVENTION AND TRAINING [09]

Accident Prevention Methods – Engineering, Education and Enforcement, Safety Education & Training – Importance, Various training methods, Effectiveness of training, Behavior Oriented Training – Communication – Purpose, Barrier to communication. Housekeeping: Responsibility of management and employees – Advantages of good housekeeping – 5 ‘s of housekeeping – Work permit system – objectives, hot work and cold work permits. Typical industrial models and methodology – Entry into confined spaces.

UNIT - IV MONITORING SAFETY PERFORMANCE [09]

Frequency rate, Severity rate, Incidence rate, Activity rate – Cost of accidents – Computation of Costs – Utility of Cost data – Plant safety inspection types, Inspection procedure – Safety sampling techniques – Job safety Analysis (JSA), Safety surveys, Safety audits – Safety Inventory Technique.

UNIT - V INVESTIGATION ON ACCIDENTS [09]

Why? When? Where? Who? & How? Basics – Man – Environment & Systems. Process of Investigation – Tools – Data Collection - Handling witnesses - Case study. Accident analysis – Analytical Techniques – System Safety – Change Analysis.

Total = 45 Periods

Text Books:

1. N.V. Krishnan, Safety Management in Industry, Jaico Publishing House, 1997.
2. Ronald P. Blake, Industrial Safety, Prentice Hall, New Delhi, 1973.

Reference Books:

1. Willie Hammer, Occupational Safety Management and Engineering, Prentice Hall, Fifth Edition, 2007.
2. Ted S. Ferry, Modern Accident Investigation and Analysis, John Wiley & Sons, Second Edition, 2007.
3. John V. Grimaldi and Rollin H. Simonds, Safety Management, American Society of Safety Engineers, Fifth Edition, 1993.
4. Accident Prevention Manual for Industrial Operations, National Safety Council, Chicago, 1982.

Course Faculty **Module Coordinator** **Chairman BoS/SFE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF908 **Course Name: Safety Management and its Principles**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Demonstrate the knowledge and understanding of basic terms in safety management.*	3	2	2	-	-	3	3	2	2	-	-	1	-	-
CO2	*Compare safety organizational requirements for effective safety management.*	3	2	2	-	-	3	3	2	2	-	-	1	-	-
CO3	*Solve the workplace hazards and apply controls measures using hierarchy of control.*	3	2	2	-	-	3	3	2	2	-	-	1	-	-
CO4	*Develop the safety performance of an organization.*	3	3	2	-	-	3	3	2	2	-	-	1	-	-
CO5	*Explain accident investigation methodologies and apply systematic procedure to identify and unearth the root cause of the incident and accident.*	3	3	2	-	-	3	3	2	2	-	-	1	-	-
	Average	**3**	**2**	**2**	**-**	**-**	**3**	**3**	**2**	**2**	**-**	**-**	**1**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/SFE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF909	**SAFETY IN AUTOMOBILE ENGINEERING (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1	*Explainabout automobile engines, fuel systems and CMV rules for proto type testing and emission standards.*	*Understand*
CO2	*Demonstrate the electrical systems-ignition, lighting, horn, wipers, HVAC and concerned CMV rules*	*Understand*
CO3	*Classifythe transmission systems - clutch, gearbox, steering, and differential. Chassis - springs, axles and brakes and corresponding CMV rules.*	*Understand*
CO4	*Outline the lubricating systems, cooling systems and miscellaneous systems. CMV rules for safety devices.*	*Understand*
CO5	*Choosepassive and active safety.*	*Apply*

UNIT - I INTRODUCTION AND EMISSION [09]

Types of automobiles. Limiting Dimensions as per Central Motor Vehicles Rules. Engines - Classification, Construction, Materials of engine components. Prototype Testing as per Central Motor Vehicles Rules. Fuel System - Fuel tank, Fuel filter, Types of Fuel system. Carburettor – Simple and Modern, Fuel injection System. Emission Standards as per CMV Rules.

UNIT - II ELECTRICITY STORAGE AND ITS UTILLIZATION [09]

Electrical System - Storage Battery Operations and Maintenance. Ignition System - Coil andMagneto Ignition System. Starting System, Lighting System, Horn System-Wind Shield WiperMotors, Fans, Heaters, Trafficators. Automobile air conditioning. Central Motor Vehicles Rulesregarding Lighting, Windshields, Wipers.

UNIT - III TRANSMISSION SYSTEM AND BRAKING SYSTEM [09]

Transmission System - Clutches - operation and fault finding of clutches, Fluid Flywheel, Gear Box types, Steering Systems, Chassis Springs, and Suspension. Differential, Dead and Live axles, Rims, Tyre etc. Brakes - Types, construction and fault finding. CMV Rules-Brakes, Steering & Tyre.

UNIT - IV LUBRICATION AND COOLING SYSTEM [09]

Lubrication Systems-Types, Components, Lubricating oil, Cooling system- Details of components, Study of Systems, Types. Miscellaneous - Special gadgets and accessories for fire fighting vehicles. Automobile accidents. CMV Rules regarding Safety devices for drivers, passengers.

UNIT - V PASSIVE AND ACTIVE SAFETY [09]

Design of body for safety, deceleration of vehicle, passenger. Concept of crumble zone, SafetyCage. Optimum crash pulse. Barrier test - Crash tests - Antilock braking system, Stability Control. Adaptive cruise control, Lane Keep Assist System, Collision warning, avoidance system, Blind Spot Detection system, Driver alertness detection System. ADAS, DAT.

Total = 45 Periods

Text Books:

1. Robert Bosch GmbH, Safety, Comfort and Convenience Systems,Wiley, Third Edition, 2007.
2. Ljubo Vlacic, Michel Parent, Fumio Harashima, Intelligent Vehicle Technologies Theory and Applications, ButterworthHeinemann, 2001.

Reference Books:

1. GBS Narang, Automobile Engineering, Khanna Publishers, Delhi,2014.
2. Kirpal Singh, Automobile Engineering, Vol.I &II. Standard publishes, Delhi, Thirteenth Edition,2012.
3. Joseph Heitner, AutomotiveMechanics-Principles & Practices, CBS Publisher-Delhi, Second Edition, 2006.
4. P. L. Kohli, Automotive Electrical Equipment's, McGraw Hill, New Delhi,1993.

Course Faculty **Module Coordinator** **Chairman BoS/SFE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF909 **Course Name: Safety in Automobile Engineering**

CO	Course Outcomes	Programme Outcomes												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain about automobile engines, fuel systems and CMV rules for proto type testing and emission standards.*	3	3	2	-	-	3	3	3	-	-	-	2	-	-
CO2	*Demonstrate the electrical systems - ignition, lighting, horn, wipers, HVAC and concerned CMV rules.*	3	3	2	-	-	3	3	3	-	-	-	2	-	-
CO3	*Classify the transmission systems - clutch, gearbox, steering, and differential. Chassis - springs, axles and brakes and corresponding CMV rules.*	3	3	2	-	-	3	3	3	-	-	-	2	-	-
CO4	*Outline the lubricating systems, cooling systems and miscellaneous systems. CMV rules for safety devices.*	3	3	2	-	-	3	3	3	-	-	-	2	-	-
CO5	*Choose passive and active safety.*	3	3	2	-	-	3	3	3	-	-	-	2	-	-
		3	**3**	**2**	**-**	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/SFE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF910	**SAFETY IN TRANSPORTATION (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1	*Explain the Working of railways and safety aspects in railway operation*	*Understand*
CO2	*Apply the Basic geometric design features of roads*	*Apply*
CO3	*Summarize about traffic studies and traffic safety*	*Understand*
CO4	*Outline the basic layout and facilities of docks and harbour*	*Understand*
CO5	*Choose the Working of airways and safety aspects in airway operation*	*Remember*

UNIT - I RAILWAY ENGINEERING [09]

Introduction of Railway Engineering: Permanent way. Curves, super-elevation, negative super elevation, transition curve, grade compensation on curves. Railway operation and control - points and crossings turn-out. Signalling and interlocking. Centralized traffic control. Railway accidents & safety. Rapid transit railways - types, merits & demerits.

UNIT - II HIGHWAY ENGINEERING [09]

Introduction of Highway Engineering: Classification of highways and urban road patterns. Typical cross section of roads. Factors controlling the alignment of roads. Basic geometric design - stopping and overtaking sight distances.

UNIT - III TRAFFFIC ENGINEERING [09]

Introduction of Traffic Engineering: Traffic characteristics. Various traffic studies and their applications. Traffic signals. Carriage-way markings. Traffic islands. Highway intersections. Principles of highway lighting. Road Accidents prevention, investigation and reduction.

UNIT - IV HARBOUR AND DOCK ENGINEERING [09]

Introduction of Harbour & Dock Engineering: Water transportation, classification of harbours, accessibility and size, ports, Indian ports. Layout of ports, breakwater, facilities (in brief) for docking, repair, approach, loading and unloading, storing and guiding.

UNIT - V AIR TRANSPORTATIONENGINEERING [09]

Classification of air transportation, Types of air craft engines - Propellants-feeding systems – Ignition and combustion - Theory of rocket propulsion - Performance study - Staging - Terminal and characteristic velocity-Applications – spaceflights. Air way accidents & safety.

Text Books:

1. B.S. Dhillon, Transportation Systems, Reliability and Safety, CRC Press, 2011.
2. John Khisty C, Kent Lall B, Transportation Engineering - An Introduction, Prentice Hall of India, New Delhi, Third Edition 2002.

Reference Books:

1. Srinivasan, R., Harbour, Dock and Tunnel Engineering, Charotar Publishing House Pvt. Ltd, Anand,2013.
2. Chandra, S. & Agarwal, M. M. Railway Engineering, Oxford University Press, New Delhi, 2007.
3. Kadiyali, L. R., Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, 2004.
4. Khanna, S. K. and Justo, C.E.G., Highway Engineering, Nem Chand & Brothers, New Delhi, Nineth Edition,2001.

Course Faculty **Module Coordinator** **Chairman BoS/SFE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SAFETY AND FIRE ENGINEERING
CO PO MAPPING

Regulation: R2020

Course Code: 20SF910 **Course Name: Safety in Transportation**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain the Working of railways and safety aspects in railway operation*	3	3	3	-	-	2	-	2	-	-	-	3	-	-
CO2	*Apply the Basic geometric design features of roads*	3	3	3	-	-	2	-	2	-	-	-	3	-	-
CO3	*Summarize about traffic studies and traffic safety*	3	3	3	-	-	2	-	2	-	-	-	3	-	-
CO4	*Outline the basic layout and facilities of docks and harbour*	3	3	3	-	-	2	-	2	-	-	-	3	-	-
CO5	*Choose the Working of airways and safety aspects in airway operation*	3	3	3	-	-	2	-	2	-	-	-	3	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**2**	**-**	**2**	**-**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/SFE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20SH901	**APPLI CATIONS OF STATISTICS** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes : On Completion of this course, the student will be able to		**Cognitive Level**
CO1	*Analyze the measures of central tendency and dispersion.*	*Analyze*
CO2	*Applying the concepts of Correlation and Regression analysis*	*Apply*
CO3	*Testing the samples using method of hypothesis to obtain inferences.*	*Remember*
CO4	*Develop their skills in Design of Experiments.*	*Remember*
CO5	*Solving Non Parametric data to obtain inferences.*	*Understand*

UNIT– I DESCRIPTIVE STATISTICS [09]

Introduction to Statistics, Measures of Central Tendency - Mean, Median, Mode, Weighted Mean, Geometric Mean, Harmonic Mean, Measures of Variability- Range, Inter-Quartile Range, Variance, Standard Deviation, Coefficient of Variation.

UNIT – II CORRELATION AND REGRESSION ANLYSIS [09]

Types of Correlation-Karl Pearson's Coefficient of Correlation- Spearman's Rank Correlation-Regression Analysis-Uses-Regression equations-X on Y and Y on X Estimation.

UNIT – III TESTING OF HYPOTHESIS [09]

Large sample test based on Normal distribution for single mean and difference of means - Tests based on t - F distributions for testing means and variances-Chi-Square Test.

UNIT – IV DESIGN OF EXPERIMENTS [09]

Analysis of variance - One-way and two-way classifications - Completely randomized design - Randomized block design - Latin square design.

UNIT – V NON PARAMETRIC TESTS [09]

The Sign Test- Rank Sum Test- Mann-Whitney U Test, One Sample run Test-Spearman's Rank Correlation and Kruskal-Wallis Test (H-test).

Total (L: 45 T:0) = 45 Periods

Text Books :

1 Gupta .S.P.,Statistical Methods , Sultan Chand & Sons Educational Publishers ,New Delhi, Thirty first Edition,2002.

2 Ross, S.M., Introduction to Probability and Statistics for Engineers and Scientists, Elsevier ,Third Edition,2004.

Reference Books :

1 Srivatsava TN and Shailaja Rego, Statistics for Management, Tata McGraw Hill,Fifth Edition, 2008.

2 Walpole. R.E., Myers. R.H., and Ye. K., Probability and Statistics for Engineers and Scientists, Pearson Education, Asia , Eighth Edition, 2007.

3 Richard I. Levin, David S. Rubin, Statistics for Management, Pearson Education, Seventh Edition, 2011.

4 Pillai R.S.N and Bagavathi.V ,Statistics ,S.Chand Publishers ,New Delhi, Seventeenth Reprint Edition 2008.

Course Faculty **Module Coordinator** **Chairman BoS / S&H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SCIENCE AND HUMANITIES
CO-PO MAPPING

Regulation : R 2020

Course Code: 20SH901 **Course Name : APPLI CATIONS OF STATISTICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Analyze the measures of central tendency and dispersion.*	3	3	3	3										
CO2	*Applying the concepts of Correlation and Regression analysis*	3	3	3	3										
CO3	*Testing the samples using method of hypothesis to obtain inferences.*	3	3	3	3										
CO4	*Develop their skills in Design of Experiments*	3	3	3	3										
CO5	*Solving Non Parametric data to obtain inferences.*	3	3	3	3										
	Average	3	3	3	**3**										

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / S&H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SH902	**COMBINATORICS AND GRAPH THEORY** (Open Elective)	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes : On Completion of this course, the student will be able to		**Cognitive Level**
CO1	*Interpret the concept of combinatorics Principles in Computer applications.*	*Understand*
CO2	*Acquire knowledge in Recurrences and Generating Functions.*	*Evaluate*
CO3	*Applying the concepts of graph theory*	*Apply*
CO4	*Constructing algorithm using Trees..*	*Remember*
CO5	*Developing Skills in Colouring and Directed Graphs.*	*Analyze*

UNIT– I COMBINATORICS [09]

The pigeon-hole principle - Basic counting problems- The binomial coefficients (the binomial theorem, algebraic vs. combinatorial proof, Pascal's identity, Pascal's triangle, Catalan numbers) - the principle of inclusion and exclusion.

UNIT – II RECURRENCES [09]

Fibonacci numbers - The substitution method- Linear recurrences (mostly homogenous recurrences, the characteristic polyr Generating functions.

UNIT – III INTRODUCTION TO GRAPH THEORY [09]

. Definition - examples – subgraphs – complements and graph isomorphism – Euler trail and circuits – planar graphs – Hamilton paths and cycles.

UNIT – IV TREES [09]

Definition – rooted trees – trees and sorting – weighted trees and prefix codes – bi connected components and Articulation points.

UNIT – V MATRICES, COLOURING AND DIRECTED GRAPH [09]

Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four color problem – Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness – Euler graphs.

Total (L: 45 T:0) = 45 Periods

Text Books :

1. Grimaldi, R.P. Discrete and Combinatorial Mathematics: An Applied Introduction, Fourth Edition, Pearson Education Asia, Delhi, 2007.
2. Narsingh Deo, Graph Theory With Application to Engineering and Computer Science, Prentice Hall of India, Second Edition, 2003.

Reference Books :

1. Douglas B. West, Introduction to Graph Theory, Prentice-Hall of India, Second Edition, 2012.
2. John Clark, Derek Allan Holton, A first look at Graph Theory, World Scientific Publishing Company Ilustrated edition, Reprint, 1991
3. Rosen, K.H., Discrete Mathematics and its Applications, Seventh Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
4. Diestel, R, Graph Theory, Springer, Third Edition,2006

Course Faculty **Module Coordinator** **Chairman BoS / S&H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SCIENCE AND HUMANITIES
CO-PO MAPPING

Regulation : R 2020

Course Code: 20SH902 **Course Name: COMBINATORICS AND GRAPH THEORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Interpret the concept of combinatorics Principles in Computer applications.*	3	3	3	3										
CO2	*Acquire knowledge in Recurrences and Generating Functions.*	3	3	3	3										
CO3	*Applying the concepts of graph theory*	3	3	3	3										
CO4	*Constructing algorithm using Trees..*	3	3	3	3										
CO5	*Developing Skills in Colouring and Directed Graphs.*	3	3	3	3										
	Average	3	3	3	**3**										

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / S&H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SH903	**OPTIMIZATION TECHNIQUES** (Open Elective)	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course.

Course Outcomes : On successful completion of the course , the student will be able to		**Cognitive Level**
CO1	*Enable to develop the decision making during the uncertain situations by linear programming approach.*	*Apply*
CO2	*Identify to minimize the Transportation and Assignment cost and maximize the profit in Industries.*	*Analyze*
CO3	*Developing the network techniques in project scheduling.*	*Apply*
CO4	*Study the importance of stock controlling to maximize the profit.*	*Remember*
CO5	*Understand and apply the Replacement and sequencing methods in manufacturing engineering.*	*Understand*

UNIT - I LINEAR PROGRAMMING PROBLEM [09]

Introduction - scope and role of OR - phases of OR - limitations of OR - linear programming problem - formulation of linear programming problem - optimum solution by graphical method - simplex method (using slack variables only).

UNIT - II TRANSPORTATION AND ASSIGNMENT PROBLEM [09]

Transportation Models (Minimizing and Maximizing Cases) - Balanced and unbalanced cases - Initial Basic feasible solution by North West Corner Rule, Least cost and Vogel's approximation methods. Check for optimality by Modified method.

Assignment Models (Minimizing and Maximizing Cases) - Balanced and Unbalanced Cases - Solution by Hungarian method.

UNIT - III NETWORK MODELS [09]

Network - Fulkerson's rule - construction of a network - critical path method (CPM) - optimistic, pessimistic and most likely time estimates - project scheduling by PERT analysis.

UNIT - IV INVENTORY MODEL [09]

Types of Inventory - Deterministic inventory models - EOQ and EBQ models with and without shortages - Quantity discount model - Price breaks - probabilistic inventory model.

UNIT - V REPLACEMENT MODELS AND SEQUENCING [09]

Replacement of items that deteriorate with time - value of money changing with time - not changing with time - optimum replacement policy - individual and group replacement. Sequencing problem - assumptions - processing of 'n' jobs in 2 machines, 'n' jobs with 'm' machines.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1. P.K. Gupta and Man Mohan,Problems in Operations Research, S. Chand and Co, New Delhi ,Fourteenth Edition, 2016.
2. Wayne. L. Winston, Operations Research applications and algorithms, Thomson learning, New Delhi, Tenth Edition 2016.

Reference Books :

1. Hira and Gupta, Problems in Operations Research, S. Chand and Co,New Delhi, Eighth Edition, 2015.
2. Taha H.A, Operation Research, Pearson Education,New Delhi, Sixth Edition, 2016.
3. J k Sharma , Operation Research, Macmillan India Pvt. Ltd., New Delhi, Seventh Edition,2007
4. R.Panneerselvam Operations Research, PHI Learning, Second Edition,2011.

Course Faculty **Module Coordinator** **Chairman BoS / S&H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SCIENCE AND HUMANITIES
CO-PO MAPPING

Regulation : R 2020

Course Code:20SH903 **Course Name : OPTIMIZATION TECHNIQUES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Enable to develop the decision making during the uncertain situations by linear programming approach.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	*Identify to minimize the Transportation and Assignment cost and maximize the profit in industries*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	*Developing the network techniques in project scheduling.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	*Study the importance of stock controlling to maximize the profit.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	*Understand and apply the Replacement and sequencing methods in manufacturing engineering.*	3	3	3	3	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / S&H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SH904	**BASIC MILITARY EDUCATION AND TRAINING**(Open Elective)	3	0	0	3

Prerequisite: **Only NCC Cadets are eligible for opting into the course.**

Course Outcomes: On Completion of this course , the student will be able to		***Cognitive level***
CO1	*Develop the character, camaraderie of NCC cadets*	*Apply*
CO2	*Inculcate the discipline and secular outlook.*	*Apply*
CO3	*Educate weapon handling and training.*	*Understand*
CO4	*Learn the quality of selfless service among the cadets by working as a team.*	*Remember*
CO5	*Learn the basis of military management.*	*Understand*

UNIT – I NCC ORGANIZATION & NATIONAL INTEGRATION [9]

NCC Organization – History of NCC- NCC Organization- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and advantages of NCC Training- NCC badges of Rank- Honours and Awards – Incentives for NCC cadets by central and state govt. National Integration- Unity in diversity- contribution of youth in nation building- national integration council- Images and Slogans on National Integration.

UNIT – II BASIC PHYSICAL TRAINING & DRILL [9]

Basic physical Training – various exercises for fitness (with Demonstration). Food – Hygiene and Cleanliness.

Drill- Words of commands- position and commands- sizing and forming- saluting- marching- turning on the march and wheeling- saluting on the march- side pace, pace forward and to the rear- marking time- Drill with arms- ceremonial drill- guard mounting.(WITH DEMONSTRATION)

UNIT – III WEAPON TRAINING [9]

Main Parts of a Rifle- Characteristics of 5.56mm INSAS rifle- Characteristics of .22 rifle- loading and unloading – position and holding- safety precautions – range procedure- MPI and Elevation- Group and Snap shooting- Long/Short range firing(WITH PRACTICE SESSION) - Characteristics of 7.62mm SLR- LMG- carbine machine gun.

UNIT – IV SOCIAL AWARENESS AND COMMUNITY DEVELOPMENT [9]

Aims of Social service-Various Means and ways of social services- family planning – HIV and AIDS- Cancer its causes and preventive measures- NGO and their activities- Drug trafficking- Rural development programmes - MGNREGA-SGSY-JGSY-NSAP-PMGSY-Terrorism and counter terrorism- Corruption – female feticide -dowry –child abuse-RTI Act-RTE Act- Protection of children from sexual offences act- civic sense and responsibility

UNIT – V SPECIALIZED SUBJECT (ARMY) [9]

Basic structure of Armed Forces- Military History – War heroes- battles of Indo-Pak war- Param Vir Chakra- Career in the Defense forces- Service tests and interviews-Field craft and Battle craft-Basics of Map reading including practical.

Total = 45 Periods

Text Books :

1 National Cadet Corps- A Concise handbook of NCC Cadets by Ramesh Publishing House, New Delhi, 2014.

Reference Books :

1 *Cadets Handbook – Common Subjects SD/SW published by DG NCC, New Delhi.*

2 *Cadets Handbook- Specialized Subjects SD/SW published by DG NCC, New Delhi*

3 *NCC OTA Precise published by DG NCC, New Delhi.*

Course Faculty **Module Coordinator** **Chairman BoS / S&H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SCIENCE AND HUMANITIES
CO-PO MAPPING

Regulation : R 2020

Course Code: 20SH904 **Course Name: BASIC MILITARY EDUCATION AND TRAINING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Display sense of patriotism, secular values and shall be transformed into motivated youth who will contribute towards nation building through national unity and social cohesion.	3	1	1	1	3	3	3	3	3	3	-	-	-	-
CO2	Demonstrate Health Exercises, the sense of discipline, improve bearing, smartness, turnout, develop the quality of immediate and implicit obedience of orders	3	1	1	1	3	3	3	3	3	3	-	-	-	-
CO3	Basic knowledge of weapons and their use and handling.	3	2	1	1	3	3	3	3	3	3	-	-	-	-
CO4	Understanding about social evils and shall inculcate sense of whistle blowing against such evils and ways to eradicate such evils	3	2	1	1	3	3	3	3	3	3	-	-	-	-
CO5	Acquaint, expose & provide knowledge about Army/Navy/ Air force and to acquire information about expansion of Armed Forces, service subjects and important battles.	3	2	1	1	3	3	3	3	3	3	-	-	-	-
Average		3	2	1	1	3	3	3	3	3	3	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / S&H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **2020**

		L	T	P	C
20SH905	**PROFESSIONAL COMMUNICATION (Open Elective)**	**3**	**0**	**0**	**3**

Prerequisite:

Course Outcomes : On Successful Completion of the Course, the student will be able to		**Cognitive Level**
CO1	*Organize and compose resume' and SWOT analysis.*	*Understand*
CO2	*Prioritize the skills for interviews and job hunt.*	*Understand*
CO3	*Interpret by Listening and reading a text and comprehend it.*	*Understand*
CO4	*Identify the purpose of writing short messages and presentation.*	*Understand*
CO5	Optimize the speaking skills to do well in Group Discussion.	*Understand*

UNIT – I SWOT Analysis and Resume' Writing [9]

SWOT Analysis – Key SWOT Questions- Assessment of strength and weakness – Mind map and Activity – Job Application and Resume' – Types of Resume' – Common mistakes in Resume' writing – Cover Letter (Email).

UNIT – II Interview Skills [9]

Types of Interviews – Telephone Interview (HR and Technical) – Dos and Don'ts in telephone Interview – Video Interviews – Practice for successful interviews – Video Samples.

UNIT - III Listening and Reading [9]

Listening – Listening and typing – Listening and sequencing of sentences – Filling in the blanks – Listening and answering questions.

Reading – Filling in the blanks – Cloze exercise – Vocabulary building – Reading and answering questions.

UNIT - IV Writing Short Messages and Presentation Skills [9]

Writing Memos – Email writing - Business Email – Elements of effective presentation – Structure of presentation – Audience analysis – Body Language.

UNIT - V Group Discussion and Essay Writing [9]

Introduction to Group Discussion – Structure of GD – Brainstorming the topic – Body Language – Mock GD – Five steps to writing an essay – writing short essays.

Total = 45 Periods

Text Books :

1 Ravindran, Padma, English for Work, Ebek Language Laboratories Private Limited, Trichy, First Edition, 2011

2 Kalpana V, Communication Skills Laboratory Manual, Vijay Nicole Imprints Private Limited, Chennai, First Edition,2013

Reference Books :

1 Norman Whitby, Business Benchmark: Pre-Intermediate to Intermediate –BEC Preliminary, Cambridge University Press, New Delhi, First Edition, 2008.

2 Meenakshi Raman and Sangeeta Sharma, Technical Communication English for Engineers, Oxford University Press, New Delhi, 2008.

3 Rizvi Ashraf M, Effective Technical Communication, Mc GrawHill, New Delhi, 28th Reprint, 2015.

4 Department of English, English for Technologies and Engineers, Orient Black Swan, Hyderabad, First Edition, 2016.

Course Faculty **Module Coordinator** **Chairman BoS / S&H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SCIENCE AND HUMANITIES
CO-PO MAPPING

Regulation : R 2020

Course Code: 20SH905 **Course Name : PROFESSIONAL COMMUNICATION**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Organize and compose resume' and SWOT analysis.									3	3		2		
CO2	Prioritize the skills for interviews and job hunt.									3	3		2		
CO3	Interpret by Listening and reading a text and comprehend it.									3	3		2		
CO4	Identify the purpose of writing short messages and presentation.									3	3		2		
CO5	Optimize the speaking skills to do well in Group Discussion.									3	3		2		
	Average									**3**	3		2		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / S&H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

	FUNDAMENTALS OF NANOSCIENCE AND TECHNOLOGY	L	T	P	C
20SH906	(Open Elective)	3	0	0	3

Prerequisite: *NIL*

Course Outcomes: On Completion of this course , the student will be able to		***Cognitive level***
CO1	*Learn the basics of nanotechnology in physics, chemistry and biology*	*Remember*
CO2	*Recognize the methods of preparation of nanomaterials*	*Analyze*
CO3	*Relate the characterization techniques for confirming nanomaterials*	*Apply*
CO4	*Categorize the nanomaterials and its preparation*	*Analyze*
CO5	*Identify the area of application and its field*	*Understand*

UNIT – I INTRODUCTION [9]

Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thin filmsmultilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties.

UNIT – II GENERAL METHODS OF PREPARATION [9]

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapor phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT – III NANOMATERIALS [9]

Nanoforms of Carbon – Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis (arc-growth, laser ablation, CVD routes, Plasma CVD), structure-properties.Applications- Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nano alumina, CaO, AgTiO2, Ferrites, Nano clays- functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

UNIT – IV CHARACTERIZATION TECHNIQUES [9]

X-ray diffraction technique, Scanning Electron Microscopy – experimental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, STM, ESCA-Nanoindentation.

UNIT – V APPLICATIONS [9]

Nano InfoTech: Information storage- nano computer, molecular switch, super chip, nanocrystal, Nano biotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery, Bioimaging – Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nano sensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sun barrier products – In Photostat, printing, solar cell, battery.

Total = 45 Periods

Text Books :

1. John Dinardo. N, “Nanoscale characterization of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000
2. Introduction to Nanoscience and Nanotechnology by Chattopadhyay K.K 1 January 2013

Reference Books :

1. Timp .G, “Nanotechnology”, AIP press/Springer, 1999.
2. AkhleshLakhtakia (Editor),“The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.
3. NANO: The Essentials: Understanding Nanoscience and Nanotechnology by T. Pradeep
4. An Introduction To Nanomaterials And Nanoscience (Pb 2020) by DAS A

Course Faculty **Module Coordinator** **Chairman BoS / S&H**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF SCIENCE AND HUMANITIES
CO-PO MAPPING

Regulation : R 2020

Course Code:20SH906 **Course Name : FUNDAMENTALS OF NANOSCIENCE AND TECHNOLOGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Learn the basics of nanotechnology in physics, chemistry and biology	3	3			2			1		2		2		
CO2	Recognize the methods of preparation of nanomaterials	3	3			2			1		2		2		
CO3	Relate the characterization techniques for confirming nanomaterials	3	3			2			1		2		2		
CO4	Categorize the nanomaterials and its preparation	3	3			2			1		2		2		
CO5	Identify the area of application and its field	3	3			2			1		2		2		
	Average	3	3			2			1		2		2		

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Course Faculty **Module Coordinator** **Chairman BoS / S&H**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CE901 **ARCHITECTURAL HERITAGE OF INDIA** (Open Elective)

L	T	P	C
3	0	0	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Illustrate various materials used and construction style of Indus Valley Civilization*	*Understand*
CO2:	*Demonstrate the materials used and construction style of Chera, Chola and Pandya architecture*	*Understand*
CO3:	*Describe the materials used and construction style of Mughal architecture*	*Understand*
CO4:	*Explain the various materials and construction style of British* architecture	*Understand*
CO5:	*Describe various materials and construction style of Portuguese, Dutch, French and Danish*	*Understand*

UNIT - I **INDUS VALLEY CIVILIZATION** **[09]**

Indus valley civilization – Chronological introduction – Construction style – Materials used – The cities Harappa, lothal and Mohenjo-Daro, The great bath – The granary at Harappa – The assembly hall – Ajanta-Ellora Cave temples – Mahabodhi temple complex

UNIT - II **SOUTH INDIAN ARCHITECTURE** **[09]**

Chera-Chola-Pandya architecture – Chronological introduction – Construction style – Materials used – Brihadeeswarar Temple – Meenakshi Temple – Kalinga – Chalukya – Pallava architecture – Mahabalipuram stone temples – Khajuraho – MuskinBhanvi – Konark Sun Temple – Hoysala – Vijayanagara architecture – twin temples Mosale – Virupaksha temple Raya Gopura at Hampi

UNIT - III **MUGHAL ARCHITECTURE** **[09]**

Mughal architecture – Chronological introduction – Construction style – Materials used – QutubMinar – TajMahal – Humayun's Tomb – Redfort – Fatehpur Sikri – Agra fort – Jama Masjid – Rajput civil architecture – Chronological introduction – Construction style – Materials used – All hill forts of Rajasthan

UNIT - IV **BRITISH ARCHITECTURE** **[09]**

British colonial architecture – Chronological introduction – Construction style – Materials used – Buildings in Chennai, Mumbai, Shimla – Churches – Mountain railways of India-bridges.

UNIT - V **COLONIAL ARCHITECTURE** **[09]**

Other colonial architecture – Portuguese-Dutch-French-Danish – Chronological introduction – Construction style – Materials used – Churches – Churches and Convents of Goa and Cochi – French town of Puducherry – Tranquebar fort – Bungalow on the beach

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Bindia Thapar, Surat Kumar Manto, and Suparna Bhalla., Introduction to Indian Architecture: Arts of Asia, Periplus Editions (HK) ltd, Hong Kong, First Edition, 2005
2. Sandhya Ketkar., The History of Indian Art, Jyotsna Prakashan Publisher, Maharashtra, E – Edition, 2020

Reference Books :

1. Christopher Tadgell., The History of Architecture in India, Phaidon Press Ltd, New York, First Edition, 1990
2. Mark M. Jarzombek, Vikramaditya Prakash, Francis D. K. Ching., A Global History of Architecture, John Wiley & Sons, Hoboken, Second Edition, 2010
3. https://nptel.ac.in/courses/124106009
4. https://ncert.nic.in/textbook/pdf/kefa106.pdf

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE901 **Course Name: Architectural Heritage of India**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Illustrate various materials used and construction style of Indus Valley Civilization*	3	3	-	2	-	2	2	-	-	-	-	3	-	-
CO2	*Demonstrate the materials used and construction style of Chera, Chola and Pandya architecture*	3	3	-	2	-	2	2	-	-	-	-	3	-	-
CO3	*Describe the materials used and construction style of Mughal architecture*	3	3	-	1	-	2	2	-	-	-	-	3	-	-
CO4	*Explain the various materials and construction style of British* architecture	3	3	-	2	-	2	2	-	-	-	-	3	-	-
CO5	*Describe various materials and construction style of* Portuguese, Dutch, French and Danish	3	3	-	1	-	2	2	-	-	-	-	3	-	-
	Average	**3**	**3**	**-**	**2**	**-**	**2**	**2**	**-**	**-**	**-**	-	**3**	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CE902 **BUILDING PLANNING AND CONSTRUCTION** (Open Elective)

L	T	P	C
3	0	0	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline the factors to be considered in planning and construction of buildings*	*Understand*
CO2:	*Infer the different components and Foundations of building in their construction practices.*	*Understand*
CO3:	*Interpret masonry and* alternative *materials of wood, aluminum and glass.*	*Understand*
CO4:	*Discuss different types of floors, roofs and the materials which are commonly used for construction.*	*Understand*
CO5:	*Explain about dampness and fire resistance in buildings*	*Understand*

UNIT - I FUNCTIONAL PLANNING OF BUILDINGS [09]

Types of Buildings, Aspects and Principles of Building Planning, Building By - laws and Regulations, Site Selection criteria, Orientation of Building and its relation to surrounding environment, Sustainability and Green Buildings - Building Bye - laws and Building code of India 2016.

UNIT - II BUILDING COMPONENTS AND FOUNDATIONS [09]

Lintels, arches, different types of floors-concrete, mosaic, terrazzo floors, pitched, flat and curved roofs, lean-to roof, coupled roofs, trussed roofs, king and queen post trusses; RCC roofs, madras terrace/shell roofs. Foundations: Shallow foundations, spread, combined, strap and mat footings.

UNIT - III ALTERNATIVE MATERIALS AND MASONRY [09]

Structure, properties, seasoning of timber; Classification of various types of woods used in buildings, defects in timber; Alternative materials for wood, galvanized iron, fibre-reinforced plastics, steel, aluminium and glass; Types of masonry, English and Flemish bonds, rubble and ashlars masonry, cavity and partition walls - Light weight concrete blocks – merits and demerits.

UNIT - IV FLOORS,ROOFS AND STAIRCASES [09]

Components of a floor, materials used for floor construction, Different types of flooring, Ground floor and upper floors, Types of roofs, Basic roofing elements and Roof coverings. Functional requirements of a good stair, type of stairs, planning a stair case.

UNIT - V DAMP PROOFING AND FIRE PROTECTION [09]

Damp proofing and Fire protection: Causes and effect of dampness on buildings, Materials and methods used for damp proofing, Fire hazards, Grading of buildings according to fire resistance, Fire resisting properties of common building materials, Fire resistant construction.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Varghese P. C., Building construction, PHI Learning Pvt. Ltd, New Delhi ,Second Edition, 2016.

2 B. C. Punmia , Ashok Kumar Jain, Arun Kumar Jain, Building Construction, Laxmi Publications, New Delhi ,Eleventh Edition,2019.

Reference Books :

1 S. K. Duggal, Building Materials II, New Age International (P) Limited, New Delhi ,Fourth Edition, 2016,

2 Bulding Bye-laws 2019

3 National Building Code of India, 2016.

4 www.nptel.ac.in/courses/105101088/2 home.htm

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE902 **Course Name: Building Planning and Construction**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Outline the factors to be considered in planning and construction of buildings*	3	2	1	1	-	3	2	-	-	-	-	2	-	-
CO2	*Infer the different components and Foundations of building in their construction practices.*	3	2	-	2	-	2	3	-	-	-	-	2	-	-
CO3	*Interpret masonry and* alternative *materials of wood, aluminum and glass.*	2	-	-	2	-	3	2	-	-	-	-	2	-	-
CO4	*Discuss different types of floors, roofs and the materials which are commonly used for construction.*	3	2	-	2	-	3	2	-	-	-	-	2	-	-
CO5	*Explain about dampness and fire resistance in buildings*	3	2	-	2	-	3	3	-	-	-	-	2	-	-
	Average	**3**	**2**	**1**	**2**	**1**	**3**	**3**	**-**	-	-	**-**	**2**	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CE903 **ELEMENTARY CIVIL ENGINEERING** (Open Elective)

L	T	P	C
3	0	0	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to	***Cognitive Level***
CO1: Provide an overview of civil engineering	*Understand*
CO2: Explain the basics of surveying , modern tools of surveying and mapping	*Understand*
CO3: Summarize the fundamentals of building materials in civil engineering	*Understand*
CO4: Explain the components of building structures.	*Understand*
CO5: Interpret various infrastructures of civil engineering in construction	*Understand*

UNIT - I OVERVIEW OF CIVIL ENGINEERING [09]

History of Civil Engineering - Role and Functions of Civil Engineer - Fields of Civil Engineering - Importance of Civil Engineering

UNIT - II BASICS OF SURVEYING [09]

Introduction - Basic Definitions (Surveying, leveling, Plans, Maps, Scales) - Introduction to divisions of surveying - Classification of surveying - Fundamental principles of surveying - Measurement in Surveying - Phases of Surveying

MODERN TOOLS OF SURVEYING AND MAPPING:

Introduction to Global Positioning System - Remote Sensing and Geographic Information System

UNIT - III FUNDAMENTALS OF BUILDING MATERIALS [09]

Bricks – stones – sand – M-sand - cement – fly ash - silica fume - mortar- concrete – steel – glass - wood –plastics – ceramics

UNIT - IV COMPONENTS OF BUILDING [09]

Foundations – stone masonry – brick masonry – beams – columns – lintels – roofing – flooring – plastering- damp proofing weathering course

UNIT - V STRUCTURES [09]

Introduction to dams, weirs, barrages and check dams - Role of transportation in national development - Modes of transportation - Introduction to road traffic and traffic control - Introduction to mass transportation system

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Anurag Kandya, Elements of Civil Engineering, Charotar Publishing House Pvt. Ltd, Gujarat, Third Edition, 2017.

2 Palanichamy M.S., Basic Civil Engineering, Tata McGraw-Hill, New Delhi, Fourth Edition, 2011.

Reference Books :

1 Poonam Sharma & Swati Rajput, Sustainable Smart Cities in India – Challenges and Future Perspectives, Springer, First Edition, 2017.

2 Dr.B.C.Punamia, Surveying, Laxmi Publication, New Delhi, Seventh Edition, 2016.

3 https://nptel.ac.in/courses/105102088

4 https://byjusexamprep.com/civil-engineering-exams/building-materials

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE903 **Course Name: Elementary Civil Engineering**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Provide an overview of civil engineering*	1	-	-	-	-	1	-	-	-	-	-	1	-	-
CO2	*Explain the basics of surveying and modern tools of surveying and mapping*	2	1	-	-	-	2	-	-	-	-	-	1	-	-
CO3	*Summarize the fundamentals of building materials in civil engineering*	2	1	-	-	-	2	2	-	-	-	-	1	-	-
CO4	*Explain the components of building structures.*	2	1	-	-	-	2	-	-	-	-	-	1	-	-
CO5	*Interpret various infrastructures of civil engineering in construction*	3	2	1	-	-	3	2	-	-	-	-	1	-	-
	Average	**3**	**2**	**1**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS / CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CE904	**ENERGY AND ENVIRONMENT** (Open Elective)	3	0	0	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline the earth's energy, environment and the processes leading to climate change.*	*Understand*
CO2:	*Infer the atmospheric issues related to the chemistry, green house gases*	*Understand*
CO3:	*Summarize the role of the terrestrial energy-environment-climate system*	*Understand*
CO4:	*Interpret the Possible effects of Global Warming and climate change.*	*Understand*
CO5:	*Outline the Natural and Anthropogenic and Green House Gas theory*	*Understand*

UNIT - I **INTRODUCTION** **[09]**

Overview on the Earth's energy requirements-Climate Change-Origins of the terrestrial atmosphere-Earth's early atmosphere- Introduction to Climate-Layers of the atmosphere.

UNIT - II **GLOBAL ATMOSPHERIC ISSUES** **[09]**

Composition of the present day atmosphere-Introduction to Atmospheric chemistry-Green House Gases, and the O3 - depletion problem-Post Industrial Revolution Scenario

UNIT - III **ENERGY BALANCE** **[09]**

Earth Atmosphere System- Solar and Terrestrial Radiation- Absorption of Radiation by gases.-Energy balance- Solar variability and the Earth's Energy Balance.

UNIT - IV **ATMOSPHERIC CHEMISTRY AND CLIMATE** **[09]**

The Global Temperature Record.-Possible effects of Global Warming. – Indian Context. Atmospheric Chemistry and Climate Change- Atmospheric Aerosol and Cloud Effects on Climate.

UNIT - V **ENVIRONMENTAL VARIABILITY** **[09]**

Natural (volcanoes, forest fires) and Anthropogenic (Antarctic Ozone Hole, Global Warming).-Green House Gas theory.- Effects of urbanization- Landscape changes-Influence of Irrigation-Desertification and Deforestation

Total (L= 40, T = 5) = 45 Periods

Text Books :

1 Peter E Hodgson, Energy the Environment and Climate Change, Imperial College Press, London, First Edition, 2010
2. Ahluwalia V K, Energy and Environment, The Energy and Resources Institute, New Delhi, First Edition, 2019

Reference Books :

1 Richard Wolfson, Energy, Environment, and Climate, Publisher: W. W. Norton & Company, New York, Second Edition,2011
2 Saeed Moaveni ,Energy, Environment, and Sustainability with Mind Tap, Cengage India Private Limited ,New Delhi, First Edition,2017
3 Wilbanks, T., Bilello D, Schmalzer D, Scott, Climate Change and Energy Supply and Use: Technical Report for the U.S. Department of Energy in Support of the National Climate Assessment., Island Press,Washington,2013
4 Frank T. Princiotta, Global Climate Change - The Technology Challenge, Springer Publisher, New York, First Edition, 2011

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE904 **Course Name: Energy and Environment**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Outline The Earth's Energy, Environment and the processes leading to climate change.*	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO2	*Infer the Atmospheric issues related to the chemistry, Green House Gases*	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO3	*Summarize the role of the Terrestrial Energy-Environment-Climate System*	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO4	*Interpret the* Possible effects of Global Warming and climate change.	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO5	*Outline the* Natural and Anthropogenic and Green House Gas theory	3	3	-	-	-	2	2	-	-	-	-	2	-	-
	Average	**3**	**3**	**-**	-	**-**	**2**	**2**	**-**	-	-	**-**	**2**	**-**	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CE905	**ENVIRONMENTAL LAWS AND POLICIES** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the basic concepts in environmental laws and its judicial activism*	*Understand*
CO2:	*Interpret different water acts and marine laws in India*	*Understand*
CO3:	*Summarize various Environment protection laws and acts in the framework of Mega projects*	*Understand*
CO4:	*Explain the management and handling of various hazardous waste management*	*Understand*
CO5:	*Summarize the International Environmental laws framed at various conferences.*	*Understand*

UNIT - I **BASIC CONCEPTS IN ENVIRONMENTAL LAW** **[09]**

An introduction to the legal system – Constitution – Acts – Rules – Regulations - Indian Judiciary - Doctrine of precedents - judicial review - Writ petitions - PIL– liberalization of the rule of locus standi - Judicial activism - Introduction to environmental laws in India - Constitutional provisions - Stockholm conference - Bhopal gas tragedy - Rio conference - General principles in Environmental law - Precautionary principle - Polluter pays principle - Sustainable development- Public trust doctrine - Overview of legislations and basic concepts.

UNIT - II **AIR- WATER - MARINE LAWS** **[09]**

National Water Policy and some state policies - Laws relating to prevention of pollution, access and management of water and institutional mechanism - Water Act, 1974 - Water Cess Act, 1977 - EPA, 1986 - Pollution Control Boards Ground water and law Judicial remedies and procedures Marine laws of India - Coastal zone regulations - Legal framework on Air pollution - Air Act,1981 - EPA, 1986

UNIT - III **ENVIRONMENT PROTECTION LAWS - LARGE PROJECTS** **[09]**

Legal framework on environment protection - Environment Protection Act as the framework legislation - strength and weaknesses of EIA - National Green tribunal the courts infrastructure projects

UNIT - IV **HAZARDOUS SUBSTANCES AND ACTIVITIES** **[09]**

Legal framework - EPA and rules made there under PLI Act, 199 - Principles of strict and absolute liability - Hazardous Wastes (Management, Handling and Transboundary) Rules, 2008 - Biomedical Waste (Management and Handling) Rules, 1998 - Municipal Solid Wastes (Management and Handling) Rules, 2000 - E - Waste (Management and Handling) Rules, 2011 - Batteries (Management & Handling) Rules, 2001

UNIT - V **INTERNATIONAL ENVIRONMENTAL LAW** **[09]**

Development of international environmental law, nature and scope of key international environmental law principles and rights (substantive and procedural), Establishment of Environmental Institutions like UNEP, Ozone Protection – Montreal Protocol for the Protection of Ozone Layer, 1987 as amended; U.N. Convention on Climate Change1992, Kyoto Protocol, 1997; Public Participation in Decision-making and Access to Justice in Environmental Matters, 1998 (Aarhus Convention); Johannesburg Conference, 2002.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Divan,S and Rosencranz, A., Environmental Law and Policy in India, Oxford India Paperbacks, New Delhi, Second edition, 2005.
2. Kanchan Chopra., Development and Environmental Policy in India: The Last Few Decades, Springer Publication, New Delhi, First edition, 2017.

Reference Books :

1. Birnie, P Boyle, and Red well's., International Law and the Environment ,Oxford University Press, United Kingdom, Fourth edition,2021.
2. Upadhyay S. and Upadhyay V., Hand Book on Environmental Law- Forest Laws, Wildlife Laws and the Environment; Vols. I, II and III, Lexis Nexis Butterworths , New Delhi ,India, First Edition , 2001.
3. Leelakrishnan,P., Environmental Law Case Book, Lexis Nexis, India, Sixth Edition, 2021.
4. Sands, P., Principles of International Environmental Law, Cambridge University press, United Kingdom, Second Edition, 2002.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE905 **Course Name: Environmental Laws and Policies**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Summarize the basic concepts in Environmental laws and its judicial activism*	3	2	2	-	-	2	-	-	-	-	2	3	-	-
CO2	*Interpret different water acts and marine laws in India*	3	2	2	-	-	-	-	-	-	-	-	3	-	-
CO3	*Summarize Various Environment protection laws and acts in the framework of Mega projects*	3	2	3	-	-	2	-	-	-	-	2	3	-	-
CO4	*Explain the management and Handling of various hazardous waste management*	3	2	3	1	-	3	1	-	-	-	2	3	-	-
CO5	*Summarize the International Environmental laws framed at various conferences.*	3	2	3	2	-	3	-	-	-	-	2	3	-	-
	Average	**3**	**2**	**3**	**3**	**-**	**3**	**1**	**-**	**-**	**-**	**2**	**3**	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CE906	**GLOBAL WARMING AND CLIMATE CHANGE** (Open Elective)	3	0	0	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline the concept of the causes and effects of global warming*	*Understand*
CO2:	*Summarize about physical and chemical characteristics of atmosphere*	*Understand*
CO3:	*Identify the causes and effects of climate change*	*Remember*
CO4:	*Infer the agreements took place among the countries regarding climate change*	*Understand*
CO5:	*Summarize about the concept of mitigation measures against climate change*	*Understand*

UNIT - I **EARTH'S CLIMATE SYSTEM** **[09]**

Role of ozone in environment – Ozone layer – Ozone depleting gases – Greenhouse gases and its sources - Green House Effect, Radiative Effects of Greenhouse Gases -The Hydrological Cycle – Green House Gases and Global Warming – Effects and causes of Global Warming, Carbon Cycle.

UNIT - II **ATMOSPHERE AND ITS COMPONENTS** **[09]**

Importance of Atmosphere – Physical Chemical Characteristics of Atmosphere - Vertical structure of the atmosphere - Composition of the atmosphere - Atmospheric stability -Temperature profile of the atmosphere - Lapse rates- Temperature inversion - effects of inversion on pollution dispersion.

UNIT - III **IMPACTS OF CLIMATE CHANGE** **[09]**

Causes of Climate change – Change of Temperature in the environment - Melting of ice Pole-sea level rise - Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

UNIT - IV **OBSERVED CHANGES AND ITS CAUSES** **[09]**

Climate change and Carbon credits – CDM- Initiatives in India - Kyoto Protocol - Intergovernmental Panel on Climate change - Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India .

UNIT - V **CLIMATE CHANGE AND MITIGATION MEASURES** **[09]**

Clean Development Mechanism – Carbon Trading – Examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding - Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS) - Waste(MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

Total (L= 40, T = 5) = 45 Periods

Text Books :

1 Kandarp Tarkeshprasad Vaishnav., Climate Change Solutions, Global Warming Solutions & Innovative Ideas For Construction of World Development, Notion Press, Chennai, First Edition, 2018

2 Vivian Moritz., Climate Change and Global Warming, Syrawood Publishing House, New York, First Edition, 2017

Reference Books :

1 Marie Antonette and Chloe Marechal., Climate Change Past, Present & Future, Wiley-Blackwell, New Jersey, First Edition, 2015.

2 Empereur Raymond., Global Warming and Climate Change, Litfire Publishing, Atlanta, First Edition, 2017.

3 Agarwal S.K., Global Warming and Climate Change Past, Present & Future, Ashish Publishing House, New Delhi, First Edition, 2004.

4 https://onlinecourses.swayam2.ac.in/arp19_ap55/preview

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE906 **Course Name: Global Warming and Climate Change**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Outline the concept of the causes and effects of global warming*	3	2	2	-		3	2	-	-	-	-	2	-	-
CO2	*Summarize about physical and chemical characteristics of atmosphere*	3	2	-	-	-	3	3	-	-	-	2	2	-	-
CO3	*Interpret knowledge about the causes and effects of climate change*	3	-	-	2	-	3	2	-	-	-	2	3	-	-
CO4	*Infer the agreements took place among the countries regarding climate change*	3	2	-	2	-	3	2	-	2	-	-	2	-	-
CO5	*Summarize skills about the concept of mitigation measures against climate change*	3	2	-	-	-	3	3	-	3	-	2	3	-	-
	Average	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**-**	**3**	-	**2**	**3**	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CE907	**INTRODUTION TO DISASTER MANAGEMENT AND MITIGATION** (Open Elective)	3	0	0	3

Prerequisite: Nil

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the concepts of disaster and its effect in Indian scenario.*	*Understand*
CO2:	*Elaborate the difference between natural and manmade disasters.*	*Understand*
CO3:	*Outline the disaster management cycle and its operation.*	*Understand*
CO4:	*Outline the disaster management in India and its profile.*	*Understand*
CO5:	*Propose the application of geo-informatics for disaster management and mitigation.*	*Apply*

UNIT - I INTRODUCTION TO DISASTER [09]

Definition of Disaster, hazard, global and Indian scenario, general perspective, importance of study in human life, Direct and indirect effects of disasters, long term effects of disasters. Introduction to global warming and climate change.

UNIT - II NATURAL DISASTER AND MANMADE DISASTERS [09]

Natural Disaster: Meaning and nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion.

Manmade Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.

UNIT - III DISASTER MANAGEMENT CYCLE AND FRAMEWORK [09]

Disaster Management Cycle, Paradigm Shift in Disaster Management Pre-Disaster Risk Assessment and Analysis, Risk Mapping, zonation and Micro zonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development, Awareness During Disaster Evacuation, Disaster Communication, Search and Rescue, Emergency Operation Centre, Incident Command System, Relief and Rehabilitation, Damage and Needs Assessment, Restoration of Critical Infrastructure, Early Recovery, Reconstruction and Redevelopment, IDNDR, Yokohama Strategy, Hyogo Framework of Action.

UNIT - IV DISASTER MANAGEMENT IN INDIA DISASTER PROFILE OF INDIA [09]

Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005, Institutional and Financial Mechanism, National Policy on Disaster Management, National Guidelines and Plans on Disaster Management, Role of Government, Non-Government and Inter-Governmental Agencies.

UNIT - V APPLICATIONS OF SCIENCE AND TECHNOLOGY FOR DISASTER MANAGEMENT & MITIGATION [09]

Geo-informatics in Disaster Management, Disaster Communication System, Land Use Planning and Development Regulations, Structural and Non Structural Mitigation of Disasters, S&T Institutions for Disaster Management in India.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. R B Singh., Disaster Management and Mitigation, World focus Publisher, New Delhi, First Edition, 2016.
2. Satish Modh, Introduction to disaster management, Macmillan publishers India ltd, New Delhi, Second Edition, 2019.

Reference Books :

1. R B Singh., Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi, Reprint Edition, 2006.
2. Pardeep Sahni, Disaster Risk Reduction in South Asia, PHI Learning, New Delhi, Fourth Edition, 2018.
3. M. Saravanakumar, Disaster Management, Himalaya Publishing House, Bangalore, First Edition, 2017
4. Singh, Disaster Management: Future Challenges, IK International, New Delhi, First Edition, 2017.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: **R 2020**

Course Code: **20CE907** **Course Name:** **Introduction to Disaster Management and Mitigation**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	*Explain the concepts of disaster and its effect in Indian scenario.*	3	3	1	-	-	2	-	-	-	-	-	3	-	-
CO2:	*Elaborate the difference between natural and manmade disasters.*	3	3	1	-	-	3	-	-	-	-	-	3	-	-
CO3:	*Outline the disaster management cycle and its operation*	3	3		-	-	2	-	-	-	-	-	3	-	-
CO4:	*Outline the disaster management in India and its profile*	3	3	1	-	-	3	-	-	-	-	-	3	-	-
CO5:	*Propose the application of geo-informatics for disaster management and mitigation.*	3	3	3	-	2	3	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**1**	-	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	-

Course Faculty **Module Coordinator** **Chairman BoS / CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CE908	**INTRODUCTION TO EARTHQUAKE ENGINEERING** (Open Elective)	3	0	0	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Illustrate the causes and effects of earthquake.*	*Understand*
CO2:	*Explain the basic concepts in seismology and correlate to earthquake engineering.*	*Understand*
CO3:	*Summarize the theory of vibrations.*	*Understand*
CO4:	*Outline the design process for earthquake resisting structures*	*Understand*
CO5:	*Predict the performance of building and structures under the earthquake.*	*Understand*

UNIT - I **CAUSES AND EFFECTS OF EARTHQUAKE** **[09]**

Causes of earthquake by natural sources and manmade sources - Earthquake effects on building structure - Liquefaction of soils, effects of liquefaction, methods to reduce liquefaction - Land and rock slides - tsunamis.

UNIT - II **ELEMENTS OF ENGINEERING SEISMOLOGY** **[09]**

Plate tectonics, Elastic rebound, seismic zoning map of India , Focus, epicenter, seismic waves, magnitude, intensity, intensity scale and its correlation with ground acceleration, characteristics of strong ground motions.

UNIT - III **THEORY OF VIBRATIONS** **[09]**

Basic concepts of vibration - Difference between static loading and dynamic loading - Types of vibration - Vibration measuring instruments - Degrees of freedom -Types of Damping.

UNIT - IV **DESIGN METHODOLOGY** **[09]**

Design methodology - Architectural consideration - Geotechnical consideration - Structural design consideration, earthquake design philosophy, importance of ductility - Capacity design - Techniques of aseismic design - Design spectrum.

UNIT - V **PERFORMANCE OF BUILDING AND STRUCTURES** **[09]**

Lessons learnt from the past earthquakes - Shear wall, types of shear wall, function of shear wall - Concepts of seismic base isolation technique - Base isolation devices - Seismic dampers - Seismic active control.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Duggal,S .K., Earthquake Resistant Design of Structures, Oxford University Press, London, Second Edition, 2013.

2 Damodarasamy, S.R. and Kavitha, S., Basics of structural dynamics and Aseismic design, PHI Learning Pvt. Ltd, New Delhi, Fifth Edition, 2006.

Reference Books :

1 Pankaj Agarwal. and Manish Shrikhande., Earthquake Resistant Design of Structures, Prentice Hall of India, New Delhi, Third Edition, 2009.

2 Chopra, Anil. K., Dynamics of Structures -Theory and Applications to Earthquake Engineering, Prentice Hall of India (P), New Delhi, Fifth Edition, 2020.

3 Murty C.V.R .Earthquake tips, IITK, Building material and technology promotion council, New Delhi, First Edition, 2005.

4 http://nptel.ac.in/syllabus/105101004/

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE908 **Course Name: Introduction to Earthquake Engineering**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Illustrate the causes and effects of earthquake.*	3	2	2	-	-	-	2	-	-	-	-	3	-	-
CO2	*Explain the basic concepts in seismology and correlate to earthquake engineering.*	3	2	2	-	-	-	2	-	-	-	-	3	-	-
CO3	*Summarize the theory of vibrations.*	3	2	3	-	-	-	2	-	-	-		3	-	-
CO4	*Outline the design process for earthquake resisting structures*	3	2	3	2	-	-	2	-	-	-		3	-	-
CO5	*Predict the performance of building and structures under the earthquake.*	3	2	3	2	-	-	2	-	-	-	-	3	-	-
	Average	**3**	**2**	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**		**3**	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CE909	**SOLID WASTE MANAGEMENT** (Open Elective)	3	0	0	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Overview the concept of Solid waste and management.*	*Understand*
CO2:	*Summarize about on-site storage and processing of solid waste.*	*Understand*
CO3:	*Summarize about collection and transportation of waste.*	*Understand*
CO4:	*Summarize about off-Site Processing of solid waste.*	*Understand*
CO5:	*Interpret about safe disposal of solid waste.*	*Understand*

UNIT - I **Solid Waste and its Perspectives** **[09]**

Sources – Types – Composition – Properties – Characteristics – Quantities – Generation rates – Types of Sampling – Functional elements – Legislative measures – 3R concept – Participatory waste management.

UNIT - II **On-Site Storage and Processing** **[09]**

On-site storage methods - materials used for containers –on site segregation of solid wastes -public health & economic aspects of storage - options under Indian conditions - Critical Evaluation of Options.

UNIT - III **Collection and Transfer** **[09]**

Collection services – Classification of container systems – Analysis of collection system – Collection routes – Guidelines – Transfer station –Site selection – Types – Manpower requirement.

UNIT - IV **Off-Site Processing** **[09]**

Processing techniques and Equipment; Resource recovery from solid wastes – composting – Factors affecting composting – Indore and Bangalore processes – Vermicomposting, Incineration, Pyrolysis - options under Indian conditions.

UNIT - V **Disposal** **[09]**

Sanitary landfills – site selection – merits and demerits - methods and operation of sanitary landfills - Leachate collection and control methods – Incinerators - types – hazardous wastes and its effects on environment – case studies.

Total (L= 40, T = 5) = 45 Periods

Text Books :

1 Tchobanoglous, G., Frank Kreith, Hand Book of Solid Waste Management, McGraw-Hill, Inc., California, Second Edition, 2002.

2 Ramachandra, T. V., Management of Municipal Solid Waste, TERI Press, New Delhi, First Edition, 2009

Reference Books :

1 William A. Worrell, P. Aarne Vesilind, Solid Waste Engineering, Cengage Learning Asia Pte Limited, Second Edition, 2012.

2 Rao, M.N., Sultana, Razia Kota, Sri Harsha, Solid and Hazardous Waste Management: Science and Engineering, Butterworth-Heinemann, Burlington, First Edition, 2016

3 John Pichtel, Waste Management Practices: Municipal, Hazardous, and Industrial, CRC Press, US, Second Edition, 2014.

4 Freeman, H. M., ―Standard Handbook of Hazardous Waste Treatment and Disposall, McGraw-Hill, Inc., Second Edition, Noida, 1997.

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE909 **Course Name: Solid Waste Management**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Overview the concept of Solid waste and management.*	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO2	*Summarize about on-site storage and processing of solid waste.*	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO3	*Summarize about Collection and transportation of waste.*	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO4	*Summarize about off-Site Processing of solid waste.*	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO5	*Interpret about safe disposal of solid waste.*	3	3	3	-	-	-	-	-	2	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS/CE**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CE910 **WATER AND AIR POLLUTION MANAGEMENT**
(Open Elective)

L	T	P	C
3	0	0	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain water and air quality standards*	*Understand*
CO2:	*Discuss water treatment and fundamentals of air pollution*	*Understand*
CO3:	*Demonstrate the particulate of air pollution.*	*Understand*
CO4:	*Classify air pollution control technologies.*	*Understand*
CO5:	*Describe air pollution control equipment.*	*Understand*

UNIT - I INTRODUCTION [09]

Water effluent standards -water quality indices - physical- chemical and biological parameters of water- water quality requirement - potable water standards -Air pollutants – Sources – Classification of air pollutants – Particulates and gaseous pollutants – Effects of air pollutants on human health, vegetation and property – Global issues and air pollution – Global warming – Ozone layer depletion – Ambient air quality and emission standards – Air pollution indices – Air act.

UNIT - II WATER TREATMENT AND FUNDAMENDALS OF ATMOSPHERIC POLLUTANTS [09]

Water purification systems in natural systems- physical processes-chemical processes and biological processes primary, secondary and tertiary treatment-Unit operations-unit processes. Mixing, clarification - sedimentation; Types; aeration and gas transfer – coagulation and flocculation, coagulation processes - stability of colloids –Disinfection - Fundamentals of meteorology – Wind roses – Atmospheric stability – Atmospheric diffusion of pollutants – Transport, transformation and deposition of air contaminants – Plume behaviour – Atmospheric diffusion theories – Plume rise.

UNIT - III PARTICULATE AIR POLLUTION [09]

Control principles – Principles and equipment description of control technologies – Particulates control by Gravitation, centrifugal, filtration, scrubbing, electrostatic precipitation – Absorption, adsorption, condensation, incineration and biofiltration for control of gaseous air pollutants.

UNIT - IV AIR POLLUTION CONTROL TECHNOLOGIES [09]

Biological air pollution control technologies – Bioscrubbers, biofilters. Air pollutants in indoor environments – Levels of pollutants in indoor and outdoor air – Indoor air pollution from outdoor sources – Measurement methods – Control Technologies.

UNIT - V AIR POLLUTION CONTROL EQUIPMENT [09]

Introduction – Installation of Settling chambers, Inertial separators, Dust trap, Involute cyclone, Multiple cyclone, Filters, Electrostatic precipitators, Scrubbers, Separating devices – Efficiency of equipment.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Rao, C. S., Environmental Pollution Control Engineering, New Age International, New Delhi, First Edition, 2006.
2 Davis M. L. and Cornwell D. A., Introduction to Environmental Engineering, Tata McGraw Hill Education Pvt. Ltd,. New Delhi, First Edition, 2010.

Reference Books :

1 Rao, C. S., Environmental Pollution Control Engineering, New Age International, New Delhi, First Edition, 2006.
2 Anjaneyulu, D., Air Pollution and Control Technologies, Allied Publishers, Mumbai, First Edition 2002.
3 S.K. Garg, “Water Supply Engineering”, Khanna Publishers, New Delhi, Thirty three Edition, 2010.
4 https://nptel.ac.in/courses/122106030

Course Faculty **Module Coordinator** **Chairman BoS /CE**

K.S.R. COLLEGE OF ENGINEERING, TIRUCHENGODE – 637215
DEPARTMENT OF CIVIL ENGINEERING
CO-PO MAPPING

Regulation: R 2020

Course Code: 20CE910 **Course Name: Water and Air Pollution Management**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Explain water and air quality standards*	3	3	-	-	-	-	2	-	-	-	-	3	-	-
CO2	*Discuss water treatment and fundamentals of air pollution*	3	3	-	-	-	-	-	-	-	-	-	2	-	-
CO3	*Demonstrate the particulate of air pollution.*	3	2	-	-	-	-	2	-	-	-	-	3	-	-
CO4	*Classify air pollution control technologies*	3	3	-	-	-	-	2	-	-	-	-	3	-	-
CO5	*Describe air pollution control equipment.*	3	3	-	-	-	-	2	-	-	-	-	3	-	-
	Average	**3**	**3**	**-**	-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Faculty **Module Coordinator** **Chairman BoS /CE**