SREE SAKTHI ENGINEERING COLLEGE

(Autonomous)

Ooty Main Road, Karamadai, Coimbatore – 641 104

(Affiliated to Anna University & Approved by AICTE, Accredited by NAAC)

B. E (Department of Civil Engineering)

(CHOICE BASED CREDIT SYSTEM)

CURRICULUM & SYLLABI

REGULATIONS 2024

(For students admitted in 2024 – 2025)

SREE SAKTHI ENGINEERING COLLEGE

Vision:

To be recognized as an international leader in engineering education, research and the application of knowledge to benefit society globally.

Mission:

To develop high quality technical education and personnel with a sound footing on basic engineering principles, technical and managerial skills, innovative research capabilities and exemplary professional conduct to lead and to use technology for the progress of mankind, adapting themselves to changing technological environment with the highest ethical values as the inner strength.

DEPARTMENT OF CIVIL ENGINEERING

Vision:

To emerge as a Centre of Excellence in Civil Engineering through quality professional education and to create eminent leaders with values committed to the profession and society.

Mission:

- To impart state of the art education and to provide industry exposure to students.
- To create Civil Engineers who successfully adapt and innovate solutions for the built environment.
- To inspire and transform the students to hard core professionals and academicians with ethical values.

B. E (DEPARTMENT OF CIVIL ENGINEERING)

PROGRAMME EDUCATIONAL OBJECTIVE (PEO's)

The 4-year rigorous B. E. Civil Engineering programme enables a graduate with the following:

PEO	OBJECTIVES
I	To acquire Civil Engineering skills to build a successful career and achieve professional success in public or private sector organizations.
II	Solve real world Civil Engineering issues concerning infrastructure development, particularly in housing, construction, water supply, sewerage, transport, and spatial planning.
III	Develop entrepreneurial traits and formulate novel technologies that are technically robust, financially viable, and socially acceptable.
IV	Collaborate in multi-disciplinary teams and endorse policies, systems, processes, and equipment tosupportCivil Engineering.
V	Perform investigation for solving Civil Engineering problems by conducting researchusingmodern equipment and software tools.

B. E (DEPARTMENT OF CIVIL ENGINEERING)

PROGRAMME OUTCOMES (PO's)

On completion of the programme, the engineering graduate shall acquire the following

PO	GRADUATE ATTRIBUTE
1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	**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.
3	**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.
4	**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.
5	**Modern tool usage:**Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6	**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.
7	**Environment 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.
8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	**Individual and team work:**Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	**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.
11	**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.
12	**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.

B. E (DEPARTMENT OF CIVIL ENGINEERING)

PROGRAMME SPECIFIC OUTCOMES (PSO's)

On successful completion of the B.E. Civil Engineering degree programme, the engineering graduate shall exhibit the following

PSO	OBJECTIVES
1	Demonstrate in-depth knowledge of Civil Engineering, capable of assessing, analyzing, and integrating both established and emerging knowledge.
2	Analyze complex Civil Engineering problems critically, apply independent judgment to integrate information, and innovate in theoretical, practical, and policy contexts.
3	Identify and resolve Civil Engineering problems, assess solutions, and develop technically feasible, economically viable, and environmentally friendly options while prioritizing health, safety, and socio-cultural factors.

Mapping of Programme Educational Objective (PEO) and Programme Outcome (PO):

PEO's	PO's												PSO's		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
I	3	3	3	2	2	3	3	2	2	3	3	3	3	3	3
II	3	2	3	3	2	2	2	2	3	3	3	3	3	3	2
III	3	2	2	1	2	2	3	3	3	2	3	2	3	2	2
IV	3	2	2	2	2	3	3	1	2	2	2	2	3	2	2

(1 – Low, 2 – Medium, 3 – High)

<u>Mapping of Course Outcome (CO) and Programme Outcome (PO):</u>

(1 – Low, 2 – Medium, 3 – High, “-“ – No Correlation)

Year	Sem	Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I Year	Semester I	24HSM101	Professional English I	1	2	2	1	1	1	1	1	2	3	1	2	-	-	-
		24BSC101	Matrices and Calculus	3	3	3	1	-	2	-	-	-	-	-	-	2	2	2
		24BSC102	Engineering Physics	3	2	-	-	-	-	-	-	-	-	-	-	1	1	1
		24ESC102	Basic Electrical and Electronics Engineering	2	2	1	-	-	-	-	1	-	-	-	2	2	2	2
		24ESC104	Engineering Graphics	3	1	2	-	2	-	-	-	-	3	-	2	3	3	3
		24HSM102	Heritage of Tamils	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24BSC121	Engineering Physics Laboratory	3	2	-	-	-	-	-	-	-	-	-	-	1	1	1
		24CDC101	Career Development Skills I	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24INP101	Induction Programme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Semester II	24HSM103	Professional English II	1	2	1	1	1	2	1	1	2	2	2	1	-	-	-
		24BSC105	Statistics and Numerical Methods	3	3	1	1	1	-	-	-	2	-	2	-	2	2	2
		24BSC103	Engineering Chemistry	3	2	2	1	-	2	2	-	-	-	-	2	2	2	2
		24ESC111	Problem Solving and Python Programming	3	2	3	1	2	-	-	-	-	-	-	2	2	2	2
		24ESC106	Engineering Mechanics	3	2	3	1	2	-	-	-	-	-	-	2	3	3	3
		24HSM104	Tamils and Technology	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		24BSC122	Engineering Chemistry Laboratory	3	3	2	1	-	1	1	-	1	-	-	1	1	1	1
		24ESC121	Engineering Practices Laboratory	3	2	1	-	2	-	-	-	2	1	-	2	3	3	3
		24CDC102	Career Development Skills II	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SREE SAKTHI ENGINEERING COLLEGE

B. E (CIVIL ENGINEERING)

CURRICULUM STRUCTURE

CATEGORY	PROPOSED MINIMUM CREDITS
Foundation Core Courses (FCC)	
a) Humanities, Social Sciences and Management Courses (HSMC)	12
b) Basic Science Courses (BSC)	28
c) Engineering Science Courses (ESC)	16
Professional Core Courses (PCC)	58
Professional Elective Courses (PEC)	18
Open Elective Courses (OEC)	12
Employability Enhancement Courses (EEC)	21
Mandatory Courses (MC)	No Credit
TOTAL MINIMUM CREDITS	**165**

COURSE TYPOLOGY

REFERENCE	COURSE TYPE
T	Theory
TP	Theory-cum-Practical
P	Practical

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Semester I

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24HSM101	Professional English I	HSMC	T	3	3	0	0	3
2	24BSC101	Matrices and Calculus	BSC	T	4	3	1	0	4
3	24BSC102	Engineering Physics	BSC	T	3	3	0	0	3
4	24ESC101	Basic Electrical and Electronics Engineering	ESC	T	3	3	0	0	3
5	24ESC103	Engineering Graphics	ESC	T	6	2	0	4	4
6	24HSM102	Heritage of Tamils	HSMC	T	1	1	0	0	1
7	24BSC121	Engineering Physics Laboratory	BSC	P	4	0	0	4	2
8	24CDC101	Career Development Skills I	EEC	T	1	1	0	0	1
9	24INP101	Induction Programme	----	-	-	-	-	-	0
Total					**25**	**16**	**1**	**08**	**21**

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Semester II

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24HSM103	Professional English II	HSMC	T	3	3	0	0	3
2	24BSC105	Statistics and Numerical Methods	BSC	T	4	3	1	0	4
3	24BSC103	Engineering Chemistry	BSC	T	3	3	0	0	3
4	24ESC111	Problem Solving and Python Programming	ESC	TP	5	3	0	2	4
5	24ESC104	Engineering Mechanics	ESC	T	3	3	0	0	3
6	24HSM104	Tamils and Technology	HSMC	T	1	1	0	0	1
7	24BSC122	Engineering Chemistry Laboratory	BSC	P	4	0	0	4	2
8	24ESC121	Engineering Practices Laboratory	ESC	P	4	0	0	4	2
9	24CDC102	Career Development Skills II	EEC	T	1	1	0	0	1
Total					**28**	**17**	**1**	**10**	**23**

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Semester III

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24BSC201	Transforms and Partial Differential Equations	BSC	T	4	3	1	0	4
2	24CEC211	Fluid Mechanics and Hydraulic Machinery	PCC	TP	5	3	0	2	4
3	24CEC201	Construction Materials and Technology	PCC	T	3	3	0	0	3
4	24CEC212	Surveying and Leveling	PCC	TP	5	3	0	2	4
5	24CEC202	Engineering Geology	PCC	T	3	3	0	0	2
6	24CEC221	Computer Aided Building Drawing	PCC	P	4	0	0	4	2
7	24CDC201	Career Development Skills III	EEC	T	2	2	0	0	1
8	24CDC222	Mini Project I	EEC	P	2	0	0	2	1
9	24MAC***	Mandatory Course I	MC	T	1	1	0	0	0
Total					**29**	**18**	**1**	**10**	**21**

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B. E CIVIL ENGINEERING

CURRICULUM & SYLLABI

Semester IV

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24BSC204	Complex Variables and Transforms	BSC	T	4	3	1	0	4
2	24BSC207	Environmental Science and Sustainability	BSC	T	2	2	0	0	2
3	24CEC203	Water Supply and Wastewater Engineering	PCC	T	3	3	0	0	3
4	24CEC206	Strength of Materials	PCC	T	3	3	0	0	3
5	24CEC204	Concrete Technology	PCC	T	3	3	0	0	3
6	24CEC205	Highway and Railway Engineering	PCC	T	3	3	0	0	3
7	24CEC222	Water and Wastewater Analysis Laboratory	PCC	P	4	0	0	4	2
8	24CEC223	Strength of Materials Laboratory	PCC	P	4	0	0	4	2
9	24CDC202	Career Development Skills IV	EEC	T	1	1	0	0	1
10	24CDC223	Mini Project II	EEC	P	2	0	0	2	1
11	24MAC221	Summer Internship I	MC	P	0	0	0	0	0
Total					**29**	**18**	**1**	**10**	**24**

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Semester V

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24CEC301	Design of Reinforced Concrete Structural Elements	PCC	T	3	3	1	0	4
2	24CEC302	Structural Analysis I	PCC	T	3	3	0	0	3
3	24CEC311	Soil Mechanics	PCC	TP	5	3	0	2	4
4	24CEP***	Professional Elective I*	PEC	T	3	3	0	0	3
5	24CEP***	Professional Elective II*	PEC	T	3	3	0	0	3
6	24CEP***	Professional Elective III*	PEC	T	3	3	0	0	3
7	24CEC321	Concrete & Highway Engineering Laboratory	PCC	P	4	0	0	4	2
8	24CDC301	Career Development Skills V	EEC	T	1	1	0	0	1
9	24CDC321	Field Survey for Civil Engineers	EEC	P	2	0	0	2	1
10	24MAC***	Mandatory Course II	MC	T	1	1	0	0	0
Total					**28**	**20**	**1**	**8**	**24**

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Semester VI

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24CEC303	Foundation Engineering	PCC	T	3	3	0	0	3
2	24CEC304	Structural Analysis II	PCC	T	3	3	0	0	3
3	24CEP***	Professional Elective IV*	PEC	T	3	3	0	0	3
4	24CEP***	Professional Elective V*	PEC	T	3	3	0	0	3
5	24CEP***	Professional Elective VI*	PEC	T	3	3	0	0	3
6	24HSM3**	Management Elective*	HSMC	T	2	2	0	0	2
7	24CDC302	Career Development Skills VI	EEC	T	1	1	0	0	1
8	24CDC324	Applications of Civil Engineering Software	EEC	P	2	0	0	2	1
9	24MAC321	Summer Internship II	MC	P	0	0	0	0	0
10	24MAC***	Mandatory Course III	MC	T	1	1	0	0	0
Total					**21**	**19**	**0**	**2**	**19**

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Semester VII

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24CEC401	Design of Steel Structural Elements	PCC	T	3	3	0	0	3
2	24CEC402	Estimation, Costing and Valuation Engineering	PCC	T	3	3	0	0	3
3	24HSM401	Professional Ethics and Human Values	HSMC	T	2	2	0	0	2
4	24$$$***	Open Elective I*	OEC	T	3	3	0	0	3
5	24$$$***	Open Elective II*	OEC	T	3	3	0	0	3
6	24CEC421	Computer Aided Design and Drafting Laboratory	PCC	P	4	0	0	4	2
7	24CDC401	Career Development Skills VII	EEC	T	2	2	0	0	1
8	24CDC421	Project Work Phase I	EEC	P	4	0	0	4	2
Total					**24**	**16**	**0**	**8**	**19**

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B. E CIVIL ENGINEERING

CURRICULUM & SYLLABI

Semester VIII

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24$$$***	Open Elective III*	OEC	T	3	3	0	0	3
2	24$$$***	Open Elective IV*	OEC	T	3	3	0	0	3
3	24CDC422	Project work Phase II	EEC	P	16	0	0	16	8
Total					**22**	**06**	**0**	**16**	**14**

MANDATORY COURSES (Offered as Non-Credit Courses)

MANDATORY COURSES I, II, III

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P
1	24MAC001	Constitution of India	MC	T	1	1	0	0
2	24MAC002	Industrial Safety	MC	T	1	1	0	0
3	24MAC003	Entrepreneurship	MC	T	1	1	0	0
4	24MAC004	Film Appreciation	MC	T	1	1	0	0
5	24MAC005	Well Being with Traditional Practices - Yoga, Ayurveda and Siddha	MC	T	1	1	0	0
6	24MAC006	Introduction to Women and Gender Studies	MC	T	1	1	0	0
7	24MAC007	Elements of Literature	MC	T	1	1	0	0

MANDATORY COURSES INTERNSHIP I, II

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P
1	24MAC221	Summer Internship I	MC	P	0	0	0	0
2	24MAC321	Summer Internship II	MC	P	0	0	0	0

MANAGEMENT ELECTIVE COURSES

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24HSM301	Principles of Management	HSMC	T	2	2	0	0	2
2	24HSM302	Total Quality Management	HSMC	T	2	2	0	0	2
3	24HSM303	Engineering Economics and Financial Accounting	HSMC	T	2	2	0	0	2
4	24HSM304	Human Resource Management	HSMC	T	2	2	0	0	2
5	24HSM305	Knowledge Management	HSMC	T	2	2	0	0	2
6	24HSM306	Industrial Management	HSMC	T	2	2	0	0	2

PROFESSIONAL ELECTIVE COURSES

PROFESSIONAL ELECTIVE I, II, III

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24CEP001	Total Station and GPS Surveying	PEC	T	3	3	0	0	3
2	24CEP002	Geographic Information System	PEC	T	3	3	0	0	3
3	24CEP003	Irrigation Engineering	PEC	T	3	3	0	0	3
4	24CEP004	Ground Improvement Techniques	PEC	T	3	3	0	0	3
5	24CEP005	Environmental Laws and Policy	PEC	T	3	3	0	0	3
6	24CEP006	Construction Management and Safety	PEC	T	3	3	0	0	3
7	24CEP007	Pre-stressed Concrete Structures	PEC	T	3	3	0	0	3
8	24CEP008	Airports, Harbours and Docks Engineering	PEC	T	3	3	0	0	3
9	24CEP009	Advanced Construction Techniques	PEC	T	3	3	0	0	3
10	24CEP010	Smart Cities	PEC	T	3	3	0	0	3
11	24CEP011	Urban Planning andDevelopment	PEC	T	3	3	0	0	3
12	24CEP012	Municipal Solid Waste Management	PEC	T	3	3	0	0	3

PROFESSIONAL ELECTIVE COURSES IV, V, VI

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24CEP013	Hydrology and WaterResources Engineering	PEC	T	3	3	0	0	3
2	24CEP014	Structural Design and Drawing	PEC	TP	4	2	0	2	3
3	24CEP015	Industrial Wastewater Engineering	PEC	T	3	3	0	0	3
4	24CEP016	Traffic Engineering and Management	PEC	T	3	3	0	0	3
5	24CEP017	Environmental Health and Safety	PEC	T	3	3	0	0	3
6	24CEP018	Construction Planning & Scheduling	PEC	T	3	3	0	0	3
7	24CEP019	Structural Dynamics and Earthquake Engineering	PEC	T	3	3	0	0	3
8	24CEP020	Environmental Impact Assessment	PEC	T	3	3	0	0	3
9	24CEP021	Repair and Rehabilitation of Structures	PEC	T	3	3	0	0	3
10	24CEP022	Prefabricated Structures	PEC	T	3	3	0	0	3
11	24CEP023	Finite Element Analysis	PEC	T	3	3	0	0	3
12	24CEP024	Tall Structures	PEC	T	3	3	0	0	3

OPEN ELECTIVE COURSES

OPEN ELECTIVES OFFERED BY THE PARENT (CIVIL) DEPARTMENT:

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24CEO001	Environment and Agriculture	OEC	T	3	3	0	0	3
2	24CEO002	Green Building Design	OEC	T	3	3	0	0	3
3	24CEO003	Geographical Information System	OEC	T	3	3	0	0	3
4	24CEO004	Climate Change and its Impacts	OEC	T	3	3	0	0	3
5	24CEO005	Disaster Management	OEC	T	3	3	0	0	3

OPEN ELECTIVES OFFERED BY DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24CSO001	Generative AI	OEC	T	3	3	0	0	3
2	24CSO002	Game Programming	OEC	T	3	3	0	0	3
3	24CSO003	Neural Networks and Deep Learning	OEC	T	3	3	0	0	3
4	24CSO004	Introduction to Augmented Reality (AR) / Virtual Reality (VR)	OEC	T	3	3	0	0	3
5	24CSO005	High Speed Networks	OEC	T	3	3	0	0	3

OPEN ELECTIVES OFFERED BY DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24EEO001	Sustainable and Environmental Friendly HV Insulation System	OEC	T	3	3	0	0	3
2	24EEO002	Smart Grids	OEC	T	3	3	0	0	3
3	24EEO003	Hybrid Energy Technology	OEC	T	3	3	0	0	3
4	24EEO004	Introduction to PLC Programming	OEC	T	3	3	0	0	3
5	24EEO005	Flexible AC Transmission Systems	OEC	T	3	3	0	0	3

OPEN ELECTIVES OFFERED BY DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24ECO001	Introduction to Control Engineering	OEC	T	3	3	0	0	3
2	24ECO002	Semiconductor Manufacturing	OEC	T	3	3	0	0	3
3	24ECO003	Mechatronics	OEC	TP	4	2	0	2	3
4	24ECO004	Sensors and Actuators	OEC	T	3	3	0	0	3
5	24ECO005	Wireless Networks	OEC	T	3	3	0	0	3

OPEN ELECTIVES OFFERED BY DEPARTMENT OF MECHANICAL ENGINEERING

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24MEO001	Drone Technologies	OEC	T	3	3	0	0	3
2	24MEO002	Introduction to Six Sigma	OEC	T	3	3	0	0	3
3	24MEO003	Sustainable Engineering	OEC	T	3	3	0	0	3
4	24MEO004	Foundation Skills in Integrated Product Development	OEC	T	3	3	0	0	3
5	24MEO005	Maintenance Engineering	OEC	T	3	3	0	0	3

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<u>CREDIT SUMMARY – SEMESTER BASIS</u>

Category / Semester	I	II	III	IV	V	VI	VII	VIII	Total Credits
HSMC	4	4	-	-	-	2	2	-	12
BSC	9	9	4	6	-	-	-	-	28
ESC	7	9	-	-	-	-	-	-	16
PCC	-	-	15	16	13	6	8	-	58
PEC	-	-	-	-	9	9	-	-	18
OEC	-	-	-	-	-	-	6	6	12
EEC	1	1	2	2	2	2	3	8	21
MC	-	-	✔	✔	✔	✔	-	-	0
Total Credits	**21**	**23**	**21**	**24**	**24**	**19**	**19**	**14**	**165**

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B. E CIVIL ENGINEERING

CATEGORY-WISE COURSE LIST

Humanities, Social Sciences and Management Courses (HSMC):

Sl. No	Course Code	Course Name	Type	Contact Periods / Week	L	T	P	Credits
1	24HSM101	Professional English I	T	3	3	0	0	3
2	24HSM102	Heritage of Tamils	T	1	1	0	0	1
3	24HSM103	Professional English II	T	3	3	0	0	3
4	24HSM104	Tamils and Technology	T	1	1	0	0	1
5	24HSM3**	Management Elective*	T	2	2	0	0	2
6	24HSM401	Professional Ethics and Human Values	T	2	2	0	0	2

Total Credits: 12

Basic Science Courses (BSC):

Sl. No	Course Code	Course Name	Type	Contact Periods / Week	L	T	P	Credits
1	24BSC101	Matrices and Calculus	T	4	3	1	0	4
2	24BSC102	Engineering Physics	T	3	3	0	0	3
3	24BSC121	Engineering Physics Laboratory	P	4	0	0	4	2
4	24BSC105	Statistics and Numerical Methods	T	4	3	1	0	4
5	24BSC103	Engineering Chemistry	T	3	3	0	0	3
6	24BSC122	Engineering Chemistry Laboratory	P	4	0	0	4	2
7	24BSC201	Transform and Partial Differential Equations	T	4	3	1	0	4
8	24BSC204	Complex Variables and Fourier Transforms	T	4	3	1	0	4
9	24BSC207	Environmental Science and Sustainability	T	2	2	0	0	2

Total Credits: 28

Engineering Science Courses (ESC)

Sl. No	Course Code	Course Name	Type	Contact Periods / Week	L	T	P	Credits
1	24ESC102	Basic Electrical and Electronics Engineering	TP	3	3	0	0	3
2	24ESC103	Engineering Graphics	T	6	2	0	4	4
3	24ESC121	Engineering Practices Laboratory	P	4	0	0	4	2
4	24ESC111	Problem Solving and Python Programming	TP	5	3	0	2	4
5	24ESC106	Engineering Mechanics	T	3	3	0	0	3

Total Credits: 16

Professional Core Courses (PCC)

Sl. No	Course Code	Course Name	Type	Contact Periods / Week	L	T	P	Credits
1	24CEC211	Fluid Mechanics and Hydraulic Machinery	TP	5	3	0	2	4
2	24CEC201	Construction Materials and Technology	T	3	3	0	0	3
3	24CEC212	Surveying and Levelling	TP	5	3	0	2	4
4	24CEC202	Engineering Geology	T	3	3	0	0	2
5	24CEC221	Computer Aided Building Drawing	P	4	0	0	4	2

6	24CEC203	Water Supply and Wastewater Engineering	T	3	3	0	0	3
7	24CEC206	Strength of Materials	T	3	3	0	0	3
8	24CEC204	Concrete Technology	T	3	3	0	0	3
9	24CEC205	Highway and Railway Engineering	T	3	3	0	0	3
10	24CEC222	Water and Wastewater Analysis Laboratory	P	4	0	0	4	2
11	24CEC223	Strength of Materials Laboratory	P	4	0	0	4	2
12	24CEC301	Design of Reinforced Concrete Structural Elements	T	3	3	1	0	4
13	24CEC302	Structural Analysis I	T	3	3	0	0	3
14	24CEC311	Soil Mechanics	TP	5	3	0	2	4
15	24CEC321	Concrete & Highway Engineering Laboratory	P	4	0	0	4	2
16	24CEC303	Foundation Engineering	T	3	3	0	0	3
17	24CEC304	Structural Analysis II	T	3	3	0	0	3
18	24CEC401	Design of Steel Structural Elements	T	3	3	0	0	3
19	24CEC402	Estimation, Costing and Valuation Engineering	T	3	3	0	0	3
20	24CEC421	Computer Aided Design and Drafting Laboratory	P	4	0	0	4	2

Total Credits: 58

Employability Enhancement Courses (EEC)

Sl. No	Course Code	Course Name	Type	Contact Periods / Week	L	T	P	Credits
1	24CDC101	Career Development Skills I	T	1	1	0	0	1
2	24CDC102	Career Development Skills II	T	1	1	0	0	1
3	24CDC201	Career Development Skills III	P	2	0	0	2	1
4	24CDC221	Mini Project I	P	2	0	0	2	1
5	24CDC202	Career Development Skills IV	p	2	0	0	2	1
6	24CDC223	Mini Project II	P	2	0	0	2	1
7	24CDC301	Career Development Skills V	T	1	1	0	0	1
8	24CDC322	Field Survey for Civil Engineers	P	2	0	0	2	1
9	24CDC302	Career Development Skills VI	T	1	1	0	0	1
10	24CDC324	Applications of Civil Engineering Software	P	2	0	0	2	1
11	24CDC421	Career Development Skills VII	P	2	0	0	2	1
12	24CDC422	Project Work Phase I	P	4	0	0	4	2
13	24CDC423	Project Work Phase II	P	16	0	0	16	08

Total Credits: 21

ENROLLMENT FOR (HONOURS) MINOR DEGREE (OPTIONAL)

A student can optionally register for additional courses (18 credits) from semester V onwards and become eligible for the award of B.E / B. Tech (Honors) or Minor degree. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For minor degree, the student can register for courses from any one of the other programmes. Moreover, the student can register for courses from any one of the following verticals also.

Verticals for Minor Degree (In addition to all the verticals of other programmes)

Verticals I	Verticals II	Verticals III	Verticals IV	Verticals V
Fintech and Block Chain	**Entrepreneurship**	**Public Administration**	**Business Data Analytics**	**Environment and Sustainability**
Financial Management	Foundations of Entrepreneurship	Principles of Public Administration	Statistics for Management	Sustainable infrastructure Development
Fundamentals of Investment	Team Building and Leadership Management for Business	Constitution of India	Datamining for Business Intelligence	Sustainable Agriculture and Environmental Management
Banking, Financial Services and Insurance	Creativity and Innovation in Entrepreneurship	Public Personnel Administration	Human Resource Analytics	Sustainable Bio Materials
Introduction to Blockchain and its Applications	Principles of Marketing Management for Business	Administrative Theories	Marketing and Social Media Web Analytics	Materials for Energy Sustainability
Introduction to Fintech	Human Resource Management for Entrepreneurs	Indian Administrative System	Operation and Supply Chain Analytics	Green Technology
Fintech Personal Finance and Payments	Financing New Business Ventures	Public Policy Administration	Financial Analytics	Environmental Quality Monitoring and Analysis

(Choice of courses for Minor degree is to be made from any one vertical of other programmes or from any one of the following verticals)

VERTICAL1: FINTECH AND BLOCK CHAIN

S. No.	CourseCode	CourseName	Type	Total Contact Periods	Periods Per Week			Credits
					L	T	P	
1	24HOF001	Financial Management	T	3	3	0	0	3
2	24HOF002	Fundamentals of Investment	T	3	3	0	0	3
3	24HOF003	Banking, Financial Services and Insurance	T	3	3	0	0	3
4	24HOF004	Introduction to Block chain and its Applications	T	3	3	0	0	3
5	24HOF005	Introduction to Fintech	T	3	3	0	0	3
6	24HOF006	Fintech Personal Finance and Payments	T	3	3	0	0	3

VERTICAL 2: ENTREPRENEURSHIP

S. No.	CourseCode	CourseName	Type	Total Contact Periods	Periods Per Week			Credits
					L	T	P	
1	24HOE001	Foundations of Entrepreneurship	T	3	3	0	0	3
2	24HOE002	Team Building & Leadership Management for Business	T	3	3	0	0	3
3	24HOE003	Creativity andInnovation in Entrepreneurship	T	3	3	0	0	3
4	24HOE004	Principles of Marketing Management for Business	T	3	3	0	0	3
5	24HOE005	Human Resource Management for Entrepreneurship	T	3	3	0	0	3
6	24HOE006	Financing New Business Ventures	T	3	3	0	0	3

VERTICAL 3: PUBLIC ADMINISTRATION

S. No.	CourseCode	CourseName	Type	Total Contact Periods	Periods Per Week			Credits
					L	T	P	
1	24HOP001	Principles of Public Administration	T	3	3	0	0	3
2	24HOP002	Constitution of India	T	3	3	0	0	3
3	24HOP003	Public Personnel Administration	T	3	3	0	0	3
4	24HOP004	Administrative Theories	T	3	3	0	0	3

5	24HOP005	Indian Administrative System	T	3	3	0	0	3
6	24HOP006	Public Policy Administration	T	3	3	0	0	3

VERTICAL 4: BUSINESS DATA ANALYTICS

S. No.	CourseCode	CourseName	Type	Total Contact Periods	Periods Per Week			Credits
					L	T	P	
1	24HOB001	Statistics for Management	T	3	3	0	0	3
2	24HOB002	Data mining for Business Intelligence	T	3	3	0	0	3
3	24HOB003	Human Resource Analytics	T	3	3	0	0	3
4	24HOB004	Marketing and Social Media Web Analytics	T	3	3	0	0	3
5	24HOB005	Operation and Supply Chain Analytics	T	3	3	0	0	3
6	24HOB006	Financial Analytics	T	3	3	0	0	3

VERTICAL 5: ENVIRONMENT AND SUSTAINABILITY

S. No.	CourseCode	CourseName	Type	Total Contact Periods	PeriodsP erWeek			Credits
					L	T	P	
1	24HOS001	Sustainable infrastructure Development	T	3	3	0	0	3
2	24HOS002	Sustainable Agriculture and Environmental Management	T	3	3	0	0	3
3	24HOS003	Sustainable Bio Materials	T	3	3	0	0	3
4	24HOS004	Materials for Energy Sustainability	T	3	3	0	0	3
5	24HOS005	Green Technology	T	3	3	0	0	3
6	24HOS006	Environmental Quality Monitoring and Analysis	T	3	3	0	0	3

SREE SAKTHI ENGINEERING COLLEGE

(Autonomous)

REGULATIONS 2024

CHOICE BASED CREDIT SYSTEM

B. E CIVIL ENGINEERING

SYLLABI

Course Code : 24HSM101	Course Title : Professional English I	
Course Category : HSMC	Credits : 3	
L:T:P (Hours/Week) : 3:0:0	Total Contact Hours : 45	Max Marks : 100

COURSE OBJECTIVES:

1. Develop speaking skills to confidently introduce oneself, express preferences, and share opinions in various settings.
2. Master reading strategies like skimming and scanning to understand and analyze information from different texts effectively.
3. Engage actively in group discussions, present ideas clearly, discuss different perspectives, and participate in role-plays.
4. Learn to write clear emails, summaries, and structured paragraphs while comparing and analyzing information from diverse sources.
5. Demonstrate proficiency in writing essays, narratives, and dialogues using appropriate grammar and effective sentence transformations.

UNIT I: INTRODUCTION TO EFFECTIVE SPEAKING 9

Listening –short text - formal & informal conversation –telephone conversation, Classroom lectures **Speaking -** Introducing oneself, one‟s family / friend; Talk about preferences – Agree and Disagree –Giving opinions - **Reading** – Telephone message - Introduction of different kinds of readingmaterials (Technical and Non-technical) - **Writing** –principles of writing – Wordformation–
Wordexpansion(rootwords/etymology)Hintsdevelopment,Readingcomprehensionexercises-**Grammar**-Partsofspeech,Questions –WHtype,Yes/ NoandTagQuestions.

UNIT II: DIFFERENT STRATEGIES OF READING 9

Listening-Listeningtotravel podcast- travel documentary, Listeningandrespondingtovideolectures/Talks-**Speaking**-Strategiesforgoodconversation-Improving fluency andself-expression–Articulation– Accent and intonation - **Reading** - Different reading strategies, Skimming , Scanning – Newspaper report -**Writing** – Descriptions,Instructions,Recommendations,Definitions–Singlesentencedefinition–**Grammar**-Typesofsentences,Prepositions,Modalverbs.

UNIT III: GROUP INTERACTION 9

Listening –Radio and TV advertisements, speeches of great personalities –**Speaking**-Groupinteraction - Speaking in formal situations (teachers, officials, foreigners), role-play – **Reading** - An article, excerpts from literature – **Writing** - Paragraph writing, Letter writing – Formal –informal **Grammar**-Synonymandantonym,Tenses,Adjectives-CauseandEffectexpressions

UNIT IV: INTRODUCTION TO EFFECTIVE WRITING 9

Listening-Listeningtoannouncements, discussions/debates-Speaking-Respondingto questions – Different forms of interviews – welcome address, vote of thanks - Reading – Longer technicaltexts, social media posts and brochures, comparingfactsandfigures-Writing-Email-etiquette, summarizing and paragraphing – Single word substitutes - Free writing on any given topic (Myfavoriteplace/Hobbies/Schoollife,etc.) Grammar–sentence pattern, idioms, Adverbs and Phrasal verbs.

UNIT V: EFFECTIVE WRITING 9

Listening -Listening to dialogues ,conversations and completing exercises based on them – Listening to longer texts and filling up the table **Speaking** – sharing information of a personal kind – greeting- peer discussion **Reading -** Reading and understanding specific meaning in a text - note making, reviews related to given topic -**Writing**–Typesofessays, storywriting-dialogue writing, Useofabbreviationsandacronyms –**Grammar**– transformation of sentences (simple, compound and complex),Collocations,fixedandsemifixed expressions.

Course Outcomes At the end of this course, students will be able to:	**Cognitive Level**
CO 1: Understand effective speaking skills to introduce themselves, describe preferences, discuss opinions, and engage in both formal and informal conversations confidently.	Understand
CO 2: Analyze different reading strategies such as skimming and scanning to understand information from various texts, including travel podcasts, video lectures, and newspaper reports.	Analyze
CO 3: Constructively engage in group discussions, articulating ideas clearly in formal settings, exploring diverse viewpoints, and effectively analyzing speeches and articles.	Understand
CO 4: Apply skills to write clear emails, summarize information effectively, and analyze facts and figures from technical texts and social media posts.	Apply
CO 5: Identify advanced writing abilities to create well-structured essays, stories, and dialogues using expressive language techniques.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	1	1	1	1	1	3	-	1	1	-	-
CO2	1	2	1	1	1	1	1	1	1	1	1	2	1	-	-
CO3	1	-	-	1	1	1	1	1	2	2	1	1	1	-	-
CO4	1	2	1	1	1	1	1	1	1	2	1	1	1	-	-
CO5	1	1	2	1	1	1	1	1	1	2	1	1	1	-	-
MAX	1	2	2	1	1	1	1	1	2	3	1	2	**1**	-	-

(1 – Low, 2 – Medium, 3 – High, "-" – No Correlation)

Text Book(s) :

T1. Locker, Kitty O., and Stephen KyoKaczmarek. Business Communication: BuildingCritical Skills. 6th ed., McGraw-Hill, 2013.

T2. Singh, Neetu. English for General Competitions: From Plinth to Paramount. n.d.

T3. Orient Blackswan. English for Engineers and Technologists. Vol. 1, 2022.

T4. Richards, Jack C. Interchange Student‟s Book 1. 4th ed., Cambridge University Press, 2015.

Reference Book(s):

R1.Verderber, Rudolph F., and Kathleen S. Verderber. Communicate! A Handbook for Interpersonal Communication. Cengage Learning, 2017.

R2.Wallwork, Adrian. English for Academic Correspondence and Socializing. Springer,2011.

R3. Chaturvedi, P.D., and Mukesh Chaturvedi. Business Communication: Concepts, Cases, and Applications. n.d.

R4. Raman, Meenakshi, and Sangeetha Sharma. Technical Communication: Principles and Practice. Oxford University Press, 2014.

Course Code :24BSC101	Course Title:Matrices and Calculus	
Course Category: BSC	Credits:4	
L:T:P(Hours/Week) : 3:1:0	Total Contact Hours:60	Max Marks:100

COURSE OBJECTIVES:

- To develop the use of matrix algebra techniques for practical applications in engineering.
- To use derivatives to analyze functions such as maxima / minima, concavity, inflection points.
- To apply advanced techniques of partial differentiation and Jacobian‟s matrices.
- To develop a strong understanding of double integral calculus, apply double integrals to solve real world problems.
- To enhance problem solving skills using triple integral calculus.

UNIT- I MATRICES 9 +3

Eigen values and Eigenvectors of a real matrix – Properties of Eigen values and Eigenvectors – Cayley – Hamilton theorem(excluding proof) – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation .

UNIT - IIDIFFERENTIAL CALCULUS 9+3

Representation of functions – Limit of a function – Continuity – Derivatives – Differentiation rules – Applications Maxima and Minima of functions of one variable – Absolute maximum and Absolute minimum – Concave upward, Concave downward.

UNIT- III MULTI VARIABLE CALCULUS 9+3

Partial differentiation – Homogeneous functions and Euler‟s theorem – Total derivative – Change of variables – Jacobian‟s – Taylor‟s series for functions of two variables – Applications: Maxima and minima of functions of two variables and Lagrange‟s method of undetermined multipliers.

UNIT- IV DOUBLE INTEGRAL 9+3

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves- Change of variables in double integrals.

UNIT V TRIPLE INTEGRAL AND ITS APPLICATIONS 9+3

Evaluation of Triple integrals –- Simple Problems- Volume as triple integrals - Volume of solids – Change of variables in triple integrals.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	

CO 1: Identify and solve algebraic Eigen value problems from the practical areas in the engineering.	Analyze
CO 2: Understand the concepts of derivatives, limit, continuity and to demonstrate the critical thinking, analytical skills in mathematical problem solving.	Understand
CO 3: Apply differentiation to optimize functions of multiple variables using partial derivatives and Lagrange multiplier.	Apply
CO 4: Use double integrals to calculate areas, volumes and surface areas of different regions and objects.	Apply
CO 5: Calculate Volumes of solids using triple integrals in cylindrical and spherical co-ordinates.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	-	2	-	-	-	-	-	-	3	-	1
CO2	3	3	3	1	-	2	-	-	-	-	-	-	3	-	1
CO3	3	3	3	1	-	2	-	-	-	-	-	-	3	-	1
CO4	3	3	3	1	-	2	-	-	-	-	-	-	3	-	1
CO5	3	3	3	1	-	2	-	-	-	-	-	-	3	-	1
MAX	3	3	3	1	-	2	-	-	-	-	-	-	3	-	1

(1 – Low, 2 – Medium, 3 – High, "-" – No Correlation)

Text Book(s):

T1. Kreyszig Erwin, " Advanced Engineering Mathematics", John Wiley And Sons (Asia) Limited, New Delhi, 10th Edition, 2019

T2. James Stewart, " Calculus: Early Transcendentals ", Cengage Learning 9thEdition,New Delhi, 2017.

T3. David C Lay, "Linear Algebra and its Applications", Pearson Publications, 5thEdition, India, 2016.

Reference Book(s):

R1. Jain RK and Iyengar SRK., "Advanced Engineering Mathematics", Narsa Publications, New Delhi, 5th Edition, 2017.

R2. SrimanthaPal and Bhunia S.C, " Engineering Mathematics " Oxford University Press, 2015.

R3. Patrick M, Fitz Patrick, "Advanced Calculus"- 2nd Edition, American Mathematical Society (2006).

R4. Jerrold. E Marsden and Anthony J. Tromba, "Vector Calculus", W. H. Freeman,6thEdition,2011.

Course Code : 24BSC102	Course Title :Engineering Physics	
Course Category : BSC	Credits : 3	
L:T:P(Hours/Week) : 3:0:0	Total Contact Hours : 45	Max Marks : 100

COURSE OBJECTIVES:

- To apply the knowledge of properties of matter in real world engineering applications.
- To analyze and characterize fiber optics and laser beams.
- To analyze thermal properties of matter and energy transfer processes.
- To analyze and explain the semiconductor materials and its application.
- To understand and apply the fundamental principles and mathematical formalism of quantum physics.

UNIT I: PROPERTIES OF MATTER **9**

Introduction-Elasticity-Stress-strain: Types of strain-Hooke's law- Stress - Strain Diagram and uses -Yield point-Elastic limit-Elastic moduli-Types of elastic moduli-Relation between elastic constants-Poisson's Ratio -Factors affecting elasticity- Bending of beam-Expression for bending moment and depression - Cantilever: Theory and Experimental determination- Expression for Young's modulus by Non uniform-Uniform bending and experimental determination-I-shape girders-Other states of matter.

UNIT II: LASER AND FIBER OPTICS **9**

LASER:

Interaction of radiation with matter (Quantum mechanical view): Principle of spontaneous emission and stimulated emission-Einstein Coefficients-Derivation-Difference between spontaneous emission and stimulated emission-Basic components in Laser-Principle of laser-properties of laser-Types of lasers: Nd-YAG laser,CO_2 laser, Semiconductor laser: Homojunction-Heterojunctions-Application of laser.

FIBER OPTICS:

Fiber optics-principle of optical fibers- acceptance angle-total internal reflection-numerical aperture-types of optical fibre-losses in fibres: scattering losses-absorption losses-fiber optics sensors: Displacement sensors-pressure sensor with micro bending concept-application of fiber optic sensors-characteristics advantages of fiber optical sensors.

UNIT III: THERMAL PHYSICS 9

Transfer of heat energy-conduction-convection-radiation- Thermal expansion of solids: Relation between α and β -Thermal expansion of liquids-Thermal Conduction/Conductivity: Heat conduction in solids-Heat Conduction through Compound media Series and Parallel-Radial flow of Heat-Analogy between thermal and electrical conduction-Experimental Measurement of Thermal Conductivity: Forbes Method (Good Conductor) -Lee"s Disc Method for finding Thermal Conductivity (Bad Conductor)-Convection: Thermal insulation-U-values-Radiation: High temperature furnace-Heat Exchangers-Greenhouse effect–Solar power-Refrigerators-Ovens.

UNIT IV: SEMICONDUCTOR AND ITS APPLICATION 9

Introduction-Basics of the band theory of solids-Types of semiconductors-Hall effect-determination of Hall coefficient-P-N junction diode-voltage -current characteristics of a P-N junction diode-Introduction to optoelectronic devices-LED-construction, working and applications- OLED- construction, working and applications-Solar cell-construction, working and applications.

UNIT V: QUANTUM PHYSICS 9

Introduction-Black body radiation –Compton effect: theory and experimental verification – wave particle duality – electron diffraction –concept of wave function and its physical significance – Schrödinger"s wave equation – time independent and time dependent equations –particle in a one-dimensional box –Tunnelling - Scanning tunnelling microscope.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply the knowledge of properties of matter to real world engineering applications	Apply
CO2: Analyze and characterize fiber optics and laser beams.	Analyze
CO3: Analyze the behavior of thermal system.	Analyze
CO4: Analyze and explain the semiconductor materials and its application.	Analyze
CO5 Understand fundamental principles and mathematical formalism of quantum physics.	Understand

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	2	1
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	2	1
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	2	1
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	2	1
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	2	1
MAX	3	2	-	-	-	-	-	-	-	-	-	-	3	2	1

(1 – Low, 2 – Medium, 3 – High, "-" – No Correlation)

Text Book(s) :

T1. Avathanulu M.N and Kshirsagar P.G, "A text book of Engineering Physics", S. Chand and company, 11th Edition,2014.

T2. Bhattacharya D.K and Poonam T, "Engineering Physics", Oxford University Press, 2017.

T3. Halliday D, Resnick R and Walker J, "Principles of Physics", Wiley, 9th Edition, 2010.

T4. Engineering Physics, Rajendran V., Tata McGraw-Hill Education Pvt. Ltd., 2010 .

Reference Book(s):

R1. Arthur Beiser, "Concepts of Modern Physics", Tata McGraw Hill, 9th Edition, 2015.

R2. Engineering Physics, R K Gaur and S L Gupta DhanpatRai Publications.Edition,2014.

R3. "Physics" by David J. Johnson.

R4. Concepts of Physics, H. C. Verma vol 1 and 2, Bharati Bhawan Publishers & Distributors; First edition (2017).

Course Code : 24ESC102		**Course Title : Basic Electrical and Electronics Engineering**	
Course Category : ESC		**Credits : 3**	
L:T:P(Hours/Week)	**3:0:0**	**Total Contact Hours : 45**	**Max Marks : 100**

COURSE OBJECTIVES:

- To introduce the basics of Electric Circuits and analysis
- To impart knowledge in the basics of working principles and application of Electrical Machines
- To introduce Analog devices and their characteristics
- To educate on the fundamental concepts of Digital Electronics
- To introduce the functional elements and working of Measuring Instruments

UNIT-I ELECTRICAL CIRCUITS 9

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm‟s Law - Kirchhoff‟s Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state)

Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)

UNIT-II ELECTRICAL MACHINES 9

Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor.

UNIT-III ANALOG ELECTRONICS 9

Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon &Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET,IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters

UNIT-IV DIGITAL ELECTRONICS 9

Review of number systems, binary codes, error detection and correction codes, Combinational logic- representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only).

UNIT-V MEASUREMENTS AND INSTRUMENTATION 9

Functional elements of an instrument, Standards and calibration, Operating Principle, types – Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers-CT and PT, DSO- Block diagram- Data acquisition.

TOTAL: 45 HOURS

Course Outcomes At the end of this course, students will be able to:	**Cognitive Level**
CO 1: Compute the Electric circuit parameters for simple problems	Apply
CO 2: Explain the working principle and applications of Electrical Machines	Apply
CO 3: Analyze the characteristics of Analog Electronic devices	Apply
CO 4: Explain the basic concepts of Digital Electronics	Apply
CO 5: Explain the operating principles of Measuring Instruments	Apply

MAPPING OF CO – PO & PSO:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	-	-	1	-	-	-	2	-	-	1
CO2	2	2	1	-	-	-	-	1	-	-	-	2	-	-	1
CO3	2	1	1	-	-	-	-	1	-	-	-	2	-	-	1
CO4	2	2	1	-	-	-	-	1	-	-	-	2	-	-	1
CO5	2	2	1	-	-	-	-	1	-	-	-	2	-	-	1
Max	2	2	1	-	-	-	-	1	-	-	-	2	-	-	1

(1 – Low, 2 – Medium, 3 – High, “-“ – No Correlation)

Text Book(s):

T1. Kothari DP and I.J Nagrath, “Basic Electrical and Electronics Engineering”, Second Edition, McGraw Hill Education, 2020

T2. S.K.Bhattacharya “Basic Electrical and Electronics Engineering”, Pearson Education, Second Edition, 2017.

T3. Sedha R.S., “A textbook book of Applied Electronics”, S. Chand & Co., 2008

T4. James A .Svoboda, Richard C. Dorf, “Dorf‟s Introduction to Electric Circuits”, Wiley, 2018.

T5. A.K. Sawhney, Puneet Sawhney „A Course in Electrical & Electronic Measurements & Instrumentation‟, DhanpatRai and Co, 2015.

Reference Book(s):

R1. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019.

R2. Thomas L. Floyd, „Digital Fundamentals‟, 11th Edition, Pearson Education, 2017.

R3. Albert Malvino, David Bates, „Electronic Principles, McGraw Hill Education; 7th edition,2017.

R4. MahmoodNahvi and Joseph A. Edminister, "Electric Circuits", Schaum‟ Outline Series, McGraw Hill, 2002.

R5. H.S. Kalsi, „Electronic Instrumentation‟, Tata McGraw-Hill, New Delhi, 2010

Web References:

1. https://archive.nptel.ac.in/courses/117/106/117106108/
2. https://archive.nptel.ac.in/courses/108/101/108101091/

Course Code: 24ESC103		Course Title: Engineering Graphics	
Course Category: ESC		Credits: 4	
L:T:P (Hours/Week)	2:0:4	Total Contact Hours:90	Max Marks: 100

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- To provide knowledge on fundamentals of engineering drawings and conic sections.
- To impart skill on orthographic projections of points and lines.
- To familiarize on projection of planes and simple solids.
- To provide knowledge on section of solids and development of surfaces of simple solids.
- To impart skill on conversion of isometric view to orthographic projection and vice versa.

UNIT I: CONCEPTS AND PLANE CURVES 6+12

Definition, standards, drawing tools, drawing sheets, scales, line and its types. Practices on lettering, numbering, dimension of drawings. Construction of conic sections - ellipse, parabola and hyperbola using eccentricity method.Cycloid and involute of circle and square.

UNIT II: PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes inclined to both the principal planes by rotating object method (Square, Circle, Polygonal surfaces).

UNIT III: PROJECTION OF SOLIDS AND FREE HAND SKETCHING 6+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Layout of views- Freehand sketching of multiple views from pictorial views of objects by free hand sketching.

UNIT IV: PROJECTION OF SECTIONED SOLIDS AND DEVLOPMENT OF SURFACES 6+12

Introduction to 'section of solids'. Section of simple solids in simple vertical position, when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of truncated prisms, pyramids, cylinders and cones. Application of sections of solids and development of lateral surfaces.

UNIT V: ISOMETRIC AND PERSPECTIVE PROJECTION 6+12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions- Applications of isometric projection. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method. Applications of perspective projection.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY)

Introduction to computer aided drafting and dimensioning using appropriate software. 2D drawing commands: Zoom, Picture editing commands, Dimensioning, Isometric drawing, Isoplanes and 3D drafting. Plotting of drawing. Practice includes drawing the projection of lines and solids. Prepare isometric view of simple solids like prisms, pyramids, cylinders and cones.

Total: 90 Periods

COURSE OUTCOMES		**Cognitive Level**
At the end of this course, students will be able to:		
CO1	Construct the conic curves, involutes and cycloid.	Create
CO2	Construct the projections of points, lines and planes.	Create
CO3	Draw the projections of simple solids.	Create
CO4	Draw the development of simple solids.	Create
CO5	Draw the orthographic, isometric and perspective projections of simple solids.	Create

MAPPING OF CO – PO & PSO:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
CO2	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
CO3	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
CO4	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
CO5	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
Max	**3**	**1**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**-**	**2**	**2**	**2**	**-**

(1 – Low, 2 – Medium, 3 – High, "-" – No Correlation)

Text Book(s):

T1. Venugopal K. And PrabhuRaja V., "Engineering Graphics", New Age International (P) Limited,2019.

T2. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai,2019

Reference Book(s):

R1. Bhatt N.D, "Engineeirng Drawing", Charotar Publishing House, 1st Edition, 2010.

R2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, 1st Edition, 2008.

R3. K Leo Dev Wins., "Engineering Drawing", Pearson (Wins) Publications, Latest Edition, 2019.

R4. Luzzader, Warren.J. andDuff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005

R5. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size, lay out of drawing sheet
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either-or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

Web References:

1. https://nptel.ac.in/courses/112103019
2. https://archive.nptel.ac.in/courses/112/102/112102304/

Course Code: 24HSM102		Course Title: Heritage of Tamils	
Course Category: HSMC		Credits: 1	
L:T:P (Hours/Week)	1:0:0	Total Contact Hours: 15	Max Marks: 100

[illegible] I [illegible]: 3

[illegible]

[illegible] II [illegible]: 3

[illegible]

[illegible] III [illegible]: 3

[illegible]

[illegible] IV [illegible]: 3

[illegible]

[illegible] V [illegible]: 3

[illegible]

HERITAGE OF TAMILS

UNIT I LANGUAGE AND LITERATURE **3**

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 3

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 3

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

UNIT IV THINAI CONCEPT OF TAMILS 3

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 3

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 : 15 PERIODS

TEXTBOOKS AND REFERENCE :

1. [illegible] – [illegible] –[illegible] .[illegible] . .([illegible] :[illegible]
2. [illegible] ([illegible]) [illegible] .[illegible] –
3. [illegible] – .([illegible])
4. [illegible] ([illegible]) [illegible] –

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL -(in print).
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - „Sangam City C ivilization on the banks of river Vaigai" (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

    Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code :24BSC121		**Course Title :Engineering Physics Laboratory**	
Course Category : BSC		**Credits : 2**	
L:T:P(Hours/Week)	**0:0:4**	**Total Contact Hours : 60**	**Max Marks : 100**

COURSE OBJECTIVES:

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.

LIST OF EXPERIMENTS

1. Determination of Young"s modulus – Uniform bending method
2. Determination of Rigidity modulus – Torsion Pendulum.
3. Determination of Young"s modulus – Cantilever method.
4. Determination of thickness of a thin wire – Air Wedge
5. Determination of Young"s modulus -Non-uniform bending method.
6. Determination of band gap of a semiconductor.
7. Lee"s disc – Determination of thermal conductivity of a bad conductor.
8. Determination of the wavelength of the laser using grating–Laser.
9. Determination of acceleration due to gravity-Compound Pendulum.
10. Semiconductor Laser:

a. Determination of wavelength of laser

b. Determination acceptance angle and numerical aperture of an optical fibre.

To make the student an active participant in each part of all lab exercises.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO 1: Understand the functioning of various physics laboratory equipment.	Understand
CO 2: Use graphical models to analyze laboratory data.	Analyze
CO 3: Use mathematical models as a medium for quantitative reasoning and describing physical reality.	Analyze
CO 4: Access, process and analyze scientific information.	Analyze
CO 5: Solve problems individually and collaboratively	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
MAX	3	2	-	-	-	-	-	-	-	-	-	-	**2**	-	-

High-3; Medium-2; Low-1; No Correlation -

Text Book(s):

T1. Practical physics G.L squires Cambridge university plus

T2. Jayaraman: Engineering Physics laboratory manual Edition, 2013,

T3. SeshaSaikumarVemula:" Engineering Physics laboratory Lab manual Edition 2017,

T4. D.K Bhattacharya and Poonam Tandon :"Engineering Physics Edition 2015.

Reference Book(s):

R1.Naidu: "Engineering Physics "(Pearson).

R2.Malik and Singh : " Engineering Physics (Tata McGraw-Hill Education Pvt. Ltd.,)

Course Code :24CDC101	Course Title : Career Development Skills I	
Course Category : EEC	Credits : 1	
L:T:P(Hours/Week) : 1:0:0	Total Contact Hours : 15	Max Marks : 25

COURSE OBJECTIVES:

- Learn about the culture of corporate world. Get groomed with professional ethics.
- Awareness about the job market; managing aspects of time and stress.
- Brief description about the higher studies courses, competitive exams and introduction to entrepreneur clauses.

UNIT I: **3**

Career Planning - Self-Assessment -Research - Skills Development - Networking - Professional Development - Flexibility and Adaptability - Work-Life Balance - Seeking Feedback - Stay Updated
Goal Settings- Set SMART :Specificity - Measurability - Achievability - Relevance - Time-bound - Breakdown into Steps - Review and Adjust - Accountability - Celebrate Achievements

UNIT II: **3**

Motivation I - Purpose -Learning Mindset - Stay Organized - Embrace Responsibility - Stay Positive - Reflect and Adapt - Peer Recognition and Support - Inspirational Guest - Speakers or Role Models
Personality Effectiveness - Self-Awareness - Emotional Intelligence -Adaptability - Conflict Resolution - Leadership Skills - Time Management - Continuous Learning - Positive Attitude.
Building Personality - Self-Reflection and Awareness - Assertiveness and Confidence - Relationship Building - Personal Branding
Discipline - Consistency and Persistence - Self-Control and Delayed Gratification - Accountability - Resilience
Interpersonal Skills and Collaboration - Presentation skills - Learning from Mistakes

UNIT III: **3**

Grooming - Dress Code Etiquette - Personal Appearance - Body Language and Posture
Hygiene - Practices & Clothing care
Cleanliness - Workspace maintenance - Environmental Awareness & Digital hygiene
Attitudes - Positive Attitude - Preparedness - Adaptability - Professionalism - Resilience -
Listening skills - Teamwork and Collaboration - Curiosity and Learning orientation - Gratitude and Humility
Manners &Behavior - Politeness and Courtesy - Confidence without arrogance - Respect for personal space and boundaries - Flexibility and Conflict Resolution skills
*Overall preparation - Role of Confidence & Cultural Sensitivity

UNIT IV: **3**

Self awareness - Understanding Strengths and Weaknesses - Personal values - **Emotional Intelligence** - Self-Reflection and Learning Style

Self-confidence - Building a Positive Self-Image - Overcoming fear of failure - Assertiveness

Time management - Setting Priorities - Planning and Scheduling - Time Estimation and Budgeting - Minimizing Procrastination - Effective decision making

Stress management - Stressors identification - Relaxation techniques - Mindfulness - Physical activity - Positive thinking - Healthy lifestyle - Sound sleep- Hobbies and leisure activities - Humour and laughter - Say 'no' to unwanted

Emotional intelligence - Self regulation - Empathy - Societal bearing - Understanding causes and consequences of emotions

UNIT V: **3**

Introduction to Higher Education - Specialization - Research opportunities - Career advancements - Employability

Competitive exams - Merit recognition - Validation of academic abilities - Global recognition (GRE, GMAT, SAT) - Competitive edge - Global career opportunities - Excel, Grow and Achieve professionally

Introduction to Entrepreneurship- Independence and autonomy - Opportunity to pursue passion - Innovation and creativity - Creating jobs - Sharing and Mutual growth via collaboration and partnerships

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO 1: Overview the goals and know diversities in the field of career planning	Understand
CO 2: Improve personal and professional effectiveness	Analyze
CO 3: Trimming up manners and behaviour	Evaluate
CO 4: Understand stress, time and emotional management; learn to overcome fear and uncomfortable situations such as public speaking	Understand and Apply
CO 5: Knowledge about the higher education, types of competitive exams and Entrepreneur assertiveness	Create

Reference Book(s):

R1. Barun K Mitra, “Personal Development and Soft Skills”, Oxford Higher Education

R2. E. Suresh Kumar, P.Sreehari, J Savithri, “Communication skills and soft skills - An integrated approach”.

R3. Raj Lakshmi Suryavanshi,“Soft Skills”, Gurucool Publishing.

SEMESTER II

Course Code : 24HSM103	**Course Title : Professional English II**	
Course Category :HSMC	**Credits : 3**	
L:T:P(Hours/Week) : 3:0:0	**Total Contact Hours : 45**	**Max Marks : 100**

COURSE OBJECTIVES:

- Develop skills in understanding and explaining cause and effect relationships through listening, speaking, reading, and writing activities.
- Enhance abilities to compare and contrast information effectively through listening, speaking, reading, and writing tasks.
- Build skills in analyzing problems, proposing solutions, and communicating ideas clearly through various listening, speaking, reading, and writing exercises.
- Acquire proficiency in reporting events and information accurately through listening, speaking, reading, and writing practices.
- Strengthen skills in delivering effective presentations and communicating clearly in professional contexts through listening, speaking, reading, and writing activities.

UNIT I: CAUSE AND EFFECT 9

Listening – Listening to longer technical talks and completing exercises- formal speeches; **Speaking** – Role play exercises based on workplace contexts- asking for and giving directions. **Reading** – an excerpt from a travelogue-Journal articles on issues like Global warming; **Writing** - Instructions; Official letter / email; **Grammar** – If conditionals, Imperatives; Cause and effect expressions, prefix and suffixes, Articles.

UNIT II: COMPARE AND CONTRAST 9

Listening – Product reviews and gap fill exercises, Short Talks (like TED Talks) for specific information; **Speaking** – discussing progress towards goals- talking about experience **Reading** – Graphical content (table / chart / graph) and making inferences, bio-note; **Writing**– Compare and Contrast Essay- writing responses to complaints- Making recommendations; **Grammar**–Degrees of Comparison; infinitives and gerunds, prepositional phrases.

UNIT III: PROBLEM AND SOLUTION 9

Listening – online discussions on current issues and role play -situational dialogues; **speaking**– discussing news stories- talking about travel procedures **Reading** – Visual content (Pictures on social issues / natural disasters) for comprehension- business letters; **Writing**- checklists- cause and effect essays- Problem and Solution Essay; **Grammar** – singular and plural, Reported speech, Relative pronoun;

UNIT IV: REPORTING **9**

Listening – Telephone interview-Oral news report; **Speaking** – discussing forecasts and scenarios – discussing likes and dislikes **Reading** – Newspaper report on survey findings- annual reports; **Writing** – report writing - accident report- Survey report,; **Grammar** – Active and passive voice, conjunction, Homophones & Homonyms

UNIT V: PRESENTATION **9**

Listening – Job interview- music review; **Speaking** – describing natural environment – explaining rules and regulations **Reading** –company profiles- an excerpt of interview with professionals; **Writing** – Job application (cover letter and CV)- transcoding; **Grammar** – Collocations- Numerical adjectives- content and function words.

Course Outcomes At the end of this course, students will be able to:	**Cognitive Level**
CO 1: Identify cause and effect relationships accurately through listening, speaking, reading, and writing activities	Understand
CO 2: Understand the effective use of comparing and contrasting information from various sources using listening, speaking, reading, and writing skills.	Understand
CO 3: Analyze problems, propose solutions, and communicate ideas clearly through listening, speaking, reading, and writing exercises.	Analyze
CO 4: Interpret events and information accurately through listening, speaking, reading, and writing practices.	Understand
CO 5: Apply skills in delivering effective presentations and communicating clearly in professional contexts through listening, speaking, reading, and writing tasks.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	1	1	1	1	1	1	2	1	1	1	-	-
CO2	1	2	-	1	1	1	1	1	1	2	1	1	1	-	-
CO3	1	2	1	1	1	1	1	1	2	2	1	1	1	-	-
CO4	1	2	1	1	1	2	1	1	1	2	1	1	1	-	-
CO5	1	1	1	1	1	1	1	1	1	2	2	1	1	-	-
MAX	1	2	1	1	1	2	1	1	2	2	2	1	1	-	-

High-3; Medium-2; Low-1; No Correlation - -

Text Book(s):

T1. Raman, Meenakshi, and Sangeeta Sharma. Technical Communication: Principles and Practice. Oxford University Press, 2014.

T2. Guffey, Mary Ellen, and Dana Loewy. Business Communication: Process and Product. 10th ed., Cengage Learning, 2021.

T3. English for Science & Technology - II. Cambridge University Press, 2023.

T4. English for Engineers and Technologists. Vol. 2, Orient Blackswan, 2022.

Reference Book(s):

R1. Laplante, Phillip A. Technical Writing: A Practical Guide for Engineers, Scientists, and Nontechnical Professionals.

R2. Wallwork, Adrian. English for Academic Correspondence and Socializing. Springer, 2011.

R3. Chaturvedi, P.D., and MukeshChaturvedi. Business Communication: Concepts, Cases, and Applications.

R4. Anderson, Paul V. Technical Communication: A Reader-Centered Approach.

Course Code: 24BSC105		**Course Title: Statistics and Numerical Methods**	
Course Category: ESC		**Credits: 4**	
L:T:P (Hours/Week)	**3:1:0**	**Total Contact Hours:60**	**Max Marks: 100**

COURSE OBJECTIVES:

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To explore the knowledge of testing of hypothesis for small and large samples this plays an important role in real life problems.
- To interpret the basic concepts of solving algebraic and transcendental equations.
- To analyze the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquire the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS (9+3)

Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS (9+3)

One way and two way classifications - Completely randomized design – Randomized block design– Latin square design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS (9+3)

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Iterative methods of Gauss Seidal– Eigenvalues of a matrix by Power method.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICALINTEGRATION (9+3)

Lagrange‟s and Newton‟s divided difference interpolations – Newton‟s forward and backwarddifference interpolation – Numerical single integration's using Trapezoidal and Simpson‟s 1/3 rules .

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS (9+3)

Single step methods: Taylor‟s series method - Euler‟s method - Modified Euler‟s method – Fourth order Runge-Kutta method for solving first order differential equations - Multi step methods:Milne‟s predictor corrector methods for solving first order differentialequations.

Total: 45 Periods

COURSE OUTCOMES		**Cognitive Level**
At the end of this course, students will be able to:		
CO1	Apply the concept of testing of hypothesis for small and large samples in real life problems.	Apply
CO2	Analyze and compare different experimental designs.	Analyze
CO3	Analyze and compare the accuracy and efficiency of different numerical methods.	Analyze
CO4	Understand the knowledge of various techniques and methods for interpolation and numerical integration.	Understand
CO5	Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.	Analyze

MAPPING OF CO – PO & PSO:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	1	1	-	-	-	2	-	2	-	3	1	-
CO2	3	3	1	1	1	-	-	-	2	-	2	-	1	1	-
CO3	3	3	1	1	1	-	-	-	2	-	2	-	1	1	-
CO4	3	3	1	1	1	-	-	-	2	-	2	-	2	1	-
CO5	3	3	1	1	1	-	-	-	2	-	2	-	2	1	-
Max	3	3	1	1	1	-	-	-	2	-	2	-	3	1	-

(1 – Low, 2 – Medium, 3 – High, "-" – No Correlation)

Text Book(s):

T1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science",Khanna Publishers, 11th Edition, New Delhi , 2022.

T2.Johnson, R.A., Miller, I and Freund J., "Miller and Freund‟s Probability andStatistics for Engineers", Pearson Education, Asia, 9th Edition, 2021.

Reference Book(s):

R1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning , 2019.

R2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2016.

R3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia ,New Delhi, 7th Edition, 2017.

R4. Gupta S.C. and Kapoor V. K., " Fundamentals of Mathematical Statistics", Sultan Chand &Sons, New Delhi, 12th Edition, 2022.

R5. Spiegel. M.R., Schiller. J. and Srinivasan .R.A., " Schaum‟ s Outlines on Probability and Statistics ", Tata Mc Graw Hill Edition, 4th Edition, 2018.

R6. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9thEdition , Pearson Education, Asia, 2016.

R7. Veerarajan.T, " probability statistics and random processes ".4th edition, Tata Mc Graw -Hill,2016.

Course Code : 24BSC103		Course Title : Engineering Chemistry	
Course Category : BSC		Credits : 3	
L:T:P(Hours/Week)	3:0:0	Total Contact Hours : 45	Max Marks : 100

COURSE OBJECTIVES:

- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To impart knowledge on the basic principles and preparation methods of nano materials.
- To familiarize the students by relating the principles and preventive methods of corrosion and to inculcate the working process and application of storage devices.
- To acquire knowledge in synthetic methods of fuels and understanding the combustion characteristics of different fuels.
- To gain knowledge in science of polymer and polymer reactions.

UNIT I : WATER TECHNOLOGY 9

Water: Sources and impurities, Water Quality Parameters: Definition and Significance of-Colour, Odour, Turbidity, pH, Hardness, Alkalinity, TDS, COD and BOD, Flouride and Arsenic. Domestic water treatment: Sedimentation with Coagulant- Sand Filtration –Disinfection methods (UV, Ozonation, Break-point Chlorination). Desalination of Brackish water: Reverse Osmosis. Boiler troubles: Scale and Sludge, Boiler Corrosion, Caustic Embrittlement, Priming and Foaming. Treatment of Boiler Feed Water: Internal Treatment (Phosphate, Colloidal, Sodium Aluminate and Calgon Conditioning) and External Treatment – Ion Exchange demineralisation and Zeolite process.

UNIT II: NANO CHEMISTRY 9

Basics: Distinction between Molecules, Nano materials and Bulk materials; Size-Dependent Properties (Optical, Electrical, Mechanical and Magnetic); Types of Nanomaterials: Definition, Properties and Uses of – Nanoparticle, Nanocluster, Nanorod, Nanowire and Nanotube. Preparation of Nanomaterials: Sol-Gel, Solvothermal, Laser Ablation, Chemical Vapour Deposition, Electrochemical Deposition and Electro Spinning. Main applicationsof nanomaterial‟s in Medicine, Agriculture, Energy, Electronics and Catalysis.

UNIT III: BATTERIES AND CORROSION 9

Batteries: Introduction - Types of Batteries – Primary battery (Dry Cell) - Secondary battery (Lead Acid battery, Lithium-Ion-battery) - Fuel cells H_2-O_2 Fuel cell, Microbial fuel cell. Corrosion – Causes- Factors- Types – Chemical , Electrochemical Corrosion (Galvanic, Differential Aeration Theory) – corrosion control- material selection and design aspects – Electrochemical protection- Sacrificial anode method and Impressed current cathodic method. Paints- constituents and function. Electroplating of copper and electroless plating of nickel.

UNIT IV : FUELS AND COMBUSTION 9

Fuels -Solid Fuel: Coal – analysis of coal (Proximate analysis only)- Carbonization,Manufacture of Metallurgical Coke (Otto Hoffmann Method) - Liqud fuel- Manufacture of synthetic Petrol (Bergius process)- Octane Number, Cetane Number , Knocking in Engines- Anti Knocking Agents, Gasoline Additives, Gaseous fuel: Compressed Natural Gas(CNG) – Liquefied Petroleum Gases(LPG)-composition only - Liquid Hydrogen fuel. Combustion: Calorific value-higher and lower calorific values- Flue gas analysis (ORSAT method).

UNIT V : POLYMER TECHNOLOGY 9

Introduction-Terminologies- Thermoplastics and Thermosetting Plastics- Types and mechanism of Polymerization: Addition (free radical)- Condensation and Copolymerization- Properties and applications of polymers-some commercial thermosetting resin-Phenol Formaldehyde resin, Amino resins, Silicone resins-some thermoplastics- Polyethylene, PVC, Polyvinyl acetate-Conducting polymer – application - LED and Liquid crystals.

Course Outcomes At the end of this course, students will be able to:	**Cognitive Level**
CO 1: To Understand the quality of water, and its treatment methods.	Understand
CO 2: To Understand the basic principles and preparatory methods of nano materials	Apply
CO 3: To Apply the principles of electro chemistry and corrosion in engineering.	Understand
CO 4: To Understand the different types of fuels, their preparation, properties and combustion characteristics.	Understand
CO.5: To Apply the science of polymer and its application	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	1	1	-	-	-	-	2	1	-	-
CO2	3	2	2	1	-	2	2	-	-	-	-	1	1	-	-
CO3	3	2	2	-	-	2	1	-	-	-	-	1	1	-	-
CO4	3	2	2	-	-	1	2	-	-	-	-	1	1	-	-
CO5	3	2	2	1	-	2	-	-	-	-	-	1	1	-	-
MAX	3	2	2	1	-	2	2	-	-	-	-	2	1	-	-

(1 – Low, 2 – Medium, 3 – High, "-" – No Correlation)

Text Book(s) :

T1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, DhanpatRai Publishing Company (P) Ltd, New Delhi, 2018.

T2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.

T3. S.S.Dara,"AtextbookofEngineeringChemistry",S.ChandPublishing,12thEdition, 2018.

T4. John O"M Bockris, Amulya K. N Reddy,"Modern Electrochemistry Vol.1 : Ionics", Kluwar Academic Publishers, London, 2nd Edition, 2002.

T5. John O"M Bockris, Amulya K. N Reddy,"Modern Electrochemistry Vol.2 :Fundamentals of Electrodics", Kluwar Academic Publishers, London, 2nd Edition, 2002.

Reference Book(s) :

R1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.

R2. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.

R3. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.

R4. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge Universit Press, Delhi, Second Edition, 2019.

R5. O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

Course Code: 24ESC111		**Course Title: Problem Solving and Python Programming**	
Course Category: ESC		**Credits: 4**	
L:T:P (Hours/Week)	**3:0:2**	**Total Contact Hours: 75**	**Max Marks: 100**

COURSE OBJECTIVES:

- To understandthebasicsofalgorithmicproblemsolving.
- TolearntosolveproblemsusingPythonconditionalsand loops.
- TodefinePythonfunctionsanduse functioncallstosolveproblems.
- TousePythondatastructures-lists,tuples,dictionariestorepresentcomplexdata.
- Todoinput/outputwithfilesinPython.

Unit-I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

Unit-II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

Unit-III CONTROL FLOW, FUNCTIONS, STRINGS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, Immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

Unit-IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation

Unit-V FILES, MODULES, PACKAGES 9

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter‟s age validation, Marks range validation (0-100).

EXPERIMENTS 30 Periods

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight ofa motorbike, Weight ofa steelbar, compute ElectricalCurrent inThree PhaseAC Circuit, etc.)
2. PythonProgramming using simple statementsand expressions(exchange the valuesoftwo variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list &tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components ofan automobile, Elements ofa civil structure, etc.- operations ofSets & Dictionaries)
6. ImplementingprogramsusingFunctions.(Factorial,largestnumberinalist,areaofshape)
7. ImplementingprogramsusingStrings.(reverse,palindrome,charactercount,replacing characters)

Total: 75 Periods

COURSE OUTCOMES		**Cognitive Level**
At the end of this course, students will be able to:		
CO1	Develop algorithmic solutions to simple computational problems.	Apply
CO2	Develop and execute simple Python programs.	Apply
CO3	Decompose a Python program using conditionals and loops for problem solving and into functions.	Analyze
CO4	Represent compound data using Python lists, tuples, and dictionaries.	Understand
CO5	Execute data from/to files in Python programs	Apply

MAPPING OF CO – PO & PSO:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	2	-	-	-	-	-	2	2	3	3	-
CO2	3	3	3	3	2	-	-	-	-	-	2	2	3	-	-
CO3	3	3	3	3	2	-	-	-	-	-	2	-	3	-	-
CO4	2	2	-	-	1	-	-	-	-	-	1	-	3	-	-
CO5	1	2	-	-	1	-	-	-	-	-	1	-	2	-	-
Max	**3**	**2**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**	**2**

(1 – Low, 2 – Medium, 3 – High, "-" – No Correlation)

Text Book(s):

T1. AllenB.Downey,"ThinkPython:HowtoThinklikeaComputerScientist",2ndEdition,O"Reilly Publishers, 2016.

T2. KarlBeecher,"ComputationalThinking:ABeginner'sGuidetoProblemSolvingand Programming", 1st Edition, BCS Learning & Development Limited, 2017.

Reference Book(s):

R1. PaulDeitelandHarveyDeitel,"PythonforProgrammers", PearsonEducation, 1stEdition, 2021.

R2. G Venkatesh and MadhavanMukund, "ComputationalThinking:APrimer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.

R3. JohnVGuttag,"IntroductiontoComputationandProgrammingUsingPython:WithApplications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021.

R4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019

R5. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018

Web References:

1. https://archive.nptel.ac.in/courses/112/106/112106286/
2. https://www.selfstudys.com/mcq/gate/mechanical-engineering/online-test/chapter-7-engineering-mechanics.

Course Code: 24ESC106		Course Title: Engineering Mechanics	
Course Category: ESC		Credits: 3	
L:T:P (Hours/Week)	3:0:0	Total Contact Hours:45	Max Marks: 100

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- To make the students to apply static equilibrium of rigid bodies both in two dimensions and also in three dimensions.
- To comprehend the effect of friction on equilibrium.
- To understand the geometrical properties of surfaces and solids.
- To understand various terms involved in Projectiles.
- To apply dynamic equilibrium of particles in solving basic problems.

UNIT I: INTRODUCTION TO MECHANICS AND FORCE SYSTEM 9

Principles and Concepts - Laws of mechanics - system of forces - resultant of a force system – Lamistheorem - moment of a force –Varignon‟s theorem - resolution of a force into force and couple – forcein space - equilibrium of a particle in space.

UNIT II: EQUILIBRIUM OF RIGID BODIES 9

Free body diagram – Types of supports –Action and reaction forces – 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 – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions.

UNIT III: PROPERTIES OF SURFACES AND SOLIDS 9

Centroids and centre of mass – Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula – Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

UNIT IV: FRICTION 9

The Laws of Dry Friction – Coefficients of Friction – Static and Dynamic Friction – Angles of Friction – Wedge friction – Wheel Friction – Body on inclined planes – Rolling Resistance – Ladder friction – Sliding friction and wear abrasion test.

UNIT V: DYNAMICS OF PARTICLES 9

Newton‟s second law of motion – D-Alembert‟s principle, dynamics equilibrium - work energy equationof particles - law of conservation of energy - principle of work and energy. Principles of impulse andmomentum - equations of momentum - laws of conservation of momentum. Impact - time ofcompression, restitution, collision - co-efficient of restitution - collision of elastic bodies by directcentral impact and oblique impact - collision of small body with a massive body - kinetic energy of aparticle-kinetics of rigid body rotation.

Total: 45 Periods

COURSE OUTCOMES		**Cognitive Level**
At the end of this course, students will be able to:		
CO1	Understand the different principles of mechanics and to solve engineering problems dealing withforces.	Create
CO2	Solve the problems in equilibrium of rigid bodies, vector methods and free body diagram.	Create
CO3	Understand the different geometrical properties of various sections.	Create
CO4	Apply the concepts of friction to solve various problems dealing with friction.	Create
CO5	Develop basic dynamics concepts – force, momentum, work and energy.	Create

MAPPING OF CO – PO & PSO:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	2	-	-	-	-	-	-	2	3	1	1
CO2	3	2	2	1	2	-	-	-	-	-	-	2	3	1	1
CO3	3	2	3	1	2	-	-	-	-	-	-	2	3	1	2
CO4	3	2	3	1	2	-	-	-	-	-	-	2	3	1	2
CO5	3	2	3	1	2	-	-	-	-	-	-	2	3	1	2
Max	**3**	**2**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**	**2**

(1 – Low, 2 – Medium, 3 – High, "-" – No Correlation)

Text Book(s):

T1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, SanjeevSanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education., 12thEdition, 2019.

T2. Vela Murali, “Engineering Mechanics-Statics and Dynamics”, Oxford University Press, 2018.

T3. Nelson.A, “Engineering Mechanics - Statics and Dynamics”, Tata Mcgraw-Hill, New Delhi 2006.

Reference Book(s):

R1. Bores i P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.

R2. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.

R3. Bansal R K “Engineering Mechanics”, Laxmi Publications Pvt. Ltd., New Delhi, 2006.

R4. Rajasekaran S, Sankarasubramanian G “Engineering Mechanics-Statics and Dynamics”, Vikas Publishing House Pvt. Ltd. New Delhi 2006.

R5. Timoshenko S, Young D H, Rao J V and SukumarPati, Engineering Mechanics, 5thEdition, McGraw Hill Higher Education, 2013.

Web References:

1. https://archive.nptel.ac.in/courses/112/106/112106286/
2. https://archive.nptel.ac.in/courses/112/106/112106180/
3. https://onlinecourses.nptel.ac.in/noc21_me70/preview
4. https://archive.nptel.ac.in/courses/122/104/122104014/

Course Code: 24HSM104		Course Title: Tamils and Technology	
Course Category: HSMC		Credits: 1	
L:T:P (Hours/Week)	1:0:0	Total Contact Hours: 15	Max Marks: 100

[illegible] I [illegible]: 3

[illegible]

[illegible] II [illegible]: 3

[illegible] & [illegible]

[illegible] III [illegible]: 3

[illegible]

[illegible] IV [illegible]: 3

[illegible]

[illegible] V [illegible]: 3

[illegible]

TAMILS AND TECHNOLOGY

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3

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

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3

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)- ThirumalaiNayakarMahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY 3

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 3

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 3

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: 15 PERIODS

<u>TEXTBOOKS AND REFERENCE:</u>

1. [illegible] .[illegible] .[illegible] – [illegible] – [illegible] :[illegible].
2. [illegible] ([illegible]) [illegible] .[illegible] –
3. [illegible] – .([illegible])
4. [illegible]) [illegible] – ([illegible]
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print).
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

Course Code: 24BSC122		Course Title : Engineering Chemistry Laboratory	
Course Category: BSC		Credits : 2	
L:T:P(Hours/Week)	0:0:4	Total Contact Hours : 60	Max Marks : 100

COURSE OBJECTIVES:

- To gain experimental knowledge of water quality parameters, such as acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electro analytical techniques such as, pH metry, potentiometry and conductometry in the determination of ions in aqueous solutions.
- To gain knowledge about the synthesis of nano particles and to understand the influence of rate of corrosion of materials depending on various factors.
- Students infer the quality of some solid and liquid fuels.

LIST OF EXPERIMENTS

1. Determination of Total, Permanent and Temporary hardness of water by EDTA method.
2. Estimation of Chloride content in water by Argentometric method and Determination of strength of given Hydrochloric acid by pH meter
3. Determination of strength of Acid by Conductometric titration (Strong acid vs Strong base / Strong base vs Mixture of acids).
4. Preparation of Gold / ZnO Nano particles by Sol- Gel Method
5. Estimation of ferrous ion content of the given solution using Potentiometer.
6. Determination of DO content of water sample by Winkler Method.
7. Determination of Rate of Corrosion of Mild steel by Weight Loss Method.
8. Determination of Efficiency of Corrosion in Mild steel.
9. Determination of calorific value of fuel using Bomb Calorimeter.
10. Determination of viscosity of oil using Redwood Viscometer.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	

CO1: To analyse the quality of water samples i.e., acidity, alkalinity, chlorine content, hardness, DO and the amount of ions in solutions through volumetric techniques.	Analyse
CO2: To gain knowledge in designing the engineering materials against corrosion.	Apply
CO3: To know the preparation of nano particles by sol- gel method.	Understand
CO4: To recognize the property and characteristics of solid and liquid fuels.	Understand
CO5: To quantitatively analyse the impurities in solution by electro analytical techniques	Analyse

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	-	1	1	-	1	-	-	1	-	-	-
CO2	3	3	1	1	-	1	1	-	1	-	-	1	-	-	-
CO3	3	3	1	-	-	1	1	-	1	-	-	1	-	-	-
CO4	3	3	1	-	-	1	1	-	1	-	-	1	-	-	-
CO5	3	3	1	1	-	1	1	-	1	-	-	1	-	-	-
MAX	3	3	2	1	-	1	1	-	1	-	-	1	-	-	-

(1 – Low, 2 – Medium, 3 – High, "-" – No Correlation)

Text Book(s):

T1. Vogel"s, "Text Book of Quantitative Chemical Analysis", Pearson Publications, 2014.

Reference Book(s):

R1. Daniel C. Harris, "Quantitative Chemical Analysis", W. H. Freeman and Company, New York, 7^{th}Edition 2007.

<table>
<tr><td colspan="2">Course Code: 24ESC121</td><td colspan="2">Course Title: Engineering Practices Laboratory</td></tr>
<tr><td colspan="2">Course Category: ESC</td><td colspan="2">Credits: 2</td></tr>
<tr><td>L:T:P (Hours/Week)</td><td>0:0:4</td><td>Total Contact Hours: 60</td><td>Max Marks: 100</td></tr>
</table>

COURSE OBJECTIVES:

- Develop practical skills in plumbing, woodwork, welding, machining, and sheet metal work.
- Understand and apply techniques for various household and industrial fittings and connections.
- Study and demonstrate the assembly and operation of common mechanical systems and components.
- Wiring various electrical joints in common household electrical wire work
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP-A (CIVIL AND MECHANICAL)

I CIVIL ENGINEERING PRACTICE

Plumbing Works:

a) Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.

b) Laying pipe connection to the suction & delivery side of a pump – inlet & outlet

c) Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances.

Carpentry Works :

a) Sawing, planning and making common joints: T-Joint, Mortise and Tennon joint, Dovetail joint.

Study

a) Study of joints in door panels, wooden furniture.

b) Study of common industrial trusses using models.

II MECHANICAL ENGINEERING PRACTICE

Welding:

a) Arc welding of butt joints, lap joints, tee joints.

b) Gas welding Practice.

Basic Machining:

a) Simple turning, drilling and tapping operations.

Sheet Metal Work:

a) Forming & Bending.

b) Model making – Trays, funnels, etc.

c) Different type of joints.

Demonstration only:

Study and assembling the following:

a) Centrifugal pump.

b) Submersible pump sets.

Demonstration only:

a) Basics of Smithy operations.

b) Foundry operation like mould preparation for grooved pulley.

c) Refrigeration and Air-Conditioning System.

Total: 30 Periods

GROUP-B (ELECTRICAL AND ELECTRONICS)

I ELECTRICAL ENGINEERING PRACTICE

a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with

b) lamp, fan and three pin socket.

c) Staircase wiring.

d) Fluorescent Lamp wiring with introduction to CFL and LED types.

e) Energy meter wiring and related calculations/ calibration.

f) Study of Iron Box wiring and assembly.

g) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)

h) Study of emergency lamp wiring/Water heater.

II ELECTRONICS ENGINEERING PRACTICE

SOLDERING WORK:

a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

a) Study an elements of smart phone.

b) Assembly and dismantle of LED TV.

c) Assembly and dismantle of computer/ laptop

Total: 30+30 = 60 Periods

COURSE OUTCOMES **At the end of this course, students will be able to:**		**Cognitive Level**
CO1	Perform basic plumbing, carpentry, welding, machining, and sheet metal tasks.	Understand
CO2	Create and interpret technical sketches for plumbing and carpentry.	Create
CO3	Execute basic electrical and electronics wiring and soldering.	Understand
CO4	Analyze and assemble mechanical systems like pumps and HVAC.	Analyze
CO5	Apply safety protocols in civil, mechanical, electrical, and electronics tasks.	Apply

<u>MAPPING OF CO – PO & PSO:</u>

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	1	-	-	-	1	1	-	2	2	1	-
CO2	3	2	1	-	1	-	-	-	1	1	-	2	2	1	-
CO3	3	2	1	-	2	-	-	-	2	1	-	2	2	1	-
CO4	3	2	1	-	1	-	-	-	1	1	-	2	2	1	-
CO5	3	2	1	-	1	-	-	-	1	1	-	2	2	1	-
Max	**3**	**2**	**1**	-	**2**	-	-	-	**2**	**1**	-	**2**	**2**	**1**	-

(1 – Low, 2 – Medium, 3 – High, “-“ – No Correlation)

Course Code :24CDC102	**Course Title : Career Development Skills II**	
Course Category : EEC	**Credits : 1**	
L:T:P(Hours/Week) : 1:0:0	**Total Contact Hours : 15**	**Max Marks : 25**

COURSE OBJECTIVES:

- Develop interpersonal skills.
- Develop Listening and Speaking skills.
- Make inferences and predictions about spoken discourse that enhance RW skills.
- Learn about team building activities.

UNIT I: **3**

Motivation II - Offer personalised guidance and support - Engage active learning methods - Create a supportive environment personally - Highlight success stories - Celebrate progress - Follow ups
Interpersonal Skills - Verbal, Non-verbal and Listening skills - Analysing problems - Contributing ideas - Positive relationships - Mutual respect – Negotiation

UNIT II: **3**
Listening skills - Focus and attention - Non-verbal cues - Paraphrasing - Understanding emotions - Reflecting feelings - Allowing pause - Avoiding interruption - Respond appropriately - Clarifying and Confirming - Maintaining open-mindedness
Conversation skills - Opening lines - Ice-breakers - Sharing and expressing ideas - Clarity and relevance - Smooth transitions - Articulate thoughts - Avoid judgement - Polite language - Express appreciation - Open to feedback

UNIT III: **3**

Reading skills - Speed and Accuracy - Understanding main ideas - Skimming and Scanning - Word recognition - Expanding vocabulary - Analysing text - Making connections - Evaluate and Synthesise - Academic / Professional / Personal reading
Writing skills - Clear communication - Logical organization - Grammar and Mechanics - Avoiding redundancy - Choosing strong words - Tone and Style - Concluding structure - Editing and Revision - Originality - Academic / Professional / Personal writing

UNIT IV: **3**

Presentation Speaking skills - Know the audience - Clear objective - Content structure - Postures and Gestures - Voice projection - Eye contact - Appropriate language - Speech clarity - Visual aids - Interaction

Public Speaking skills - Research - Audience pulse - Pace and Pause - Expertise - Authenticity - Adaptability to unexpected situations

SWOTAnalysis - Enhanced Self awareness - Benchmarking with Strengths, Weakness, Challenges and Opportunities - Risk management - Versatility - Decision making - Personal growth - Quality approach

UNIT V: **3**

Team building - Openness - Cooperation - Building trust - Respect - Diversity and Inclusion - Cohesion - Prioritisation - Learning team culture - Celebrate success

Activity Sessions - Debate- Critical thinking - Confidence building - Persuasive techniques - Ethical reasoning – Empathy- **Picture connector** - Imagination and Innovation - Analysis - Societal awareness - Expression - Cognitive development - Playful exploration

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO 1: Quality communication with the co-workers and build a strong social relationship	Understand and Apply
CO 2: Develop listening and conversing skills	Apply
CO 3: Improve Reading & Writing Skills	Apply
CO 4: Deliver the presentation in a more powerful and persuasive way. Improve clarity and confidence.	Evaluate
CO 5: Unlock individual potentials	Create

Reference Book(s):

R1. Daniel Goleman, "The Emotionally Intelligent Workplace".

R2. Charles T. Rajendra, "Top Talking in English (International communication skills)".

R3. Sangeetha Sharma and GajendrasinghChauhan,"Soft skills - An integrated approach to maximize personality", Wiley Publishing.

Course Code: 24BSC201	**Course Title: Transforms and Partial Differential Equations**	
Course Category: BSC	**Credits: 4**	
L:T:P (Hours/Week) 3:1:0	**Total Contact Hours: 60**	**Max Marks: 100**

COURSE OBJECTIVES
• To introduce the foundational concepts of partial differential equations and their solutions for standard types.
• To present Fourier series analysis in different intervals.
• To familiarize students with the use of Fourier series methods for solving wave and heat flow problems in various contexts.
• To provide students with a solid foundation in Laplace and Fourier Transform techniques, focusing on their mathematical formulation, properties, and applications.
• To develop Z-transform techniques for discrete-time systems.

UNIT I	**PARTIAL DIFFERENTIAL EQUATIONS**	**9+3**
Formation of partial differential equations –Solutions of standard types of first order partial differential equations - Lagrange’s linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.		
UNIT II	**FOURIER SERIES**	**9+3**
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval’s identity – Harmonic analysis.		
UNIT III	**APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS**	**9+3**
Classification of PDE – Method of separation of variables - Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction.		
UNIT IV	**FOURIER AND LAPLACE TRANSFORMS**	**9+3**
Statement of Fourier integral theorem– Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval’s identity-Laplace transform- Existence Criterion for the Laplace Transform -Laplace transform of basic functions- Fundamental properties.		
UNIT V	**Z - TRANSFORMS AND DIFFERENCE EQUATIONS**	**9+3**
Z- transforms - Elementary properties – Convergence of Z-transforms – Initial and final value theorems - Inverse Z-transform using partial fraction and convolution theorem - Formation of difference equations – Solution of difference equations using Z - transforms.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Recognize and solve higher order partial differential equations.
CO2: Express the given function and data in terms of Fourier series.
CO3: Understand how to solve one- and two-dimensional heat flow issues as well as one-dimensional wave equations by using Fourier series techniques.
CO4: Illustrate Fourier and Laplace transforms to solve engineering problems, including signal analysis and linear differential equations with constant coefficients.
CO5: Possess the knowledge of Z transforms to analyze linear time invariant systems.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	-	-	-	2	-	-	1	-	-	-
CO2	3	3	1	1	-	-	-	-	2	-	-	1	-	-	-
CO3	3	3	1	1	-	-	-	-	2	-	-	1	-	-	-
CO4	3	3	1	1	-	-	-	-	2	-	-	1	-	-	-
CO5	3	3	1	1	-	-	-	-	2	-	-	1	-	-	-

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Veerarajan T ., “ Transforms and Partial Diffrential Equations ”, 3rd Reprint published in 2016 by Tata McGraw Hill Education Pvt.Ltd, New Delhi.
T2.	Grewal B.S., “Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2018.
T2.	Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, 2018.

REFERENCE BOOK(S)

R1.	Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 10th Edition, Laxmi Publications Pvt. Ltd, 2021.
R2.	James. G., "Advanced Modern Engineering Mathematics", 4thEdition, Pearson Education, New Delhi, 2016.
R3.	Narayanan. S., Manicavachagom Pillay, T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students Vol. II & III ", S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

Course Code: 24CEC211	Course Title: Fluid Mechanics and Hydraulic Machinery	
Course Category: PCC	Credits: 4	
L:T:P (Hours/Week) 3:0:2	Total Contact Hours: 75	Max Marks: 100

COURSE OBJECTIVES
• To learn the basic properties of fluids.
• To get knowledge about dimensional analysis and model laws.
• To know the types and characteristic of open channel flow.
• To describe the uniform, gradually and rapidly varied flows in steady state conditions and Flow in pipes.
• To know the various types of turbines and pumps.

UNIT I	FLUID PROPERTIES , STATICS AND KINEMATICS	9
Fluid and fluid properties - definition - capillary rise and fall - surface tension - vapour pressure, compressibility, bulk modulus - viscosity - Newton's law of viscosity - pressure measuring instrument - manometer and gauges. Fluid Kinematics - Flow visualization - lines of flow –introduction to stream lines, equipotential lines-flow net- velocity field and acceleration - Equation of streamline - stream function - velocity potential function - circulation .		
UNIT II	DIMENSIONAL ANALYSIS AND MODEL STUDIES	9
Fundamental and derived units - dimensional homogeneity and similarity - rayleigh's method -Buckingham π theorem method - model and its type - model laws and scale effects.		
UNIT III	OPEN CHANNEL FLOW	9
Open channel flow -definition - types - properties of open channel - velocity distribution in open channel flow - uniform flow - manning's and Chezy's formulas - determination of depth and velocity - most economical sections (trapezoidal channel) - drawdown and backwater curves - hydraulic jump.		
UNIT IV	FLOW THROUGH PIPES	9
Major and minor losses - flow through pipes in series and parallel - equivalent pipe and pipe network - measuring instruments - Venturimeter, Orificemeter - derivation: Euler's & Bernoulli's equation - applications of Bernoulli's equation.		
UNIT V	HYDRAULIC TURBINES AND PUMPS	9

Turbines - classification - working principles and velocity triangle of Pelton wheel, Francis, and Kaplan turbines. Pumps - working principle of Rotodynamic pump, positive displacement pump.

PRACTICALS

1.	Flow Through Venturimeter.
2.	Flow Through Orificemeter.
3.	Determination of Major And Minor Losses In Pipes.
4.	Characteristics of Pelton Wheel Turbine.
5.	Characteristics of Francis Turbine.
6.	Flow Through Notches.
7.	Characteristics of Centrifugal Pumps.
8.	Characteristics of Reciprocating Pumps.

Total: 75 Hours

COURSE OUTCOMES

At the end of this course, students will be able to

CO1: Understand the properties of fluids and fundamental concept of fluid mechanics.

CO2: Understand the principle of model analysis and dimensional analysis by using various methods.

CO3: Apply their knowledge of fluid mechanics in addressing problems in open channel.

CO4: Analysis of flow through pipes and usage of measuring instruments.

CO5: Apply principles of fluid mechanics to the operation, design, and selection of fluid Machinery such as pumps and turbines.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		1			1					1	1		
CO2	3	2	1	2			1					1	1		
CO3	3	2	1									1	1		
CO4	3	2	1	2			1					1	1		
CO5	3	2	1	1			1					1	1		

(1 -Low, 2 -Medium, 3 -High)

TEXT BOOK(S)

T1.	R.K. Bansal, “Fluid Mechanics and Hydraulic Machines”, Lakshmi publications, New Delhi, 2018.
T2.	Modi P.N and Seth, “Hydraulics and Fluid Mechanics including Hydraulic Machines”, Rajsons Publications Pvt. Ltd, Delhi, 2017.
T3.	Jain.A.K, “Fluid Mechanics” (Including Hydraulic Machines),Twelth
	Edition,KhannaPublishers, 2016.

REFERENCE BOOK(S)	
R1.	Roberson J.A. and Crowe C.T., “Engineering Fluid Mechanics”, Jaico Books, Mumbai, 2000.
R2.	Streeter, V.L. Wylie, E.B. and Bedford K.W, “Fluid Mechanics” , 9th edition, Tata Mc Graw Hill, New Delhi, 2017.
R3.	Fox W.R. and McDonald A.T., “Introduction to Fluid Mechanics” John- Wiley and Sons, Singapore, 2018.

Course Code: 24CEC201	Course Title: Construction Materials and Technology	
Course Category: PCC	Credits: 3	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To understand the building materials and their properties.
• To exploring modern construction materials and their applications.
• To understand the fundamentals of structural elements and best construction techniques.
• To study the various construction equipment for earthwork, concreting, and structural erection.
• To understand the construction planning and scheduling techniques.

UNIT I	STONES - BRICKS - LIME - CONCRETE BLOCKS	9
Stone as building material - criteria for selection - tests on stones - Bricks - Classification - manufacturing of clay bricks - tests on bricks - compressive strength - water absorption - Efflorescence - lime - preparation of lime mortar - concrete hollow blocks - lightweight concrete blocks.		
UNIT II	CONSTRUCTION MATERIALS	9
Timber - market forms - plywood - veneer - false ceiling materials - steel - mechanical treatment - aluminium - uses - market forms - refractories - Mechanical treatment – Paints – Varnishes – Distempers – Bitumens.		
UNIT III	MODERN MATERIALS	9
Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products – Composite materials – Types – Applications of laminar composites – Fibre textiles – Geomembranes and Geotextiles for earth reinforcement – AAC blocks- porotherm blocks.		
UNIT IV	CONSTRUCTION PRACTICES & SERVICE REQUIREMENTS	9
Types of foundations - shallow and deep foundations - stone masonry - brick masonry - plastering and pointing - cavity walls - diaphragm walls - formwork - centering and shuttering - shoring - scaffolding - underpinning - roofing - flooring - joints in concrete – contraction / construction / expansion joints - fire protection - thermal Insulation - ventilation and Air conditioning - acoustics and sound insulation - damp proofing.		
UNIT V	CONSTRUCTION EQUIPMENTS	9

Selection of equipment for earthwork excavation, concreting, material handling and erection of structures - dewatering and pumping equipment.

Total : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Identify the good quality brick, stone and blocks for construction.
CO2: Recognize the market forms of timber, steel, aluminum and applications of various Composite materials.
CO3: Identify the best construction and service practices such as thermal insulations and air Condition of building.
CO4: Select various equipments for construction works conditioning of building.
CO5: Understand the construction planning and scheduling techniques.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2		3		2	2					2	3		
CO2	3			2			2					2	3		2
CO3	3			2			3				2		3		2
CO4	2										2		3	3	
CO5	2	3	2	3	2	2			2		3	2	3	3	3

(1 -Low, 2 -Medium, 3 -High)

TEXT BOOK(S)

T1.	Varghese.P.C, Building Materials, Second Edition PHI Learning Ltd., 2015.
T2.	Arora S.P and Bindra S.P Building construction, DhanpatRai and sons, 2013.
T3.	Varghese.P.C, Building Construction, Second Edition PHI Learning ltd., 2016.

REFERENCE BOOK(S)

R1.	Punmia ,B.C Building construction , Laxmi publication (p)ltd..,2008.
R2.	Peurifoy R.L., Schexnayder,C.J., Shapira A., Schmitt.R., Construction Planning Equipment and Methods, Tata McGraw-hill, 2011.
R3.	Srinath L.S.,PERT and CPM -Principles and applications, Delhi, 2012.

Course Code: 24CEC212	Course Title: Surveying and Levelling	
Course Category: PCC	Credits: 4	
L:T:P (Hours/Week) 3:0:2	Total Contact Hours: 75	Max Marks: 100

COURSE OBJECTIVES
• To study the different surveying equipment’s in the field of civil engineering
• To enhance the ability to calculate surveying quantities.
• To enable the suitability of surveying instruments and method to a given problem
• To learn about the advanced methods of surveying to solve complex civil engineering problems.
• To understand the principle of modern surveying instruments.

UNIT I	INTRODUCTION TO SURVEYING	9
Definition, classification of surveys, principles of surveying, plan and map, scale. Chain surveying: ranging and chaining, survey station and survey lines, instruments used for setting out right angles, obstacles in chaining, errors in chain survey.		
UNIT II	COMPASS SURVEYING AND PLANE TABLE SURVEYING	9
Compass Surveying: Introduction, bearing and angles, system of bearings, conversion of WCB to RB and vice versa, prismatic compass, magnetic declination, local attraction, computation of compass traverse. Plane table surveying: accessories, working operations, methods of plane tabling - radiation, intersection, traversing, resection (two point problem), errors in plane table surveying.		
UNIT III	LEVELLING	9
Definitions, levelling instruments- types of level and level staff, temporary adjustments of a level, benchmark and its types, methods of levelling - contouring. Areas and Volumes: calculation of areas and volumes by mid ordinate, average ordinate, trapezoidal and Simpson's methods.		
UNIT IV	THEODOLITE SURVEYING	9
Types of theodolite, parts of theodolite, definitions, measurement of horizontal and vertical angle, Tachometric surveying - stadia and tangential methods - setting out of simple curves.		
UNIT V	MODERN METHODS OF SURVEYING	9
Electronic Distance Measurement (EDM) - types, total station - principles, measurements. Global Positioning System (GPS) - segments of GPS, application of Total station and GPS.		

PRACTICALS	
1.	Aligning, Chaining and Ranging of a line.
2.	Determination of area of the boundary by traversing using chain (perpendicular offset).
3.	Determination of included angles of a given boundary by traversing using compass.
4.	Locate the position of Plane table by radiation method.
5.	Determine the reduced levels of the given points by height of collimation.
6.	Measurement of horizontal and vertical angle by using theodolite.
7.	Determination of horizontal distance by Tangential method.
8.	Determination of area by using Total station.
	Total: 75 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the basic classifications of surveying and to compute the linear measurement in chain surveying.
CO2: Compute angular measurements in compass surveying and to prepare plan with plane table surveying
CO3: Determine the Reduced levels of various points on ground and to compute the areas and volumes using levelling principles.
CO4: Determine the distance and heights of the object by using theodolite and to setting out curves by various methods.
CO5: Measure with modern surveying equipment.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			1				2	1		1	1		1
CO2	3	2							2	1		1	1		1
CO3	3	2							2	1		1	1		1
CO4	3	2			1				2	1		1	1		1
CO5	3	2							2	1		1	1		1

(1 -Low, 2 -Medium, 3 -High)

TEXT BOOK(S)	
T1.	Punmia, B.C, Ashok K Jain and Arun K Jain, "Surveying" Vol. I&II, Laxmi Publication, 16th Edition, New Delhi, 2005.

T2.	Kanetkar, T.P, and Kulkarni, S.V, "Surveying and Levelling" Vol.I&II, United Book Corporation,23rd Edition, Pune, 2007.
T3.	Chandra.A.M "Plane Surveying and Higher Surveying", New Age International (P)Limited, Publishers, Chennai, 2002.

REFERENCE BOOK(S)	
R1.	Arora, K.R, "Surveying" Vol.I& II, Standard Book House Publishers& distributors, New Delhi, 2008.
R2.	Duggal S.K, "Surveying, Vol. I & II", Tata McGraw-Hill, Publishing Company, 2004.
R3.	Venkatramaiah C, "Textbook of Surveying", 2nd Edition, University Press, Hyderabad, 2011.

Course Code: 24CEC202	Course Title: Engineering Geology	
Course Category: PCC	Credits: 2	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To understand the role of geology in Civil engineering and the impact of earth's processes on engineering projects
• To learn mineralogical properties, classifications, and applications of minerals and resources in Civil engineering.
• To explore rock types, their classification, engineering properties, and applications in construction.
• To study structural geological features, their engineering implications, and geophysical investigation techniques.
• To analyze geological conditions for infrastructure projects and use mapping tools like RS and GIS for site improvement and hazard prevention.

UNIT I	GENERAL GEOLOGY	9
Role of Geology in Civil engineering - branches of geology - earth structures and composition - elementary knowledge on continental drift and plate tectonics - earth processes - weathering - geological work of rivers, wind and sea - engineering importance - earthquake belts in India.		
UNIT II	MINERALOGY	9
Introduction - crystallography - elements, symmetry, axes, forms and systems - mineral properties - physical, optical - Study of rock forming minerals - felspar group - orthoclase, microcline, albite, anorthite - pyroxene group - enstatite, augite - oxide minerals - quartz, corundum - carbonate minerals - calcite, dolomite, magnesite - minerals usage in civil engineering field - Coal and petroleum.		
UNIT III	PETROLOGY	9
Classification of rocks - distinction between igneous, sedimentary and metamorphic rocks - occurrence, engineering properties and distribution -igneous - granite, syenite, diorite, gabbro, pegmatite, dolerite and basalt sedimentary rocks - sandstone, limestone, shale, conglomerate metamorphic rocks - quartzite, marble, slate, phyllite, gneiss and schist.		

UNIT IV	STRUCTURAL GEOLOGY	9
Introduction- basic terminologies - study of structural features - folds, faults and joints - engineering considerations - geophysical investigations - seismic and electrical - engineering properties of rock as a construction material.		
UNIT V	**GEOLOGICAL CONDITIONS AND MAPPING**	**9**
Geological conditions necessary for construction of dams, tunnels, buildings, road cuttings - landslides - soil mass movement - thematic maps using RS and GIS - causes and preventions - improvement of sites - coastal protection.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Analyze geological agents and processes involved in rock and soil formation and their influence on earth's surface
CO2: Identify the available minerals by their properties and behavior to assess the suitability in field.
CO3: Classify and identify the available rocks in the construction site.
CO4: Perform geological investigations and mapping for construction projects.
CO5: Apply the geological concepts in civil engineering projects.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2		1	1			1		1	2		1
CO2	3	3	2	2		1	1			2		2	2		2
CO3	3	3	3	2		1	1			1		2	2		2
CO4	3	3	3	3		2	2			2		2	2		2
CO5	3	3	3	3		2	2			2		3	2		2

(1 -Low, 2 -Medium, 3 -High)

TEXT BOOK(S)	
T1.	Parbin Singh. A "Text book of Engineering and General Geology", Katson Publishing House, Ludhiana 2013.
T2.	Duggal S.K, Pandey H.K. and Rawal N, “Engineering Geology”, McGraw Hill Education Private Limited, 2017.

REFERENCE BOOK(S)	
R1.	Varghese P. C, “Engineering Geology for Civil Engineers”, PHI Learning Private Limited, Delhi, 2012.
R2.	Blyth F.G.H. and M.H.de Freitas, “Geology for Engineers”, CRC Press, Boca Raton, 2017.

Course Code: 24CEC221	Course Title: Computer Aided Building Drawing	
Course Category: PCC	Credits: 2	
L:T:P(Hours/Week): 0:0:4	Total Contact Hours: 60	Max Marks : 100

COURSE OBJECTIVES
• To apply principles of planning and orientation to design building components like doors and windows.
• To analyze and design load-bearing wall structures.
• To design buildings incorporating sloping roofs.
• To analyze and design reinforced concrete framed structures.
• To design industrial buildings with north light roofing systems and utilize Building information modeling.

LIST OF EXPERIMENTS	
1.	Principles of planning, orientation and complete joinery details Paneled and Glazed Doors and Windows
2.	Principles of planning, orientation and complete joinery details Glazed Doors.
3.	Principles of planning, orientation and complete joinery details Windows.
4.	Buildings with load bearing walls.
5.	Buildings with sloping roof (steel roof trusses).
6.	R.C.C. framed structures.
7.	Industrial buildings -North light roof structures.
8.	Building Information Modeling.
	Total: 60 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Apply principles of building planning and orientation, incorporating joinery details for paneled and glazed doors and windows.
CO2: Design buildings utilizing load-bearing wall structures, ensuring stability and structural integrity.

CO3: Design and draft buildings featuring sloping roof structures, considering functional and aesthetic aspects.
CO4: Design reinforced concrete framed structures, focusing on material selection, load distribution, and safety
CO5: Understand the Building Information Modeling (BIM) for effective planning, design, and management of construction projects.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	1	1	1				1	2		1
CO2	3	3	3	2	2	1	2	1	1			2	2		1
CO3	3	3	3	2	2	1	2	1	1			2	2		2
CO4	3	3	3	3	3	2	2	1	1			3	2		2
CO5	2	3	3	3	3	3	1	2	2			3	2		2

(1 -Low, 2 -Medium, 3 -High)

TEXT BOOK(S)

T1.	Sikka V. B, A Course in Civil Engineering Drawing, 6th Edition, S.K. Kataria and Sons, 2006.
T2.	George Omura, "Mastering in AUTOCAD 2002", BPB Publications, 2002

REFERENCE BOOK(S)

R1.	Shah.M.G, Kale. C.M. and Patki. S.Y, "Building Drawing with an Integrated Approach to Built Environment", Tata McGraw Hill Publishers Limited, 2004.
R2.	Verma.B.P, "Civil Engineering Drawing and House Planning", Khanna Publishers, 2003.
R3.	Marimuthu V.M, Murugesan R. and Padmini S, "Civil Engineering Drawing-I", Pratheeba Publishers, 2008.

Course Code: 24BSC205	Course Title: Complex variables and transforms	
Course Category: BSC	Credits: 4	
L:T:P (Hours/Week) 3:1:0	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES
• Understand the concept of analytic functions and its properties
• Study the techniques of residues and Contour integration
• know the basics of vector calculus and its applications
• Solve ordinary differential equations using Laplace Transform
• Solve ordinary differential equations using Inverse Laplace Transform

UNIT I	ANALYTICAL FUNCTION	9+3
Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy – Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function (excluding proofs) – Harmonic conjugate – Construction of analytic functions – Conformal mapping: $w=z+k$, kz, $1/z$ and bilinear transformation.		
UNIT II	**COMPLEX INTEGRATION**	**9+3**
Cauchy's integral theorem (Statement) and Cauchy's integral formula – Laurent's series expansions – Singular points – Residues – Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle.		
UNIT III	**VECTOR CALCULUS**	**9+3**
Gradient, divergence and curl – Irrotational and solenoidal vector fields (Definition only) – Vector integration – Green's theorem in a plane , Gauss divergence theorem and Stoke's theorem (excluding proofs) .		
UNIT IV	**LAPLACE TRANSFORMS**	**9+3**
Laplace transform – Sufficient condition for existence – Transform of elementary functions - Basic properties – Transforms of derivatives and integrals of functions – Derivatives and integrals of transforms – Transforms of unit-step function and impulse function – Transform of periodic functions.		
UNIT V	**INVERSE LAPLACE TRANSFORMS**	**9+3**
Inverse Laplace transform – Statement of Convolution theorem – Initial and final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Examine the standard techniques of complex variable, analytic function and conformal mapping.
CO2:Illustrate a contour integral with an integrand which has singularities in the closed region .
CO3: Interpret the line, surface and volume integral.
CO4: Apply the concept of Laplace transform to find the solution of linear ordinary differential equations with constant coefficients.
CO5: Apply the concept of Laplace transform to find the solution of linear ordinary differential equations with constant coefficients.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	-	-	-	-	-	-	-	-	2	-	-	-
CO2	2	3	1	-	-	-	-	-	-	-	-	2	-	-	-
CO3	2	3	1	-	-	-	-	-	-	-	-	2	-	-	-
CO4	2	3	2	-	-	-	-	-	-	-	-	2	-	-	-
CO5	2	3	2	-	-	-	-	-	-	-	-	2	-	-	-
MAX	2	3	1.4	-	-	-	-	-	-	-	-	2	-	-	-

(1–Low, 2–Medium, 3–High,“-“–No Correlation)

TEXT BOOK(S)	
T2.	Grewal B.S., “Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2018.
T2.	Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, 2018.

REFERENCE BOOK(S)	
R1.	Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Company Limited, New Delhi , 11th Reprint 2018.
R2.	Bali N, Goyal M and Watkins C, "Advanced Engineering Mathematics", Fire wall Media(An imprint of Lakshmi Publications Private Limited), NewDelhi, 7th Edition, 2015.

Course Code : 24BSC206	**Course Title : Environmental Science and Sustainability**	
Course Category : BSC	**Credits: 2**	
L:T:P(Hours/Week) : 2:0:0	**Total Contact Hours: 30**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand and appreciate the unity of life in all its forms, the implications of life style on the environment.
• To understand the various causes for environmental degradation.
• To understand the various energy resources and importance of energy efficiency.
• To understand individuals contribution in the environmental pollution.
• To understand the impact of pollution at the global level and also in the local environment.

UNIT I	**ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY**	**6**
Key environmental problems, their basic causes and sustainable solutions-IPAT equation-Ecosystem, earth – life support system and ecosystem components-Food chain-Food web-Energy flow in ecosystem-Ecological succession-stages involved-Primary and secondary succession-Hydrarch-mesarch-xerarch-Importance-types-mega-biodiversity-Threats due to natural and anthropogenic activities -Conservation methods.		
UNIT II	**SUSTAINING NATURAL RESOURCES AND ENVIRONMENTAL QUALITY**	**6**
Environmental hazards – causes and solutions-Biological hazards – AIDS-Malaria-Chemical hazards- BPA-PCB-Phthalates-Mercury-Nuclear hazards- Risk and evaluation of hazards- Water foot print-virtual water-blue revolution-Water quality management and its conservation-Solid and hazardous waste – types and waste management methods-Sustainable Development Goals (SDG).		
UNIT III	**ENERGY RESOURCES**	**6**
Renewable –Nonrenewable energy resources- Advantages and Disadvantages – Oil-Natural Gas-Coal-Nuclear energy-energy efficiency and renewable energy-Solar energy-Hydroelectric power-Ocean thermal energy-Wind Energy-Geothermal energy-Energy from biomass-solar- Hydrogen revolution.		
UNIT IV	**ENVIRONMENTAL IMPACT ASSESSMENT**	**6**
Introduction to environmental impact analysis-EIA guidelines-Notification of Government of India (Environmental Protection Act – Air-water-forest and wild life)-Impact assessment methodologies-Public awareness-Environmental priorities in India.		

UNIT V	GLOBAL CLIMATIC CHANGE AND MITIGATI	6
Climate disruption-Green house effect-Ozone layer depletion-Acid rain-Kyoto protocol- Carbon credits-Carbon sequestration methods-Montreal Protocol-Role of Information technology in environment-Case Studies-Guest lecture by Industry Experts or R&D organization.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO 1: Understand the interrelationship between living organism and environment.
CO 2: Identify various environmental hazards and waste management techniques.
CO 3: Design various methods for the conservation of resources.
CO 4: Understand the importance of environment by assessing its impact on the human world.
CO 5: Understand the Global climatic changes and its mitigation procedures.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	3	1	1	-	-	1	-	-	1
CO2	1	-	-	-	-	3	2	2	1	-	-	2	-	-	2
CO3	2	-	-	-	-	3	2	2	1	-	-	2	-	-	2
CO4	1	-	-	-	-	2	1	2	1	-	-	2	-	-	2
CO5	1	-	-	-	-	2	1	2	1	-	-	2	-	-	2

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	T1. G. Tyler Miller and Scott E. Spoolman (2016), Environmental Science, 15th Edition, Cengage learning.
T2.	George Tyler Miller, Jr. and Scott Spoolman (2012), Living in the Environment – Principles, Connections and Solutions, 17th Edition, Brooks/Cole, USA.

REFERENCE BOOK(S)

R1.	David M. Hassenzahl, Mary Catherine Hager, Linda R. Berg (2011), Visualizing Environmental Science, 4thEdition, John Wiley & Sons, USA.

Course Code: 24CEC203	Course Title: Water Supply and Wastewater Engineering	
Course Category: PCC	Credits: 3	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To identify the sources of water and its demand.
• To learn the concepts of components of water supply systems from source to recipient.
• To gain adequate knowledge about the water treatment processes and its design.
• To provide the essential distribution network for public water supplies.
• To offer required information on sewage treatment plant design and disposal techniques.

UNIT I	SOURCES AND NEED OF WATER SUPPLY	5
Water requirement - rate of demand and supply - per capita consumption - population forecasting, etc. - physical, chemical, and bacteriological properties - standard of potable water as per Indian standard.		
UNIT II	**COLLECTION , CONVEYANCE OF RAW WATER FROM SOURCE AND TREATMENT OF RAW WATER**	**11**
Intakes, types of intakes - conveyance of water - pipes and pipe materials, joints - types of pumps and gravity and rising mains - planning - run-off estimation - rainfall data analysis, storm water drain design - rainwater harvesting, treatment process of raw water(primary-screening, aeration, secondary treatment- sedimentation, filtration) – Disinfection.		
UNIT III	**UNIT OPERATIONS / PROCESSES FOR WASTEWATER TREATMENT**	**12**
Layout plan and section of municipal wastewater treatment plant - physical unit operations: screening, flow equalization, mixing, flocculation, sedimentation - chemical unit processes: chemical precipitation - biological unit processes: aerobic attached growth and aerobic suspended growth treatment processes - anaerobic suspended growth treatment processes - an aerobic suspended growth treatment processes - low-cost sanitation systems - septic tanks, soak pit - stabilization ponds.		
UNIT IV	**DISTRIBUTION SYSTEM**	**8**

Layouts of distribution networks - components of distribution system - hardy cross methods for network analysis - storage capacity of ESR (Elevated Service Reservoir) and underground reservoir - selection and location of reservoir - methods of distribution system.		
UNIT V	**COLLECTION OF SEWAGE & ESTIMATION OF ITS DISCHARGE**	**9**
Different types of sewers - sewerage systems - variation in sewage flow - sewer appurtenance - estimation of wastewater discharge in a sewer in the sewerage system - estimation of storm water discharge in urban area - separate and combined sewerage systems - laying and testing of sewers.		
		Total : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Know the various components of water supply scheme and design of intake structure.
CO2: Analyze the process of conventional treatment and design of water and Wastewater treatment systems.
CO3: Understand and design the various advanced treatment systems.
CO4: Design and evaluate water distribution systems and water supply in buildings.
CO5: Estimate sewage generation and design sewer systems including sewage pumping.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2				1	1	1				1	1		2
CO2	3	2				1	1	1				1	1		2
CO3	3	2				1	1	1				1	1		2
CO4	3	2				1	1	1				1	1		2
CO5	3	2				1	1	1				1	1		2

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Garg, S.K. Environmental Engineering, Vol.I and Vol.IIKhanna Publishers, New Delhi, 2015.
T2.	Punmia B.C, Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi 2010.

T3.	Duggal K.N, "Elements of Environmental Engineering" S. Chand and Co. Ltd., New Delhi, 2014.

REFERENCE BOOK(S)	
R1.	Sincero A P and Sincero G.A, Environmental engineering: A design approach, Prentice-Hall, New Delhi (1999).
R2.	Bhave P. R. and Gupta R, Analysis of Water Distribution Networks, Narosa publishing house, New Delhi, 2018.
R3.	Metcalf and Eddy Inc., Tchobanoglous G, Burton F, and Stensel H D, Wastewater engineering - treatment and reuse, Tata-McGraw Hill, New Delhi, 2009.
R4.	Punmia, B.C, Jain, A.K, and Jain.A.K, Environmental Engineering, Vol.II, Laxmi Publications, 2010.

Course Code: 24CEC206	**Course Title: Strength of Materials**	
Course Category: PCC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the concepts of bi-axial state of stress, strain, elastic modulii, thin and thick shells, principal stresses and principal planes.
• To study the concept of bending, shear and torsion of circular shafts , thin walled open and closed sections
• To determine slope and deflection of statically determinate beams.
• To analyze simple pin jointed plane trusses and to analyse and design columns
• To study the bending of straight and curved beams and location of shear centre.

UNIT I	**STRESSES,STRAINS AND THEORIES OF FAILURE**	**9**
Stresses, strains and deformations in simple bar, stepped and compound bars – Thermal stresses and strains – relationship between Elastic constants – Bi axial state of stress –Thin and thick cylinders, thin spherical shells under internal fluid pressure - change in dimensions and volume - Principal stresses and principal planes – Mohr‘s circle of stresses - Principal stress, principal strain, shear stress, strain energy and distortion energy theories – simple application problems.		
UNIT II	**BENDING OF BEAMS, TORSION OF CIRCULAR SHAFTS AND THIN WALLED SECTIONS**	**9**
Types of supports, beams and loads – Shear force and bending moment diagrams for simply supported, cantilever and over-hanging beams - Theory of simple bending – Bending stress distribution – Shear stress distribution -Torsion of circular shafts and thin walled open and closed sections.		
UNIT III	**DEFLECTION OF STATICALLY DETERMINATE BEAMS**	**9**
Relationship between bending moment, shear, curvature, slope and deflection of statically determinate beams - to calculate slope and deflection of statically determinate beams using Double Integration method – Macaulay‘s method – Area moment method – Conjugate beam method - Strain energy method		
UNIT IV	**ANALYSIS OF PIN JOINTED PLANE STRUSS AND COLUMNS**	**9**
Analysis of simple pin-jointed plane trusses using method of joints and method of sections , Analysis of short columns and long columns - Euler’s theory - Rankine’s theory		
UNIT V	**BENDING OF CURVED BEAMS, UNSYMMETRICAL BENDING AND SHEAR CENTRE**	**9**

Bending of curved beams - Winkler Bach equation - calculation of stresses in crane hooks - Unsymmetrical bending of beams - Location of shear center for simple mono-symmetrical sections.

Total: 45 Hours

COURSE OUTCOMES

At the end of this course, students will be able to

CO1:To understand the concepts of bi axial state of stress, strain, elastic modulii, thin and thick shells,principal stresses and principal planes.

CO2:To study the concept of bending, shear and torsion of circular shafts , thin walled open and closed sections

CO3:To determine slope and deflection of statically determinate beams.

CO4:To analyze simple pin jointed plane trusses and to analyse and design columns

CO5:To study the bending of straight and curved beams and location of shear centre.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			2					1			2		
CO2	3	2		2	2					1			2		
CO3	2	2			2					1			2		
CO4	3	2			2					1			2		
CO5	3	2			2					1			2		

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1. Bansal R.K, “Strength of Materials”, Laxmi Publications, New Delhi, 2017.

T2. Rajput R.K, “Strength of Materials”, S.Chand and Co, New Delhi, 2014.

REFERENCE BOOK(S)

R1. Chandramouli P.N, “Fundamentals of Strength of Materials”, PHI Learning Private Limited, New Delhi, 2013.

R2. Subramanian R, “Strength of Materials”, Oxford University Press, New Delhi, 2010.

Course Code: 24CEC204	**Course Title: Concrete Technology**	
Course Category: PCC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the fresh and hardened properties of concrete.
• To have better knowledge about the chemical and mineral admixtures in concrete.
• To familiarize with the IS method of mix design as per the latest code.
• To know the importance and applications of special concretes.
• To diagnose the strength and durability of concrete structures using different testing methods.

UNIT I	**FRESH AND HARDENED CONCRETE**	**9**
Fresh concrete: mechanism of hydration - water - cement ratio - factors affecting strength of the concrete - workability - concepts and tests as per Indian codal specifications. Concrete manufacturing stages: batching - mixing - transportation - placing of concrete - curing of concrete. Water: quality of water for mixing and curing - use of sea water for mixing concrete. Hardened concrete: properties and tests - strength of concrete - temperature effects - creep of concrete - thermal properties of concrete - micro cracking of concrete.		
UNIT II	**ADMIXTURES**	**9**
Admixtures – necessity – types-chemical admixtures with specific properties - accelerators - retarders -plasticizers and super plasticizers - air entraining admixtures-water proofers - coloring agent. Mineral admixtures-fly ash-slag -micro and nano silica- mineral additives and fillers.		
UNIT III	**MIX DESIGN**	**9**
Mix design-factors influencing mix proportion-variability in test results -quality control - sampling and acceptance criteria-mix design by American concrete institute method and Indian standard code method.		
UNIT IV	**SPECIAL CONCRETES AND CONCRETING METHODS**	**9**
Light weight concrete - fibre reinforced concrete - polymer concrete - ready mix concrete-self compacting concrete - high strength concrete - high performance concrete-pervious concrete - bio and bacterial concrete - smart concrete; concrete methods: extreme weather concreting - vacuum dewatering concreting - underwater concreting - gunite and shotcreting.		

UNIT V	NON - DESTRUCTIVE TEST AND DURABILITY OF CONCRETE	9
Rebound hammer-ultra sonic pulse velocity test. durability of concrete-mechanism of corrosion-causes and effects-permeability of concrete – shrinkage-plastic shrinkage -drying shrinkage-chemical attack-sulfate attack of concrete structures - chloride attack- remedial measures.		
		Total : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Determine the properties of fresh and hardened of concrete.
CO2: Apply a suitable admixture in the required field conditions.
CO3: Design the concrete mix using ACI and IS code methods.
CO4: Evaluate the properties and applications of special concretes.
CO5: Diagnose the strength and durability of concrete structures with different testing methods.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1				2						2	1		2
CO2	3	2				3						2	1		2
CO3	3	2				2						2	1		2
CO4	3	2				2						2	1		2
CO5	2	1				2						2	1		2

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	Shetty, M.S, “Concrete Technology”, Theory & Practice, S.Chand and Co, 2012.
T2.	Santakumar A.R, “Concrete Technology”, Oxford University Press, New Delhi, 2012.
T3.	Gambhir M.L, “Concrete Technology”, Tata McGraw Hill, 2012.

REFERENCE BOOK(S)	
R1.	Kumar Mehta P, Paulo, and Moteiro J. M, “Concrete-Micro Structure, Properties and Materials”, 3rd Edition, Mcgraw Hill, 2006.
R2.	IS10262-2019 Concrete Mix Proportioning Guidelines, Bureau of Indian Standards, 2019, New Delhi, 2001.

Course Code: 24CEC205	**Course Title: Highway and Railway Engineering**	
Course Category: PCC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand highway planning, design elements, and sight distance considerations.
• To evaluate and test highway construction materials for suitability.
• To design flexible and rigid pavements using relevant methods.
• To learn about railway track components, design, and maintenance.
• To understand advanced railway engineering concepts, operations, and urban transportation.

UNIT I	**INTRODUCTION TO HIGHWAY**	**9**
Introduction to transportation systems, classification of roads, highway planning-road cross section-camber, gradient, super elevation - sight distance: pie theory-stopping sight distance-over taking sight distance-intermediate sight distance. Horizontal curves: super elevation-widening of pavements -transition curves. Types of gradients-grade compensation on curves-introduction to vertical curve.		
UNIT II	**HIGHWAY MATERIALS**	**9**
Pavement materials: desirable properties and testing of highway materials-soil: California bearing ratio test, field density test; aggregate: crushing, abrasion, impact, water absorption, flakiness and elongation indices and stone polishing value test; Bitumen: penetration, ductility, viscosity and softening point test.		
UNIT III	**PAVEMENT DESIGN**	**9**
Rigid and flexible pavements- components and their functions- factors affecting the design of pavements; design practice for flexible pavements (IRC method and recommendations-problems)-design practice for rigid pavements (IRC recommendations - concepts only). Types of road constructions: water bound macadam, bituminous and cement concrete road.		
UNIT IV	**RAILWAY PLANNING AND CONSTRUCTION**	**9**
Elements of permanent way - rails, sleepers, ballast, rail fixtures and fastenings, selection of gauges - track stress, coning of wheels, creep in rails, defects in rails - route alignment surveys, conventional and modern methods-geometric design of railway, gradient, super elevation, widening of gauge on curves (problems)-railway drainage- level crossings-signalling.		

UNIT V	RAILWAY TRACK CONSTRUCTION MAINTENANCE AND OPERATION	9
Points and crossings - design of turnouts, working principle-track circuiting - construction & maintenance - conventional, modern methods and materials, lay outs of railway stations and yards, rolling stock, tractive power, track resistance - role of Indian railways in national development - railways for urban transportation.		
		Total : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain the various highway development and design cross section elements.
CO2: Determine the characteristics of pavement materials and design of pavement as per IRC.
CO3: Design the pavement as per IRC.
CO4: Understand the methods of route alignment and design elements in railway planning and constructions.
CO5: Understand the construction techniques and maintenance of track laying and railway Stations.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1				2	3					2	1		1
CO2	3	2				3	3					2	1		1
CO3	3		1			2	2					2	1		
CO4	3	2	1	1		2	2					2	1		1
CO5	2	1				2	3					2	1		1

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	Khanna.S. K,Justo.C.E.G and Veeraragavan A, "Highway Engineering", Nemchand Publishers, 2014.
T2.	Kadiyali.L.R, "Principles and Practice of Highway Engineering", 6th edition, Khanna Technical Publications, Delhi, 2015.

REFERENCE BOOK(S)	
R1.	Kadiyali L.R, “Principles and Practice of Highway Engineering”, Khanna Technical Publications, New Delhi, 2013 Second Edition.
R2.	Rangwala, “Railway Engineering”, Charotar Publishing House, 2013.

Course Code: 24CEC222	Course Title: Water and Wastewater Analysis Laboratory	
Course Category: PCC	**Credits: 2**	
L:T:P(Hours/Week): 0:0:4	**Total Contact Hours: 60**	**Max Marks : 100**

COURSE OBJECTIVES
• To measure key physical properties of water samples, including electrical conductivity and turbidity.
• To determine the concentration of specific chemical constituents in water, such as fluoride and sulfate.
• To optimize the coagulation process in water treatment using jar test apparatus.
• To assess chlorine content in bleaching powder and residual chlorine levels in water.
• To analyze wastewater quality by determining various parameters, including solids, sludge volume index, dissolved oxygen, BOD and COD.

LIST OF EXPERIMENTS	
ANALYSISOFWATER SAMPLE	
1	Sampling and preservation methods for water and wastewater (Demonstration only)
2	Measurement of pH, Alkalinity and Acidity of Fresh water
3.	Measurement of Electrical conductivity and turbidity.
4	Determination of fluoride in water by spectrophotometric method /ISE.
5.	Determination of Sulphate in water.
6.	Determination of Optimum Coagulant Dosage by Jar test apparatus.
7.	Determination of available Chlorine in Bleaching powder and residual chlorine in water.
ANALYSISOFWASTEWATER SAMPLE	
8.	Estimation of suspended, volatile and fixed solids.
9.	Determination of Sludge Volume Index in waste water.
10.	Determination of Dissolved Oxygen.
11.	Estimation of B.O.D.
12.	Estimation of C.O.D.
	Total: 60Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Calibrate and standardize the equipment.
CO2: Collect proper sample for analysis.
CO3:Know the sample preservation methods.
CO4: Perform field oriented testing of water and wastewater.
CO5: Understand the wastewater quality.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2		1	1	1		1		1	2	1	
CO2	3	3	3	2		1	2	1	1	2		2	2	1	
CO3	3	3	3	2		1	2	1	1	2		2	2	1	
CO4	3	3	3	3		2	2	1	1	2		3	2	1	
CO5	2	3	3	3		3	3	2	2	3		3	2	1	

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Garg, S.K. Environmental Engineering, Vol.I and Vol.II Khanna Publishers, New Delhi, 2015.
T2.	Punmia B.C, Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi 2010.
T3.	Duggal K.N, "Elements of Environmental Engineering" S. Chand and Co. Ltd., New Delhi, 2014.

REFERENCE BOOK(S)

R1.	APHA, "Standard Methods for the Examination of Water and Waste water", 22nd Ed. Washington, 2012.
R2.	"Laboratory Manual for the Examination of water, wastewater soil Rump", H.H. and Krist,H.– Second Edition, VCH, Germany, 3rd Edition, 1999.
R3.	"Methods of air sampling &analysis", James P.Lodge Jr (Editor) 3rd Edition, Lewis publishers,Inc,USA,1989.

Course Code: 24CEC223	**Course Title: Strength of Materials Laboratory**	
Course Category: PCC	**Credits: 2**	
L:T:P(Hours/Week): 0:0:4	**Total Contact Hours: 60**	**Max Marks : 100**

COURSE OBJECTIVES
• To expose the students to the testing of different materials.
• To determine the tension and compression test on different materials.
• To determine the torsion test on materials.
• To calculate the hardness on metals by different methods.
• To calculate the deflection of different materials.

LIST OF EXPERIMENTS	
1	Tension test on steel rod
2	Compression test on wood
3.	Double shear test on metal
4	Torsion test on mild steel rod
5.	Impact test on metal specimen (Izod and Charpy)
6.	Hardness test on metals (Rockwell and Brinell Hardness Tests)
7.	Deflection test on metal beam
8.	Compression test on helical spring
9.	Deflection test on carriage spring
	Total: 60Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Calibrate and standardize the equipment.
CO2: The stress distribution and strains in regular and composite structures subjected to axial loads has been learned.
CO3: Understand the shear force, bending moment and bending stresses in beams.
CO4: The torsion equation in design of circular shafts and helical springs has been studied.
CO5: Understand the hardness of different materials.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2		1	1	1		1		1	2	1	
CO2	3	3	3	2		1	2	1	1	2		2	2	1	
CO3	3	3	3	2		1	2	1	1	2		2	2	1	
CO4	3	3	3	3		2	2	1	1	2		3	2	1	
CO5	2	3	3	3		3	3	2	2	3		3	2	1	

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Bansal R.K, “Strength of Materials”, Laxmi Publications, New Delhi, 2017.
T2.	Rajput R.K, “Strength of Materials”, S.Chand and Co, New Delhi, 2014.

REFERENCE BOOK(S)

R1.	Strength of Materials Laboratory Manual, Anna University, Chennai – 600 025.
R2.	IS1786-2008 (Fourth Revision, Reaffirmed 2013), High strength deformed bars and wires for concrete reinforcement – Specification, 2008.

Course Code: 24CEC301	**Course Title: Design of Reinforced Concrete Structural Elements**	
Course Category: PCC	**Credits: 4**	
L:T:P(Hours/Week) 3:1:0	**Total Contact Hours: 60**	**Max Marks: 100**

COURSE OBJECTIVES
• To develop an understanding on the basic concepts in the behavior and design of reinforced concrete systems and elements using working stress and limit state method.
• To learn the design of beams as per code.
• To introduce the design principles of slab and staircase.
• To introduce the concepts in the design of RC Column design.
• To accrue knowledge in the concept of RC footings.

UNIT I	**INTRODUCTION TO R.C.C.DESIGN**	**9+3**
Objective of structural design - steps in RCC structural design process - type of loads on structures and load combinations- code of practices and specifications - concept of working stress method, ultimate load design and limit state design methods for RCC - properties of concrete and reinforcing steel - analysis and design of singly reinforced rectangular beams by working stress method - limit state philosophy as detailed in is code - advantages of limit state method over other methods - analysis and design of singly and doubly reinforced rectangular beams by limit state method.		
UNIT II	**DESIGN OF BEAMS**	**9+3**
Analysis and design of flanged beams for - use of design aids for flexure - behaviour of RC members in shear, bond and anchorage - design requirements as per current code - behaviour of rectangular RC beams in shear and torsion - design of RC members for combined bending, shear and torsion		
UNIT III	**DESIGN OF SLABS AND STAIRCASE**	**9+3**
Concepts assumptions -methods of analysis application of virtual work method to square, rectangular slabs analysis and design of one way and two way rectangular slab subjected to uniformly distributed load for various boundary conditions and corner effects- design of flat slab- types of staircases - design of dog-legged staircase.		
UNIT IV	**DESIGN OF COLUMNS**	**9+3**
Types of columns - eccentricity analysis - design of short column for axial bending - uniaxial		

bending - biaxial bending - design principles of slender column.

UNIT V	DESIGN OF FOOTINGS	9+3
Design of axially loaded rectangular footing - eccentrically loaded rectangular footing - design of combined rectangular footing for two columns only- design of mat foundation- design of trapezoidal foundation.		
		Total: 60 Hours

COURSE OUTCOMES

At the end of this course, students will be able to

CO1: Design flexural members using limit state method under different loading conditions.

CO2: Know the analysis and design of flanged beams by limit state method and sign of beams for shear, bond and torsion.

CO3: Design of slab for various end condition and design of staircase.

CO4: Design RC columns of any cross section with different end conditions.

CO5: Design of footings according to column positioning.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1			1	1					1	2	1	
CO2	3	2	1			1	1			1		1	2	1	
CO3	3	2	1			1	1			1		1	2	1	
CO4	3	2	1			1	1			1		1	2	1	
CO5	3	2	1			1	1			1		1	2	1	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Unni krishnan Pillai and Devdass Menon, “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd. 2016.
T2.	N.Krishnaraju, "Design of Reinforced Concrete Structures: IS: 456-2000”,Fourth edition, CBS Publishers and distributors, Pvt. Ltd., 2016.

REFERENCE BOOK(S)

R1.	Punmia B.C. Ashok K. Jain and Arun K. Jain, “Limit State design of Reinforced Concrete”, Laxmi Publications (P) Ltd., New Delhi, 2016.
R2.	Varghese, P.C, “Limit State Design of Reinforced Concrete”, Prentice Hall of India, Pvt. Ltd., New Delhi, 2013.
R3.	Gambhir M L, “Fundamentals of Structural Steel Design”, McGraw Hill Education India Pvt. Limited, 2017

Course Code: 24CEC302	**Course Title: Structural Analysis I**	
Course Category: PCC	**Credits: 3**	
L:T:P(Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To Understand computation of slopes and deflections using energy methods
• To Analysis of indeterminate structures by theorem of three moments and slope deflection method.
• To Analysis of indeterminate beams and frames for internal forces using Moment distribution method.
• To understand matrix flexibility methods for analyzing the indeterminate structures.
• To comprehend stiffness matrix method for analyzing the indeterminate structures.

UNIT I	**WORK ENERGY METHOD**	**9**
Static and kinematic indeterminacy - work and energy - principle of virtual work - deflections of determinate trusses, beams and frames- castigliano's theorem, betti's law and maxwell's reciprocal theorem - analysis of indeterminate trusses by strain energy method (with redundancy restricted to two)- lack of fit - temperature stresses.		
UNIT II	**THEOREM OF THREE MOMENTS AND SLOPE DEFLECTION METHOD**	**9**
Theorem of three moments - applications on beams - derivation of slope deflection equations - equilibrium conditions - analysis of continuous beams and rigid frames - support settlements - symmetric frames with symmetric and skew-symmetric loading (with redundancy restricted to three).		
UNIT III	**MOMENT DISTRIBUTION METHOD**	**9**
Stiffness and carry over factors - distribution and carryover of moments - analysis of continuous beams - plane rigid frames with and without sway (with redundancy restricted to three)- symmetric and skew - symmetric loading - support settlement.		
UNIT IV	**MATRIX FLEXIBILITY METHOD**	**9**
Equilibrium and compatibility - determinate and indeterminate structures - indeterminacy - primary structure -compatibility conditions - element to structure transformation - analysis of indeterminate pin jointed plane frames, continuous beams, rigid jointed plane frames.		
UNIT V	**MATRIX STIFFNESS METHOD**	**9**
Element and global stiffness matrices - analysis of continuous beams - co-ordinate		

transformations - rotation matrix - transformations of stiffness matrices, load vectors and displacements vectors - analysis of pin-jointed plane frames and rigid frames (with redundancy limited to three).

Total: 45 Hours

COURSE OUTCOMES

At the end of this course, students will be able to

CO1: Evaluate the truss, beam and frame using strain energy method.

CO2: Apply and understand the indeterminate structures by theorem of three moments and slope deflection method.

CO3: Apply and understand the indeterminate beams and frames for internal forces using Moment distribution method.

CO4: Analyze matrix flexibility method for analysis of continuous beams, pin jointed trusses and rigid plane frames.

CO5: Apply matrix stiffness approach for analysis of continuous beams, pin jointed trusses and rigid plane frames.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	3		3			3	2			1	2	
CO2	3	1	1	3		3			3	2			3	1	
CO3	2	2	2	3		3			3	2			2	3	
CO4	3	3	2	3		3			3	2			2	1	
CO5	3	3	1	3		3			3	2			1	2	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1. Reddy. C.S, “Basic Structural Analysis”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2017.

T2. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, “Theory of structures”, Laxmi Publications Pvt. Ltd., New Delhi, 2017.

REFERENCE BOOK(S)

R1. Wang C.K, “Indeterminate Structural Analysis”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2017.

R2. BhavaiKatti, S.S, “Structural Analysis - Vol. 1 & Vol. 2”, Vikas Publishing Pvt Ltd., New Delhi, 2011.

Course Code:24CEC311	Course Title: Soil Mechanics	
Course Category: PCC	Credits:4	
L:T:P (Hours/Week) 3:0:2	Total Contact Hours: 75	Max Marks: 100

COURSE OBJECTIVES
• To impart knowledge on soil properties relevant to Civil Engineering and their determination
• To understand the physical significance of effective stress and its relation with pore pressure
• To understand how stresses are transferred through soils and be able to compute both geostatic and induced stresses due to point, line, and area loads.
• To impart knowledge on estimation of the amount of consolidation and settlement.
• To computation of shear strength parameters and differentiate various modes of slope failure.

UNIT I	PHYSICAL PROPERTIES AND CLASSIFICATION OF SOIL	9
Soil formation soil problems in engineering physical properties of soil phase relations - index properties of soil-grain size distribution-atterberg's limits - identification and classification of soils (BIS classification).		
UNIT II	PERMEABILITY AND SEEPAGE IN SOIL	9
Soil water concept of total, neutral and effective stresses-capillary phenomena permeability and its determination methods permeability of stratified soils seepage flow one dimensional flow - flow net-determination of seepage quantity, quick sand condition.		
UNIT III	STRESS DISTRIBUTION	9
Vertical stress distribution in soil influence factors, isobars - boussinesq's equation, westergaard's equation and newmark's influence chart - stress below equivalent point load. contact pressure under rigid and flexible area.		
UNIT IV	COMPACTION AND CONSOLIDATION	9
Compaction laboratory test - factors affecting compaction - field compaction methods- compaction control; Consolidation immediate, primary and secondary consolidation - consolidation test - interpretation of consolidation test results -terzaghi's theory of consolidation, pressure void ratio relationship, pre-consolidation pressure - Total settlement; co-efficient of consolidation - curve fitting methods, rate of settlement.		

UNIT V	SHEAR STRENGTH AND SLOPE STABILITY	9
Shear strength failure criterion- shear strength tests direct shear test, UCC, vane shear test and tri axial test - different drainage conditions- shear properties of cohesive and cohesion less soils - mohr's stress circle; Slope failure mechanisms - finite slopes and infinite slopes - swedish circle method and friction circle method (theory only).		

PRACTICALS	
1.	Determine the specific gravity of soil.
2.	Determine the grain size distribution-Sieve analysis.
3.	Determine the grain size distribution - Hydrometer analysis.
4.	Determine the Liquid limit, Plastic limit, Shrinkage limit of given sample.
5.	Determine the Field density of soil - Sand-replacement method.
6.	Determine the Field density of soil - Core cutter method.
7.	Determination of moisture-density relationship using standard Proctor compaction test.
8.	Determine the Permeability of soil (constant head and falling head methods).
	Total: 75 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Identify the types of soil and expected behavior on application of load.
CO2: Determine the permeability of soil, estimate soil stresses and prepare flow net diagram.
CO3: Estimate the stresses and displacement in soil mass due to various type of surface loading.
CO4: Estimate the total settlement and time rate of settlement of the soil.
CO5: Analyze shear properties of cohesive and cohesion less soils and Analyze the slope failure.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2		3	1	1		1	1		1	2	1	
CO2	3	2	2		2	1	1		1	1		1	2	1	
CO3	3	2	2		-	1	1		1	1		1	2	1	
CO4	3	2	2		2	1	1		1	1		1	2	1	
CO5	2	2	2		2	1	1		1	1		1	2	1	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Punmia P.C, "Soil Mechanics and Foundations", Laximi Publications Pvt. Ltd, New Delhi, 2017.
T2.	Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2014.

REFERENCE BOOK(S)	
R1.	McCarthy, D.F, "Essentials of Soil Mechanics and Foundations Basic Geotechniques", 6th Edition, Prentice Hall of India, 2002.
R2.	Karl Terzaghi, Ralph B. Peck, and Gholamreza Mesri, "Soil Mechanics in Engineering Practice", 3rd Edition, John Wiley & Sons, 1996.
R3.	Gopal Ranjan and Rao A.S.R, "Basic and Applied Soil Mechanics", New age international Publishers, 2000.
R4.	Murthy, V.N.S, "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2011.

Course Code: 24CEC321	Course Title: Concrete & Highway Engineering Laboratory	
Course Category: PCC	Credits: 2	
L:T:P (Hours/Week) 0:0:4	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES
• To study the properties of materials constituent, mix design procedure and fresh concrete.
• To learn the tests on hardened concrete and how the different materials shall modify the performance of concrete.
• To know the properties of bitumen and their suitability.
• To study the various tests carried out on cement and aggregates.
• To exposure on field tests on bitumen mixes.

LIST OF EXPERIMENTS	
1.	Test on Aggregates: i. Determination of Crushing strengthof the given aggregate. ii. Determination of Abrasion value of the given aggregate. iii. Determination of Impact value of the given aggregate. iv. Determination of Water absorption of the given aggregate. v. Determination of Flakiness and Elongation index of the given aggregate.
2.	Test on Cement: i. Determination of Fineness of the cement. ii. Determination of Consistency of the cement. iii. Determination of Initial and Final setting of the cement.
3.	Concrete Mix Design: Mix design as per IS code.
4.	Test on Fresh Concrete: i. Find the slump value of concrete using Slump cone test. ii. Find the fresh concrete property using Compaction factor.
5.	Test on Hardened concrete: i. Determination of Compressive strength of given concrete samples. ii. Determination of Flexure test of given concrete samples.

6.	<u>Test on Bitumen: (include Modified Bitumen)</u> i. Determine the Penetration value of the given sample. ii. Determine the Softening point of the given sample. iii. Determine the Ductility of the given sample. iv. Determine the Viscosity of the given sample.
	Total: 60 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Assure the quality of coarse aggregate used in concrete.
CO2: Various workability tests on fresh concrete.
CO3: Ensure the strength characteristics of the given concrete.
CO4: Understand the quality and grade check on bitumen.
CO5: Choose the correct grade bitumen for road works.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	1	1		1	1		1	2	2	
CO2	2	2	2	1	2	1	1		1	1		1	2	2	
CO3	2	2	2	1	2	1	1		1	1		1	2	2	
CO4	2	2	2	1	2	1	1		1	1		1	2	2	
CO5	2	2	2	1	2	1	1		1	1		1	2	2	

(1 - Low, 2 - Medium, 3 - High)

CODE BOOK(S)

C1.	IS 383:1993, "Specification for Course and fine aggregates from natural sources for Concrete".
C2.	IS 2386 (Part 1 to IV): 1963, "Methods of Test for Aggregates for Concrete, Part I: Particle Size and Shape".
C3.	IS 1201-1220 (1978),"Methods for testing tars and Bituminous Materials".
C4.	IRC SP 53:2010, "Guidelines on use of Modified Bitumen".
C5.	IS 456:2000, "Plain and Reinforced Concrete-Code of Practice".
C6.	IS 10262:2019, "Concrete Mix Proportioning-Guidelines".

Course Code: 24CDC321	**Course Title: Field Survey for Civil Engineers**	
Course Category: ECC	**Credits: 1**	
L:T:P (Hours/Week) 0:0:2	**Total Contact Hours: 60**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand and apply the theodolite survey for traverse area calculation.
• To perform radial contouring and block leveling for topographic mapping.
• To conduct road alignment surveys, including longitudinal and cross-section profiling.
• To utilize GPS for determining latitude and longitude of a location.
• To apply modern equipment and methods for calculating area and volume.
At the end of the camp, each student shall have mapped and contoured the area. The camp record shall include all original field observations, calculations and plots.

Ten days Survey Camp will be conducted during summer vacation in the following activities:
1. Area of Traverse using Theodolite survey.
2. Radial contouring - Radial Line at Every 30 Degree and Length not less than 60 meter on each radial Line
3. Block Level/ By squares of size at least 100 meter x 100 meter at least 20 meter interval
4.Longitudinal section and cross section of road alignment for a Length of not less than 1 Kilometer at least L.S. at every 30 m and C.S. at every 90 m.
5. Use of GPS to determine latitude and longitude of survey camp location.
6. Sun observation to determine azimuth of a survey line.
7.Determination of elevation of an object using single plane method when base is accessible/inaccessible.
8. Calculation of area and volume using modern equipment.
Total: 60 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Perform traverse area calculation using a theodolite.
CO2: Understand the radial contouring and block leveling techniques.
CO3: Analyse road alignment surveys with accurate longitudinal and cross-sections.

CO4: Apply GPS for location positioning and sun observation for azimuth determination.
CO5: Understand the modern tools for area, volume, and elevation measurement.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2			1	1		1	1		1	2	1	
CO2	3	2	2		1	1	1		1	1		1	2	1	
CO3	3	2	2		1	1	1		1	1		1	2	1	
CO4	3	2	2		2	1	1		1	1		1	2	1	
CO5	3	2	2		2	1	1		1	1		1	2	1	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Punmia, B.C, Ashok K Jain and Arun K Jain, “Surveying Vol. I&II”,16th Edition,Laxmi Publication, New Delhi, 2005.
T2.	Chandra.A.M, “Plane Surveying and Higher Surveying”, New Age International (P)Limited, Publishers, Chennai, 2002.

REFERENCE BOOK(S)

R1.	Arora, K.R, “Surveying Vol.I& II”, Standard Book House Publishers& distributors, New Delhi, 2008.
R2.	Duggal S.K, “Surveying, Vol. I & II”, Tata McGraw-Hill, Publishing Company, 2004.
R3.	Venkatramaiah C, “Textbook of Surveying”, 2nd Edition, University Press, Hyderabad, 2011.

Course Code: 24CEC303	Course Title: Foundation Engineering	
Course Category: PCC	Credits: 3	
L:T:P (Hours/Week): 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To investigate soil properties and select appropriate foundations.
• To determine bearing capacity and settlement of foundations.
• To design and proportion shallow foundations.
• To analyze and design pile foundations.
• To evaluate earth pressure and design stable retaining walls.

UNIT I	SITE INVESTIGATION AND SELECTION OF FOUNDATION	9
Introduction-Scope and objectives - methods of exploration - auguring and boring - wash boring and rotary drilling - depth of boring - spacing of bore hole - sampling techniques - representative and undisturbed sampling - methods - different types of samplers - bore log report - data interpretation- strength parameters and liquefaction potential - selection of foundation based on soil condition.		
UNIT II	BEARING CAPACITY AND SETTLEMENT	9
Introduction- location and depth of foundation - codal provisions - bearing capacity of shallow foundation on homogeneous deposits - Terzaghi's formula and BIS formula - factors affecting bearing capacity - problems - bearing capacity from in-situ tests (plate load, spt and scpt) allowable bearing pressure - seismic considerations in bearing capacity evaluation. determination of settlement of foundations on granular and clay deposits - total and differential settlement.		
UNIT III	SHALLOW FOUNDATION	9
Types of footings - contact pressure distribution, isolated footing - combined footings - proportioning - mat foundation - types and applications- floating foundation -codal provision (no structural design).		
UNIT IV	DEEP 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 - capacity from in-situ tests - negative skin friction - uplift capacity - group capacity by different methods (field's rule, converse-labarre formula and block failure criterion) -		

settlement of pile groups - pile load tests - under reamed piles.		
UNIT V	**RETAINING WALLS**	**9**
Plastic equilibrium in soils - active and passive states - Rankine's theory –cohesionless and cohesive soil - condition for critical failure plane - earth pressure on retaining walls of simple configurations - culmann's graphical method - pressure on the wall due to line load - stability analysis of retaining walls - use of geosynthetics for different applications.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand soil investigation work, prepare the soil report and select a suitable type of foundation for the given soil condition.
CO2: Estimate bearing capacity of soil using various theories and by in-situ testing.
CO3: Design the overall dimensions of different types of foundations.
CO4: Assess the behavior of single pile and group of piles in different types of soils.
CO5: Estimate the earth pressure behind retaining walls and to carry out stability analysis.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1					2			3	2		
CO2	3	3	1	1					2			3	2		
CO3	3	3	1	1					2			3	2		
CO4	3	3	1	1					2			3	2		
CO5	3	3	1	1					2			3	2		

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Arora K.R, "Soil Mechanics and Foundation Engineering", 7th Edition Standard Publishers and Distributors, new Delhi, 2014.
T2.	Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2018.

REFERENCE BOOK(S)

R1.	GopalRanjan and Rao A.S.R, "Basic and Applied soil mechanics", 2nd Edition, Wiley eastern ltd, New Delhi, 2014.
R2.	Murthy, V.N.S, "Soil Mechanics and Foundation Engineering", 5thEdition,CBS

	Publishers Distribution Ltd., New Delhi, 2011.
R3.	Das, B.M, "Principles of Geotechnical Engineering",5^{th} Edition, Thompson Brooks/ Coles Learning, Singapore, 2002.

Course Code: 24CEC304	Course Title: Structural Analysis II	
Course Category: PCC	Credits: 3	
L:T:P (Hours/Week): 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To learn creation of influence line for the analysis of determinate structures.
• To Explore Muller Breslau's principle for developing influence line to analyze indeterminate structures.
• To analysis of space truss and arch structures.
• To analysis of cable supported structures.
• To apply the principles of plastic analysis to determine the collapse load of beams and rigid frames.

UNIT I	INFLUENCE LINES FOR DETERMINATE STRUCTURES	9
Rolling loads - influence lines for reactions, shear force and bending moment in statically determinate beams - calculation of critical stress resultants due to concentrated and distributed moving loads - absolute maximum bending moment - influence lines for member forces in pin jointed plane frames.		
UNIT II	INFLUENCE LINES FOR INDETERMINATE BEAMS	9
Muller breslau's principle - influence line for shearing force, bending moment and support reaction components of propped cantilever, continuous beams (redundancy restricted to one) and fixed beams.		
UNIT III	SPACE TRUSSES AND ARCHES	9
Space trusses - method of tension coefficients - arches - types of arches - analysis of three hinged and two hinged - parabolic and circular arches - settlement and temperature effects - fixed arches.		
UNIT IV	CABLES AND SUSPENSION BRIDGES	9
Equilibrium of cable - length of cable - anchorage of suspension cables - stiffening girders - cables with three hinged and two hinged stiffening girders.		
UNIT V	PLASTIC ANALYSIS	9
Plastic theory - statically indeterminate structures - plastic moment of resistance - plastic modulus - shape factor - load factor - plastic hinge and mechanism - length of plastic hinge -		

collapse load - static and kinematic methods - upper and lower bound theorems.

Total: 45 Hours

COURSE OUTCOMES

At the end of this course, students will be able to

CO1: Analyse the determinate structures using influence line method.

CO2: Analyse the indeterminate structures using influence line method.

CO3: Analyze space truss, parabolic and circular arches.

CO4: Analyze the suspension bridges with two hinged and three hinged stiffening girders.

CO5: Apply the plastic analysis method to compute collapse load in beams and rigid frames.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2		1	1	1			1	2		2		
CO2	2	2	2		1	1	1			1	2		2		
CO3	2	2	2		2	1	1			1	2		2		
CO4	2	2	2		2	1	1			1	2		2		
CO5	2	2	2		2	1	1			1	2		2		

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1. Vaidyanathan R and Perumal P, “Comprehensive Structural Analysis” – Vol. I & II”, Laxmi Publications, New Delhi, 2016.

T2. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, ‘Theory of structures”, Laxmi Publications Pvt. Ltd., New Delhi, 2017.

REFERENCE BOOK(S)

R1. Ghali.A, Nebille,A.M and Brown,T.G, “Structural Analysis - A unified classical and Matrix approach” 6^{th}edition, Spon Press, London and New York, 2017.

R2. Gambhir. M.L, “Fundamentals of Structural Mechanics and Analysis”, PHI Learning Pvt. Ltd., New Delhi, 2011.

R3. BhavaiKatti, S.S, “Structural Analysis” – Vol. 1 &Vol, Vikas Publishing Pvt. Ltd,.

Course Code: 24CDC322	Course Title: Applications of Civil Engineering Software	
Course Category: PCC	**Credits: 1**	
L:T:P (Hours/Week): 0:0:2	**Total Contact Hours: 30**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the fundamental concepts and applications of civil engineering software for design and analysis.
• To master proficiency in using industry-standard software for civil engineering.
• To apply software tools for modelling, simulation, and optimization of civil engineering structures.
• To analyze real-world engineering problems using digital tools to improve accuracy and efficiency.
• To enhance decision-making skills through software-based project management and data analysis.

MODULE I	Introduction to Civil Engineering Software	15
• Importance and applications of software in civil engineering. • Overview of software (Any one: STAAD Pro, ETABS, SAP2000, Revit, Civil 3D etc.,) • Fundamentals of design and analysis tools.		
MODULE II	**Structural Analysis and Design Software**	**15**
• Introduction to modeling of structural elements. • Load calculations, material properties, and design parameters. • Application of software in design of beam, frame, and truss analysis. • Reinforced concrete and steel structure design.		
		Total: 30 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the ability to use civil engineering software for structural analysis and design.
CO2: Analyze structural analysis using relevant tools.
CO3: Apply digital models and conduct simulations to optimize civil engineering solutions.
CO4: Interpret software-generated results for practical engineering applications and project

planning.
CO5: Effectively utilize design and analysis software for decision-making in civil engineering projects.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3								1	2	2	1	
CO2	3	3	3								1	2	2	1	
CO3	3	2	3								1	3	2	1	
CO4	2	3	3								2	2	2	1	
CO5	3	3	3								2	3	2	1	

(1 – Low, 2 – Medium, 3 – High)

Course Code: 24CEC401	**Course Title: Design of Steel Structural Elements**	
Course Category: PCC	**Credits: 3**	
L:T:P (Hours/Week)3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the types and properties of structural steel and I.S. rolled sections.
• To apply the concept of limit state design in structural steel design.
• To analyze and design simple and eccentric bolted and welded connections.
• To evaluate different types of joint failures and determine joint efficiency.
• To introduce high - strength friction grip (HSFG) bolts and understand their applications.

UNIT I	**INTRODUCTION TO STRUCTURAL STEEL AND DESIGN OF CONNECTIONS**	**9**
General-types of steel - properties of structural steel-I.S. rolled sections-concept of limit state design-design of simple and eccentric bolted and welded connections-types of failure and efficiency of joint-prying action-introduction to HSGF bolts.		
UNIT II	**DESIGN OF TENSION AND COMPRESSION MEMBERS**	**9**
Behaviour and design of simple and built- up members subjected to tension- shear lag effect - design of lug angles - tension splice - behaviour of short and long columns-Euler's column theory- design of simple and built- up compression members with lacings and battens-design of column bases-slab base and gusseted bas.		
UNIT III	**DESIGN OF BEAMS**	**9**
Design of laterally supported and unsupported beams - design of built - up beams-design of plate girders.		
UNIT IV	**INDUSTRIAL STRUCTURES**	**9**
Design of roof trusses- loads on trusses - purlin design using angle and channel sections-truss design, design of joints and end bearings- design of gantry girder-introduction to pre-engineered buildings.		
UNIT V	**PLASTIC ANALYSIS AND DESIGN**	**9**
Introduction to plastic analysis- theory of plastic analysis - design of continuous beams and portal frames using plastic design approach.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the design philosophy of steel structures and identify the different failure modes of bolted and welded connections, and determine their design strengths.
CO2: Select the most suitable section shape and size for tension and compression members and beams according to specific design criteria.
CO3: Apply the principles, procedures and current code requirements to the analysis and design of steel tension members, columns, column bases and beams.
CO4:Identify and compute the design loads on Industrial structures, and gantry girder.
CO5: Find out ultimate load of steel beams and portal frames using plastic analysis.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2				2					1	1	1	
CO2	1	1	2		1						2	1	1	1	
CO3	1	1	2		1						2	1	1	1	
CO4	2	1	2		1	1	1	1	1		2	1	1		
CO5	1	2	2	1								1	1	1	

(1-Low, 2-Medium, 3-High)

TEXT BOOK(S)

T1.	Duggal S.K, “Design of Steel Structures”, Tata McGraw Hill, Publishing Co. Ltd., New Delhi, 2010.
T2.	Bhavikatti S.S, “Design of Steel Structures”, Ik International Publishing House, New Delhi, 2017.

REFERENCE BOOK(S)

R1.	GambhirM L, “Fundamentals of Structural Steel Design”, McGraw Hill Education India Pvt. Limited, 2013.
R2.	Jack C. Mc Cormac and Stephen F Csernak, “Structural Steel Design”, Pearson Education Limited, 2013.
R3.	Sarwar AlamRaz, “Structural Design in Steel”, New Age International Publishers, 2014.
R4.	Subramanian N, “Design of Steel Structures”, Oxford University Press, New Delhi, 2016.

Course Code:24CEC402	**Course Title: Estimation, Costing and Valuation Engineering**	
Course Category: PCC	**Credits: 3**	
L:T:P (Hours/Week)3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the philosophy and purpose of estimation in construction projects.
• To understand the concepts of standard and observed data in rate analysis.
• To understand different types of specifications used in construction.
• To understand the concept and types of construction contracts, including BOT models.
• To understand the fundamental concepts and importance of valuation in civil engineering.

UNIT I	**QUANTITY ESTIMATION**	**9**
Philosophy - purpose-methods of estimation-centre line method-long and short wall method-types of estimates-approximate estimates-detailed estimate-estimation of quantities for buildings, bituminous and cement concrete roads, septic tank, soak pit, retaining walls-Culverts.		
UNIT II	**RATE ANALYSIS AND COSTING**	**9**
Standard data-observed data-schedule of rates-market rates-materials and labour-standard data for man hours and machineries for common civil works-rate analysis for all building works, canals, and roads-cost estimates -Analysis of rates for the item of work asked, the data regarding labour, rates of material and rates of labour.		
UNIT III	**SPECIFICATIONS, REPORTS AND TENDERS**	**9**
Specifications-detailed and general specifications-constructions-sources-types of specifications-principles for report preparation-report on estimate of residential building-culvert-roads-TTT act 2000-tender notices-types-tender procedures-drafting model tenders , E- tendering-E NOI-E not- digital signature certificates-encrypting- decrypting-reverse auction.		
UNIT IV	**CONTRACTS**	**9**
Contract-types of contracts-BOT-types-formation of contract-contract conditions-contract for labour, material, design, construction-drafting of contract documents based on IBRD /		

MORTH standard bidding documents-construction contracts-contract problems-arbitration, litigation and legal requirement.		
UNIT V	**VALUATION**	**9**
Definitions-various types of valuations-valuation methods-necessity- year's purchase-sinking fund-capitalised value-depreciation-escalation-valuation of land-buildings-calculation of standard rent-mortgage-lease-types of lease.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the types of contracts.
CO2: Understand types of specifications, principles for report preparation, tender notices.
CO3: Analyze Rates for all Building works, canals, and Roads and Cost Estimate.
CO4: Estimate the quantities for buildings.
CO5: Evaluate valuation for building and land.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	2	1	2	1	2	2	2	2	2
CO2	2	1	2	2	2	2	2	1	2	1	2	2	2	2	2
CO3	2		1	2		2	1	1	2	1	1	2	2	2	2
CO4	2			2		2	1	1	2	1	1	2	2	2	2
CO5	2	1	1	2	2	2	1	1	2	1	1	2	2	2	2

(1-Low, 2-Medium, 3-High)

TEXT BOOK(S)

T1.	B.N Dutta "Estimating and Costing in Civil Engineering", CBS Publishers & Distributors (P) Ltd, Twenty eighth revised edition, 2020.
T2.	B.S.Patil, "Civil Engineering Contracts and Estimates", 7th edition, University Press, 2015.
T3.	D.N. Banerjee, "Principles and Practices of Valuation", V Edition, Eastern Law House, 2015.

REFERENCE BOOK(S)	
R1.	Hand Book of Consolidated Data - 8/2000, Vol.1, TNPWD.
R2.	Tamil Nadu Transparencies in Tenders Act, 1998 and rules 2000.
R3.	Arbitration and Conciliation Act, 1996.
R4.	Standard Bid Evaluation Form, Procurement of Good or Works, The World Bank, April 1996.
R5	Standard Data Book for Analysis and Rates, IRC, New Delhi, 2019.

Course Code: 24HSM401	**Course Title: Professional Ethics and Human Values**	
Course Category: HSMC	**Credits: 2**	
L:T:P (Hours/Week) 2:0:0	**Total Contact Hours: 30**	**Max Marks : 100**

COURSE OBJECTIVES
• To learn about morals, values & work ethics and how to live peacefully.
• To create awareness about the customs and religions and learn different professional roles.
• To provide depth knowledge on framing of the problem and determining the facts.
• To create awareness about safety, risk & risk benefit analysis.
• To develop knowledge about global issues.

UNIT I	**HUMAN VALUES**	**6**
Morals, Values and Ethics - Integrity-Work Ethic-Service learning - Civic Virtue - Respect for others - Living Peacefully - Caring - Sharing - Honesty - Courage - Cooperation - Commitment - Empathy - Self Confidence Character - Spirituality-Case Study.		
UNIT II	**ENGINEERING ETHICS**	**6**
Senses of Engineering Ethics-Variety of moral issued - Types of inquiry - Moral dilemmas - Moral autonomy - Kohlberg’s theory-Gilligan’s theory-Consensus and controversy -Models of professional roles-Theories about right action-Self-interest-Customs and religion - Uses of Ethical theories - Valuing time - Cooperation – Commitment-Case Study.		
UNIT III	**ENGINEERING AS SOCIAL EXPERIMENTATION**	**6**
Engineering As Social Experimentation - Framing the problem - Determining the facts - Codes of Ethics - Clarifying Concepts - Application issues - Common Ground -General Principles - Utilitarian thinking respect for persons-Case study.		
UNIT IV	**ENGINEERS RESPONSIBILITY FOR SAFETY AND RISK**	**6**
Safety and risk - Assessment of safety and risk - Risk benefit analysis and reducing risk-Safety and the Engineer-Designing for the safety-Intellectual Property Rights(IPR).		
UNIT V	**GLOBAL ISSUES**	**6**
Globalization - Cross culture issues-Environmental Ethics - Computer Ethics - Computers as the instrument of Unethical behavior - Computers as the object of Unethical acts - Autonomous Computers-Computer codes of Ethics - Weapons Development -Ethics and Research - Analyzing Ethical Problems in research- Case Study.		
		Total: 30Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand and analyse the essentials of human values and skills, self-exploration, happiness and prosperity.
CO2: Recognize the theories and principles of professional ethics.
CO3:Understand various social issues, industrial standards, code of ethics and role of professional ethics in engineering field.
CO4:Analyse Safety and Risk benefit analysis and acquire knowledge on professional rights and responsibilities of an engineer.
CO5: Provide the sensitivity and global outlook in the contemporary world to fulfill the professional obligations effectively.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1					2	1	3	1	1	2	1	1	1	
CO2	1					3	2	3	2	1	2	1	1	1	
CO3	1	2	2			3	3	3	2	1	1	1	1	1	
CO4	1	2	2			3	3	3	2	1	2	1	1	1	
CO5	1					3	2	3	2	1	1	1	1	1	

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	Mike W. Martin and Roland Schinzinger, “Ethics in Engineering”, Fourth Edition, McGraw-Hill Education, Delhi, 2005.
T2.	M.Govindarajan, S.Natarajan and V.S.Senthilkumar, “Professional Ethicsand Human Values”, PHI Learning Private Limited, 2013.

REFERENCE BOOK(S)	
R1.	Jayshree Suresh and B.S. Raghavan, “Human Values and Professional Ethics”, Fourth Revised Edition, S.Chand& Company Limited, New Delhi, 2012.
R2.	S. B. Gogate, “Human Values and Professional Ethics”,First Reprint, Vikas Publishing House Pvt. Ltd., Noida, 2014.
R3.	Charles E. Harris, Michael S. Pritchard, Ray W. James, Michael Jerome Rabins and Elaine E. Englehardt, “ Engineering Ethics Concepts and Cases”, Fifth Edition, Wadsworth Cengage Learning, 2014.

Course Code: 24CEC421	**Course Title: Computer Aided Design and Drafting Laboratory**	
Course Category: PCC	**Credits: 2**	
L:T:P (Hours/Week): 0:0:4	**Total Contact Hours: 60**	**Max Marks : 100**

COURSE OBJECTIVES
• To develop hands-on skills in designing and detailing reinforced concrete and steel structures in compliance with IS codes
• Toanalyze and draft structural drawings for retaining walls, bridges, and water tanks using engineering standards.
• To understand load considerations and reinforcement detailing in bridges, water tanks, and industrial structures.
• To explore the structural behavior of different components through the design of plate girders and truss girder bridges.
• To expertise preparing detailed structural drawings for complex structures encountered in civil engineering practice.

LIST OF EXPERIMENTS	
1.	Design and drawing of RCC cantilever and counter fort type retaining walls with reinforcement details.
2.	Design of solid slab and RCC Tee beam bridges for IRC loading and reinforcement details.
3.	Design and drafting of circular and rectangular RCC water tanks.
4.	Design of plate Girder Bridge - Truss Girder bridges - Detailed Drawings including connections.
5.	Design of hemispherical bottomed steel tank.
	Total: 60 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Apply knowledge of IS codes and structural principles to the design of concrete and steel structures

CO2:Develop expertise in preparing reinforcement detailing and construction drawings.
CO3: Design and analyze retaining walls, bridges, and water tanks considering safety and economy roofs.
CO4: Demonstrate skills in drafting structural drawings for execution in construction projects.
CO5: Understand the practical applications of design principles in real-world civil engineering projects.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	1							1	2	2	1
CO2	2	1	2	1	1							1	2	2	1
CO3	2	1	2	2	1							1	2	2	2
CO4	2	2	2	2	2							1	2	2	2
CO5	2	2	2	2	2							1	2	2	2

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Krishnaraju,N. “Structural Design & Drawing, Universities Press, 2009
T2.	Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, “Comprehensive Design of Steel Structures, Laxmi Publications Pvt. Ltd., 2003

REFERENCE BOOK(S)	
R1.	Krishnamurthy, D., “Structural Design & Drawing – Vol. II and III, CBS Publishers, 2010.
R2.	Shah V L and Veena Gore, “Limit State Design of Steel Structures” IS800-2007, Structures Publications, 2009.

Course Code: 24CEP001	**Course Title: Total Station and GPS Surveying**	
Course Category: PCC	**Credits: 3**	
L:T:P (Hours/Week): 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand total station principles, electromagnetic wave properties, atmospheric effects, and related computations.
• To comprehend the principles of operation, error sources, and practical applications of laser scanning and photogrammetry techniques for spatial data acquisition.
• To enable students to understand and apply the principles of GPS/GNSS for accurate positioning through analysis of satellite motion, system segments, signal structure, and error factors.
• To develop skills in GPS data processing, including observables, error correction, and software utilization.
• To apply total station and GNSS knowledge to surveying methods like traversing, trilateration, and topographic mapping

UNIT I	**FUNDAMENTALS OF TOTAL STATION AND ELECTROMAGNETIC WAVES**	**9**
Methods of measuring distance, basic principles of total station, historical development, classifications, applications and comparison with conventional surveying - applications of electromagnetic waves, propagation properties, wave propagation at lower and higher frequencies - refractive index (RI) - factors affecting RI - computation of group for light and near infrared waves at standard and ambient conditions - computation of RI for microwaves at ambient condition - reference refractive index - real-time application of first velocity correction. Measurement of atmospheric parameters - mean refractive index - second velocity correction - total atmospheric correction - use of temperature - pressure, transducers.		
UNIT II	**ELECTRO-OPTICAL AND MICROWAVE**	**9**
Electro - optical system: measuring principle, working principle, sources of error, infrared and laser total station instruments. Microwave system: measuring principle, working principle, sources of error, microwave total station instruments. Comparison between electro-optical and microwave system. Care and maintenance of total station instruments. Cogo functions: area, inverse / MLM, REM, resection - land survey applications.		

UNIT III	SATELLITE SYSTEM	9
Basic concepts of GPS - historical perspective and development - applications -geoid and ellipsoid - satellite orbital motion - keplerian motion - kepler's law - perturbing forces - geodetic satellite - doppler effect - positioning concept - gnss and irnss - sbas: gagan and waas different segments - space, control and user segments - satellite configuration - GPS signal structure - orbit determination and representation - anti spoofing and selective availability - task of control segment - GPS receivers.		
UNIT IV	**GPS DATA PROCESSING**	**9**
GPS observables - code and carrier phase observation - linear combination and derived observables - concept of parameter estimation - downloading the data - rinex format- differential data processing - software modules - solutions of cycle slips, ambiguities - multi path and other observational errors - satellite geometry and accuracy measures - continuously operating reference system (CORS) - long base line processing - use of different processing software's: open source, scientific and commercial.		
UNIT V	**SURVEYING METHODS AND APPLICATIONS**	**9**
Total station: traversing and trilateration measurement and adjustment - plan metric map and contour map and topography mapping. GNSS: concepts of rapid, static, semi-kinematic, pure kinematic and RTK methods. Observation by radiation, lee frog and trilateration measurement and processing - topography mapping using PPK and RTK methods - total station and GNSS application.		
Total : 45 Hours		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand about the fundamental concept of Total station.
CO2: Apply knowledge about electromagnetic waves and its usage in Total station and GNSS.
CO3: Apply Knowledge on basic concepts of GNSS
CO4: Understand the measuring and working principle of electro optical and microwave Total station and GPS
CO5: Create knowledge about Total station and GNSS data processing and Mapping.

COURSE ARTICULATION MATRIX															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	3	2			1			2	3			2
CO2	2	2	3	2	3	3			1		-	2			2
CO3	2	2	2	2	3	2			1		-	2			2
CO4	2	2	3	3	3	3			1		-	2			2
CO5	2	3	3	3	3	3			2		-	2			2

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Rueger, J.M, "Electronic Distance Measurement", 4th Edition, Springer-Verlag, Berlin, 1996.
T2.	SatheeshGopi, rasathishkumar and N.madhu, "Advanced Surveying , Total Station GPS and Remote Sensing", 2nd Edition, Pearson education ,ISBN: 978-81317 00679, 2017.
T3.	Gunter Seeber, "Satellite Geodesy", 2nd Edition, Walter De - Gruyter, Berlin, 2003.

REFERENCE BOOK(S)	
R1.	R.Subramanian, "Surveying and Levelling", Second Edition, Oxford University Press, 2012.
R2.	Laurila, S.H, "Electronic Surveying in Practice", John Wiley and Sons Inc, 1983.
R3.	Guocheng Xu, "GPS Theory, Algorithms and Applications", 3rd Edition, Springer - Verlag, Berlin, 2016.
R4.	Alfred Leick, "GPS satellite surveying", 4th Edition, John Wiley & Sons Inc,2015.

Course Code: 24CEP002	Course Title: Geographic Information System	
Course Category: PCC	Credits: 3	
L:T:P (Hours/Week): 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To gain foundational knowledge of GIS principles, data formats, and operational mechanics.
• To comprehend the organization and storage structures of spatial data.
• To master the skills to input, manage, and prepare spatial data for analysis.
• To develop an understanding of spatial data quality, standards, and sharing protocols.
• To acquire proficiency in analyzing, visualizing, and applying GIS data.

UNIT I	FUNDAMENTALS OF GIS	9
Introduction to GIS - basic spatial concepts - coordinate systems - GIS and information systems - definitions - history of GIS - components of a GIS - hardware, software, data, people, methods - proprietary and open source software - types of data - spatial, attribute data- types of attributes - scales/ levels of measurements.		
UNIT II	**SPATIAL DATA MODELS**	**9**
Database structures - relational, object oriented - entities - ER diagram - data models - conceptual, logical and physical models - spatial data models - raster data structures - raster data compression - vector data structures - raster vs vector models - TIN and grid data models.		
UNIT III	**DATA INPUT AND TOPOLOGY**	**9**
Scanner - raster data input - raster data file formats - georeferencing - vector data input - digitizer - datum projection and reprojection - coordinate transformation - topology - adjacency, connectivity and containment - topological consistency - non topological file formats - attribute data linking - linking external databases - GPS data integration.		
UNIT IV	**DATA QUALITY AND STANDARDS**	**9**
Data quality - basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage - metadata - GIS standards -interoperability - OGC - spatial data infrastructure.		
UNIT V	**DATA MANAGEMENT AND OUTPUT**	**9**
Import/export - data management functions - raster to vector and vector to raster conversion -		

data output - map compilation - chart/graphs - multimedia - enterprise vs. desktop GIS- distributed GIS.

Total : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the fundamental principles and components of a Geographic Information System (GIS).
CO2: Analyze differentiate between raster and vector data models and analyze their suitability for specific applications.
CO3: Apply data input techniques to create and manage spatial data, including establishing topological relationships.
CO4: Evaluate spatial data quality based on established standards and recommend appropriate data sharing practices.
CO5: Create design and produce effective GIS outputs, including maps and reports, to communicate spatial information.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	1	1								2	2
CO2	3	2	1	1	1	1								2	3
CO3	2	1	1	1	3	1								2	2
CO4	2	1	2	1	2	1								2	2
CO5	2	2	2	1	2	2								3	3

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Kang - Tsung Chang, "Introduction to Geographic Information Systems", 2nd Edition, McGraw Hill Publishing, 2011.
T2.	Ian Heywood, Sarah Cornelius, Steve Carver and Srinivasa Raju, "An Introduction Geographical Information Systems", 2nd Edition, Pearson Education, 2007.

REFERENCE BOOK(S)	
R1.	Lo.C.P, Albert and K.W. Yeung, "Concepts and Techniques of Geographic Information Systems", Prentice-Hall India Publishers, 2006.

Course Code: 24CEP003	**Course Title: Irrigation Engineering**	
Course Category: PCC	**Credits: 3**	
L:T:P (Hours/Week): 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To quantify crop water needs based on various factors.
• To design and evaluate different irrigation methods and systems.
• To analyze and design hydraulic structures for water management.
• To design and manage canal systems for efficient water delivery.
• To apply modern techniques for sustainable irrigation water management.

UNIT I	**CROP WATER REQUIREMENT**	**9**
Need and classification of irrigation - historical development and merits and demerits of irrigation - types of crops - crop season - duty, delta and base period - consumptive use of crops - estimation of evapotranspiration using experimental and theoretical methods.		
UNIT II	**IRRIGATION METHODS**	**9**
Tank irrigation - well irrigation - irrigation methods: surface and sub-surface and micro irrigation - design of drip and sprinkler irrigation - ridge and furrow irrigation-irrigation scheduling - water distribution system- irrigation efficiencies.		
UNIT III	**DIVERSION AND IMPOUNDING STRUCTURES**	**9**
Types of impounding structures - gravity dam - forces on a dam - design of gravity dams; earth dams, arch dams - diversion head works - weirs and barrages.		
UNIT IV	**CANAL IRRIGATION**	**9**
Canal regulations - direct sluice - canal drop - cross drainage works - canal outlets - design of prismatic canal - canal alignments - canal lining - Kennedy's and Lacey's regime theory - design of unlined canal.		
UNIT V	**WATER MANAGEMENT IN IRRIGATION**	**9**
Modernization techniques - rehabilitation - optimization of water use - minimizing water losses - on form development works - participatory irrigation management - water resources associations - changing paradigms in water management - performance evaluation - economic aspects of irrigation.		
		Total : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand knowledge and skills on crop water requirements.
CO2: Apply the methods and management of irrigation.
CO3: Create knowledge on types of Impounding structures
CO4: Understand methods of irrigation including canal irrigation.
CO5: Create knowledge on water management on optimization of water use.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2											2	1
CO2	2	1	2											3	2
CO3	3	3	3											3	2
CO4	3	3	3											3	2
CO5	2	1	1											2	2

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Dilip Kumar Majumdar, "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2008.
T2.	Punmia B.C, "Irrigation and water power Engineering", 16th Edition, Laxmi Publications, New Delhi, 2009.
T3.	Garg S. K, "Irrigation Engineering and Hydraulic structures", 23rd Revised Edition, Khanna Publishers, New Delhi, 2009.

REFERENCE BOOK(S)

R1.	Duggal, K.N. and Soni, J.P, "Elements of Water Resources Engineering", New Age International Publishers, 2005.
R2.	Linsley R.K and Franzini J.B, "Water Resources Engineering", McGraw-Hill Inc, 2000.
R3.	Chaturvedi M.C, "Water Resources Systems Planning and Management", Tata McGraw- Hill Inc, New Delhi, 1997.

Course Code: 24CEP004	Course Title: Ground Improvement Techniques	
Course Category: PCC	Credits: 3	
L:T:P (Hours/Week): 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To evaluate problematic soil properties and select appropriate improvement techniques.
• To design and implement effective dewatering systems for various soil conditions.
• To apply in-situ treatment methods for densification and consolidation of soils.
• To design and utilize earth reinforcement techniques for various applications.
• To implement and monitor grouting techniques for soil stabilization.

UNIT I	PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES	8
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	DEWATERING	10
Dewatering techniques - well points - vacuum and electro osmotic methods - seepage analysis for two dimensional flows for fully and partially penetrated slots in homogeneous deposits - design for simple cases.		
UNIT III	INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS	10
In-situ densification of cohesionless soils - shallow as deep compaction - dynamic compaction - vibro-flotation, sand compaction piles and deep compaction. Consolidation of cohesionless soils - preloading with sand drains, and fabric drains, stabilization of soft clay ground using stone columns and lime piles - installation techniques - simple design - relative merits of above methods and their limitations.		
UNIT IV	EARTH REIN FORCEMENT	9
Concept of reinforcement - types of reinforcement material - reinforced earth wall - mechanism - simple design - applications of reinforced earth; functions of geotextiles in filtration, drainage, separation, road works and containment applications.		
UNIT V	GROUTING TECHNIQUES	8
Types of grouts - grouting equipment's and machinery - injection methods - grout monitoring - stabilization with cement, lime and chemicals - stabilization of expansive soil.		

Total : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand knowledge on methods and selection of ground improvement techniques.
CO2: Analyze dewatering techniques and design for simple cases.
CO3: Create knowledge on in-situ treatment of cohesionless and cohesive soils.
CO4: Understand the concept of earth reinforcement and design of reinforced earth.
CO5: Analyze types of grouts and grouting technique.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2											2	2
CO2	2	3	2											2	1
CO3	2	3	2											2	2
CO4	2	3	2											2	1
CO5	2	3	2											2	1

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Purushothama Raj.P, “Ground Improvement Techniques”, 2nd Edition, Lakshmi Publications, 2016.
T2.	Koerner, R.M, “Construction and Geotechnical Methods in Foundation Engineering”, McGraw Hill, 1994.
T3.	Nihar Ranjan Patra, “Ground Improvement Techniques”, First Edition, Vikas Publishing House, 2012.
T4.	Mittal.S, “An Introduction to Ground Improvement Engineering”, First Edition, Medtech Publisher, 2013.

REFERENCE BOOK(S)

R1.	Duggal, K.N and Soni, J.P, “Elements of Water Resources Engineering”, New Age International Publishers, 2005.
R2.	Linsley R.K and Franzini J.B, “Water Resources Engineering”, McGraw-Hill Inc, 2000.
R3.	Chaturvedi M.C, “Water Resources Systems Planning and Management”, Tata McGraw- Hill Inc., New Delhi, 1997.

Course Code: 24CEP005	Course Title: Environmental Laws and Policy	
Course Category: PCC	Credits: 3	
L:T:P (Hours/Week): 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To understand international and national environmental legal frameworks.
• To analyze the Indian Constitution's role in environmental protection.
• To evaluate legal remedies for environmental pollution.
• To interpret major Indian environmental legislation and regulations.
• To apply environmental law principles through case study analysis.

UNIT I	INTRODUCTION TO ENVIRONMENTAL LEGISLATIONS AND INTERNATIONAL SCENARIO	9
Significance of environmental law - international environmental law - development of international environmental law - source and general principals of international environmental law - general rights and obligations of states - general issues of the international law related to environmental protection - stockholm declaration - RIO declaration on environment and development- basel convention on the control of trans boundary movement of hazardous wastes and their disposal - convention of biological diversity - U.N frame work convention on climate change - montreal protocol on substances that deplete ozone layer - kyoto protocol.		
UNIT II	INDIAN CONSTITUTIONS AND ENVIRONMENTAL PROTECTION	9
Indian constitution and environmental protection - constitutional provisions concerning environment articles 14,15,(2) (b) 19 (e),21,31,32,38,39,42,47, 48-a,49,51,51-a: Indian environmental policy 2006 administrative machinery for pollution control common law & criminal law nuisance, negligence, strict liability and absolute liability, provisions of IPC relating to environmental problems (public nuisance u/s 268 and others (sections 269,270,277,284,285,286,425 to 440) section 133 of cr.p.c.		
UNIT III	REMEDIES FOR ENVIRONMENTAL POLLUTION	9
Common law remedies/remedies under law of tort - penal remedies - Indian penal code and code of criminal procedure - remedies under constitutional law - writs - public interest litigation - public liability insurance act, 1991 - the national green tribunal act 2010.		

UNIT IV	MAJOR INDIAN LEGISLATIONS	9

Water act (1974) air act (1981) environmental protection act (1986) major notifications, the municipal solid wastes (management and handling) rules 2000 - bio medical wastes (management and handling) rules 1998 - hazardous wastes (management and handling rules 1989 - environment impact assessment notifications- coastal regulation zone notification-public hearing notifications.

UNIT V	ENVIRONMENT AND DEVELOPMENT CASE LAWS	9

Meaning and concept of development – Its impact on environment - conflict between environment and development - Concept of Sustainable Development - Polluter Pay Principle, Precautionary Principle -Public Trust Doctrine. Landmark Judgments – Oleum gas leakage case, Rural Litigation and Entitlement Kendra, Dehradun, (1985) Supp SCC 487) Vellore Citizen Welfare Forum vs. Union of India, (1996) 5SCC 647) Ganga Pollution case (1988) I SCC) S. Jagannath vs. UOI (1997) SCC867) Vellore Citizens welfare forum case M.C. Mehta Vs. Kamalnath (1997) I SCC 388)

Total : 45 Hours

COURSE OUTCOMES

At the end of this course, students will be able to

CO1: Understand origins and sources of environmental laws, and understand how and by whom environmental laws are made and interpreted

CO2: Apply the key principles of, and actors within, environmental laws

CO3: Understand the National Environmental Policy and Various Legislations enacted in line with Policy

CO4: Analyze environmental laws within various contexts and to evaluate laws against procedural and substantive criteria.

CO5: Apply the Legal system operating in India and will be in a position to prepare compliance reports for getting environmental clearance.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2								2				3		
CO2	1					1			2				3		
CO3	2			3		2		3				2	3		
CO4	2					2		3				2			

CO5	2	3		3	3	2		3			1	2	3	2	2

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Leelakrishnan P, “Environmental Law in India”, Butterworths, 1998.
T2.	Shanthakumar S, “Environmental Law - An Introduction”, Butterworths, 2004.
REFERENCE BOOK(S)	
R1.	Leelakrishnan P, “Environmental Case Book”, Lexis Nexis, 2000.
R2.	Shyam Diwan and Armin Rosencranz, “Enviromental Law and Policy in India”, Oxford, 2001.

Course Code: 24CEP006	Course Title: Construction Management and Safety	
Course Category: PCC	Credits: 3	
L:T:P (Hours/Week): 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To understand the interdisciplinary nature of construction projects and master project organization and resource management.
• To develop proficiency in estimating project costs, preparing bills, and applying economic principles to construction decisions.
• To learn and apply project planning and scheduling techniques, including PERT, resource leveling, and network crashing.
• To gain comprehensive knowledge of construction safety principles, regulations, and hazard analysis to ensure safe work environments.
• To master safe operating procedures for various construction activities and equipment to prevent accidents and ensure worker safety.

UNIT I	GENERAL OVERVIEW AND PROJECT ORGANIZATION	9
Introduction - interdisciplinary nature of modern construction projects - execution of project - evaluation of bits - resource management.		
UNIT II	ESTIMATION OF PROJECT COST & ECONOMICS	9
Estimating quantities - description of items - estimation of project cost - running account bills - decision making in construction projects - depreciation of construction equipment - case study.		
UNIT III	PLANNING AND SCHEDULING	9
Introduction - project scheduling - uncertainties in duration of activities using pert - project monitoring and control system - resource levelling and allocation - crashing of network.		
UNIT IV	SAFETY DURING CONSTRUCTION	9
Basic terminology in safety - types of injuries - safety pyramid - accident patterns - planning for safety budget, safety culture - introduction to OSHA regulations - site safety programs - job hazard analysis, accident investigation & accident indices-violation, penalty.		
UNIT V	SAFE OPERATING PROCEDURES	9
Safety during alteration, demolition works - earthwork, steel construction, temporary structures, masonry & concrete construction, cutting & welding - construction equipment,		

materials handling- disposal & hand tools - other hazards - fire, confined spaces, electrical safety.
Total : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Create comprehensive project proposals.
CO2: Analyze and evaluate project cost estimations.
CO3: Identify and estimate construction activity requirements.
CO4: Understand the causes and prevention of construction site accidents.
CO5: Evaluate Plan, assess, analyze and manage the construction project sites.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3			3	2						1	2	2	3
CO2	2	3			3	2						1	2	2	3
CO3		3	3		3		1						3	3	2
CO4	2	3		2	3		2					2			
CO5	2	2	2			2							2	2	2

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Albert Lester, "Project Management, Planning and Control", 7^{th} Edition, Butterworth-Heinemann, USA, 2017.
T2.	Patrick X.W. Zou and Riza YosiaSunindijo, "Strategic Safety Management in Construction and Engineering" John Wiley & Sons, Ltd 2015.

REFERENCE BOOK(S)

R1.	Barcus, S.W and Wilkinson.J.W, "Hand Book of Management Consulting Services", McGraw Hill, New York, 1986.
R2.	Joy P.K, "Total Project Management - The Indian Context", New Delhi, Macmillan India Ltd., 1992.

Course Code: 24CEP007	Course Title: Pre-stressed Concrete Structures	
Course Category: PCC	Credits: 3	
L:T:P (Hours/Week): 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To understand pre-stressing principles, methods, and material behavior.
• To design pre-stressed concrete beams for flexure and shear.
• To analyze deflections and design anchorage zones in pre-stressed members.
• To design composite and continuous pre-stressed concrete beams.
• To apply pre-stressing concepts to various structural elements.

UNIT I	INTRODUCTION - THEORY AND BEHAVIOUR	9
Basic principles of pre-stressing - classification and types - advantages over ordinary reinforced concrete - materials - high strength concrete and high tensile steel - methods of pre-stressing - freyssinet, magnel, lee-mccall and gifford udall anchorage systems - analysis of sections of stresses by stress concept, strength concept and load balancing concept - losses of pre-stress in post-tensioned and pre-tensioned members.		
UNIT II	DESIGN FOR FLEXURE AND SHEAR	9
Basic assumptions of flexural design - permissible stresses in steel and concrete as per I.S.1343 code - different types of sections - design of sections of type i and type ii post - tensioned and pre-tensioned beams - check for flexural capacity based on I.S. 1343 code - influence of layout of cables in post-tensioned beams - location of wires in pre-tensioned beams - design for shear based on I.S. 1343 code.		
UNIT III	DEFLECTION AND DESIGN OF ANCHORAGE ZONE	9
Factors influencing deflections - short-term deflections of uncracked members - prediction of long - term deflections due to creep and shrinkage - check for serviceability limit states. determination of anchorage zone stresses in post-tensioned beams by magnel’s method, guyon’s method and I.S. 1343 code - design of anchorage zone reinforcement - check for transfer bond length in pre- tensioned beams - design of anchorage zone reinforcement - check for transfer bond length in pre - tensioned beams.		
UNIT IV	COMPOSITE BEAMS AND CONTINUOUS BEAMS	9
Analysis and design of composite beams - shrinkage strain and its importance - differential shrinkage - methods of achieving continuity in continuous beams - analysis for secondary		

moments - concordant cable and linear transformation - calculation of stresses - principles of design.		
UNIT V	**MISCELANEOUS STRUCTURES**	**9**
Role of pre-stressing in members subjected to tensile forces and compressive forces - design of tension members and compression members - design of tanks, pipes, sleepers and poles - partial pre-stressing - methods of achieving partial pre-stressing, merits and demerits of partial pre-stressing.		
		Total : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Apply pre-stressed concrete beams, incorporating calculations for pre-stress losses.
CO2: Create pre-stressed concrete members to resist flexural and shear forces..
CO3: Analyze and design anchorage zones for post-tensioned members, and estimate beam deflections.
CO4: Create composite pre-stressed concrete members and continuous beams for structural applications.
CO5: Apply specialized pre-stressed concrete elements, including water tanks, pipes, poles, and sleepers.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2												
CO2	2	1	2											1	1
CO3	3	1	2											3	2
CO4	2	1	2											3	2
CO5	2	1	2											2	2

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Krishna Raju N, "Prestressed concrete", 5th Edition, Tata McGraw Hill Company, New Delhi, 2012.
T2.	Pandit.G.S and Gupta, S.P, "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, 2014.

REFERENCE BOOK(S)	
R1.	Lin T.Y and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
R2.	Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2017.

Course Code: 24CEP008	**Course Title: Airports, Harbours and Docks Engineering**	
Course Category: PCC	**Credits: 3**	
L:T:P (Hours/Week): 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand airport planning principles, including site selection and layout.
• To analyze and design airfield components such as runways, taxiways, and aprons.
• To apply runway design principles, considering wind rose diagrams and geometric elements.
• To comprehend seaport components, harbor planning, and coastal structure design.
• To evaluate seaport regulations, environmental impact assessment, and coastal protection.

UNIT I	**AIRPORT PLANNING**	**9**
Air transport characteristics - airport classification - ICAO - airport planning: site selection typical airport layouts, case studies, parking and circulation area.		
UNIT II	**AIRPORT COMPONENTS**	**9**
Airport classification, planning of airfield components - runway, taxiway, apron, hangar - passenger terminals - geometric design of runway and taxiways - runway pavement design - difference between highway and airport pavements - introduction to various design methods - airport drainage.		
UNIT III	**AIRPORT DESIGN**	**9**
Runway design: orientation, wind rose diagram, problems on basic and actual length, geometric design - elements of runway design - airport zones - passenger facilities and services - runway and taxiway markings- air traffic control tower- instrumental landing.		
UNIT IV	**SEAPORTS COMPONENTS AND CONSTRUCTION**	**9**
Definition of basic terms: harbor, port, satellite port, docks - dry and floating dock, waves and tides - planning and design of harbors: harbour layout and terminal facilities - coastal structures: piers, break waters, wharves, jetties, quays, spring fenders, dolphins floating landing stage - navigational aids-inland water transport.		
UNIT V	**SEAPORT REGULATIONS AND EIA**	**9**
Wave action on coastal structures and shore protection and reclamation - coastal regulation zone, 2011 - EIA - methods of impact analysis and its process.		
		Total : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Gain an insight on the planning and site selection of Airport Planning and design.
CO2: Understand on Design of various Airport components.
CO3: Analyze and design the elements for orientation of runways and passenger facility systems.
CO4: Understand the various features in Harbours and Ports, their construction, coastal protection works.
CO5: Apply on various Environmental Regulations and Acts.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3								1			2	2
CO2		3				3			2					2	3
CO3	3	3	3								1			2	3
CO4	3	3				3			2					2	2
CO5	3	2	3								1			2	3

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Khanna.S.K, Arora.M.G and Jain.S.S, “Airport Planning and Design”, Nemachand and Bros, Roorkee,1994
T2.	Robert Honjeff and Francis X.Mckelvey, "Planning and Design of Airports", McGraw Hill, New York, 1996.
T3.	Richard De Neufille and Amedeo Odoni, "Airport Systems Planning and Design", McGraw Hill, New York,2003
T4.	Subramanian K.P,” Highways, Railways, Airport and Harbour Engineering”, SciTech Publications (India), Chennai, 2010.

REFERENCE BOOK(S)	
R1.	Venkatramaiah. C, “Transportation Engineering”-Vol.2 “Railways, Airports, Docks and Harbours”, “Bridges and Tunnels”, Universities Press (India) Private Limited, Hyderabad, 2015.
R2.	Mundrey J S, “Railway Track Engineering”, McGraw Hill Education (India) Private Ltd., New Delhi, 2013.

Course Code: 24CEP009	Course Title: Advanced Construction Techniques	
Course Category: PCC	Credits: 3	
L:T:P (Hours/Week): 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To understand airport planning principles, including site selection and layout.
• To analyze and design airfield components such as runways, taxiways, and aprons.
• To apply runway design principles, considering wind rose diagrams and geometric elements.
• To comprehend seaport components, harbor planning, and coastal structure design.
• To evaluate seaport regulations, environmental impact assessment, and coastal protection.

UNIT I	SUB STRUCTURE CONSTRUCTION	9
Construction methodology - box jacking - pipe jacking - under water construction of diaphragm walls and basement - tunneling techniques - piling techniques - driving well and caisson - sinking cofferdam - cable anchoring and grouting - driving diaphragm walls, sheet piles - laying operations for built up offshore system - shoring for deep cutting - large reservoir construction - well points - dewatering for underground open excavation.		
UNIT II	SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS	9
Vacuum dewatering of concrete flooring - concrete paving technology - techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections - erection techniques of tall structures, large span structures - launching techniques for heavy decks - in-situ pre-stressing in high rise structures, post tensioning of slab- aerial transporting - handling and erecting lightweight components on tall structures.		
UNIT III	CONSTRUCTION OF SPECIAL STRUCTURES	9
Erection of lattice towers - rigging of transmission line structures - construction sequence in cooling towers, silos, chimney, sky scrapers - bow string bridges, cable stayed bridges - launching and pushing of box decks - construction of jetties and break water structures - construction sequence and methods in domes - support structure for heavy equipment and machinery in heavy industries - erection of articulated structures and space decks.		
UNIT IV	REHABILITATION AND STRENGTHENING TECHNIQUE	9
Seismic retrofitting - strengthening of beams - strengthening of columns - strengthening of slab - strengthening of masonry wall, protection methods of structures, mud jacking and		

grouting for foundation - micro piling and underpinning for strengthening floor and shallow profile - sub grade water proofing, soil stabilization techniques.		
UNIT V	**DEMOLITION**	**9**
Demolition techniques, demolition by machines, demolition by explosives, advanced techniques using robotic machines, demolition sequence, dismantling techniques, safety precaution in demolition and dismantling.		
		Total : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the modern construction techniques used in the sub structure construction
CO2: Demonstrate knowledge and understanding of the principles and concepts relevant to super structure construction for buildings
CO3: Understand the concepts used in the construction of special structures
CO4: Knowledge on Various strengthening and repair methods for different cases
CO5: Identify the suitable demolition technique for demolishing a building.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1											1	2
CO2	1													2	1
CO3	2	3	3					1						2	2
CO4	2	3	3					1						2	2
CO5	1	3	3					1						2	1

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Jerry Irvine, “Advanced Construction Techniques”, CA Rocket, 1984
T2.	Patrick Powers. J, “Construction Dewatering: New Methods and Applications”, John Wiley & Sons, 1992.

REFERENCE BOOK(S)

R1.	Peter H.Emmons, “Concrete repair and maintenance illustrated”, Galgotia Publications Pvt. Ltd., 2001.
R2.	Sankar, S.K. and Saraswati. S, “Construction Technology”, Oxford University, New Delhi, 2008.

Course Code: 24CEP010	Course Title: Smart Cities	
Course Category: PCC	Credits: 3	
L:T:P (Hours/Week): 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To understand the concept and challenges of urbanization and smart city development.
• To analyze and design airfield components such as runways, taxiways, and aprons.
• To explore the relationship between sustainability, smart planning, and intelligent city services.
• To examine the application of technologies like ICCC and data analytics in smart city implementation.
• To learn project management principles for smart city projects, including planning, risk, and evaluation.

UNIT I	INTRODUCTION	6
Urbanization, need of focused development, role of authorities, smart city, opportunity and challenges - smart infrastructures for city - smart cities mission.		
UNIT II	SMART PHYSICAL INFRASTRUCTURE	12
Infrastructure development in smart cities - physical infrastructure, land use - compact/mixed-use development, transit oriented development (TOD); smart city management-transportation unified governance structure (UMTA). smart public transportation, smart parking, intelligent traffic management, detour management; low emission vehicles, electric mobility - environmental projects etc.		
UNIT III	SUSTAINABILITY AND SMART PLANNING	10
Relationship between sustainability and smart planning - place making project guidelines - surveillance, smart street lighting, intelligent emergency services, intelligent disaster forecasting and management, GIS - based spatial decision support systems, smart communication services;		
UNIT IV	APPLICATION OF TECHNOLOGIES IN SMART CITIES	8
Role of technologies in smart cities - integrated command and control center (ICCC), data analytics, data driven strategies implementation in smart cities.		
UNIT V	SMART CITIES PROJECT MANAGEMENT	9
Need for project management, philosophy and concepts; project phasing and stages; project		

organizational structuring: planning and scheduling: project cost analysis; procurement and contracting: ppp: project monitoring and evaluation: risk management; case studies.
Total : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the basics of Urbanization and the role of smart cities.
CO2: Apply principles for implementing smart physical infrastructure in urban environments.
CO3: Analyze the relationship between smart planning and sustainable urban development.
CO4: Evaluate the effectiveness of various technologies in smart city planning.
CO5: Analyze and synthesize lessons learned from smart city project case studies.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2		1			1				1	1		1
CO2	3	3	3		1			1				1	1		2
CO3	3	1	3		1			1				1	1		2
CO4	3	2	2		1			1				1	1		1
CO5	2	2	3		1			1				1	1		2

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	P Sharma, "Sustainable Smart cities in India, Challenges and Future Perspectives", Springer Link, 2017.
T2.	Sameer Sharma,"Smart Cities Unbounded- Ideas and Practice of Smart Cities in India", Bloomsbury India, 2018.

REFERENCE BOOK(S)	
R1.	Binti Singh, Manoj Parmar, "Smart City in India Urban Laboratory", Paradigm or Trajectory, Routledge India, 2019.

Course Code: 24CEP011	Course Title: Urban Planning and Development	
Course Category: PCC	Credits: 3	
L:T:P (Hours/Week): 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To define key urban settlement concepts and analyze the impacts of urbanization.
• To understand fundamental planning principles and theories to urban development.
• To develop proficiency in formulating and evaluating various urban and regional development plans.
• To analyze the implementation of urban plans, including legal, financial, and institutional aspects.
• To apply knowledge of urban planning legislation, regulations, and design principles.

UNIT I	INTRODUCTION	7
Definition of human settlement, urban area, town, city, metropolitan city, megalopolis, urbanisation, urbanism, suburbanisation, urban sprawl, peri-urban areas, central business district, urban agglomeration, census definition of urban settlements, classification of urban areas - positive and negative impacts of urbanisation - ATAL mission for rejuvenation and urban transformation.		
UNIT II	PLANNING PROCESS AND THEORIES	10
Principles of planning - stages in planning process - goals, objectives, delineation of planning areas, draft plans, evaluation, final plan. planning theories - garden city concept, geddesian triad by patrick geddes, modernism concept by le-corbusier, radbun concept, neighbourhoods, theories of ekistics, bid - rent theory by william alonso, green belt concept.		
UNIT III	DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION	10
Types of plans - regional plan, master plan, structure plan, detailed development plan, new town/ satellite town - development plan, urban nodes, smart city plan - scope and content of regional plan (RP), master plan (MP), and the detailed development plan (DDP), methodologies for the preparation of the RP, MP, and the DDP - case studies.		
UNIT IV	PLAN IMPLEMENTATION	10
Planning standards, project formulation and evaluation; project report preparation and presentation; legal, financial and institutional constraints - problems due to multiple laws,		

rules and institutions; financing of urban development projects; urban planning agencies and their functions in the plan formulation and implementation.		
UNIT V	**URBAN AND REGIONAL PLANNING LEGISLATIONS, REGULATIONS AND DESIGNS**	**8**
Town and country planning, local bodies and land acquisition acts, development and building rules, site analyses, layouts and buildings design.		
		Total : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the basic issues and meaning of terminologies in urban planning.
CO2: Analyze the different types of theories of urban planning and city development.
CO3: Apply the different types of plan, their strategies and their preparation process.
CO4: Evaluate the planning standards, evaluate the constraints and the financial mechanism.
CO5: Analyze on various town and country planning acts and their functions.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3					3	3					1		3	
CO2	2		3	2		3	2					1		2	
CO3	3		3			2	3					1		3	
CO4			2	2	2		2					1		1	
CO5	3	2	1	2		3	2					1		3	2

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Goel, S.L, “Urban Development and Management”, Deep and Deep publications, New Delhi 2002.
T2.	George Chadwick, “A Systems view of planning”, Pergamon press, Oxford 1978.

REFERENCE BOOK(S)	
R1.	Tamil Nadu Town and Country Planning Act 1971, and Rules made thereunder, Government of Tamil Nadu, Chennai.
R2.	Thooyavan, K.R.,” Human Settlements - A Planning Guide to Beginners”, M.A Publications, Chennai, 2005.

Course Code: 24CEP012	**Course Title: Municipal Solid Waste Management**	
Course Category: PCC	**Credits: 3**	
L:T:P (Hours/Week): 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To articulate the specific knowledge students will acquire and demonstrate by the course's end.
• To define the tangible, hands-on skills students will develop and apply.
• To establish the level of conceptual mastery students are expected to achieve.
• To create measurable objectives that enable accurate assessment of student learning.
• To align course objectives with learning activities and ensure they directly relate to the course content.

UNIT I	**SOURCES AND CHARACTERISTICS**	**9**
sources and types of municipal solid wastes - public health and environmental impacts of improper disposal of solid wastes - sampling and characterization of wastes - factors affecting waste generation rate and characteristics - elements of integrated solid waste management - requirements and salient features of solid waste management rules (2016) - role of public and NGO’s - public private participation - elements of municipal solid waste management plan.		
UNIT II	**SOURCE REDUCTION , WASTE STORAGE AND RECYCLING**	**8**
Waste management hierarchy - reduction, reuse and recycling - source reduction of waste - on-site storage methods - effect of storage, materials used for containers - segregation of solid wastes - public health and economic aspects of open storage - case studies under Indian conditions - recycling of plastics and construction/demolition wastes.		
UNIT III	**COLLECTION AND TRANSFER OF WASTES**	**8**
Methods of residential and commercial waste collection - collection vehicles - manpower - collection routes - analysis of waste collection systems; transfer stations –location, operation and maintenance; options under Indian conditions - field problems- solving.		
UNIT IV	**PROCESSING OF WASTES**	**12**
Objectives of waste processing - physical processing techniques and equipment; resource recovery from solid waste composting and biomethanation; thermal processing options - case studies under Indian conditions.		

UNIT V	WASTE DISPOSAL	8
Land disposal of solid waste - sanitary landfills - site selection, design and operation of sanitary landfills - landfill liners - management of leachate and landfill gas- landfill bioreactor - dumpsite rehabilitation.		
		Total : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management.
CO2: Apply principles of reduction, reuse, and recycling to develop practical waste management strategies.
CO3: Create comprehensive systems for the storage, collection, transport, processing, and disposal of municipal solid waste.
CO4: Analyze solid waste management issues from an integrated, holistic, local, and international perspective.
CO5: Implement appropriate disposal methods for municipal solid waste, considering environmental and regulatory factors.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1					1				1		2	1
CO2	2	3	3					1				1		2	2
CO3	3	3	3					1				1		2	2
CO4	2	2	2					1				1		2	1
CO5	3	2	3					1				1		2	2

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	William A. Worrell and P. Aarne Vesilind," Solid Waste Engineering", Cengage Learning, 2012.
T2.	John Pitchel, "Waste Management Practices-Municipal", Hazardous and industrial – CRC Press, Taylor and Francis, New York 2014.

REFERENCE BOOK(S)	
R1.	CPHEEO, “Manual on Municipal Solid waste management”, Central Public Health and Environmental Engineering Organisation , Government of India, New Delhi, 2014.
R2.	George Tchobanoglous and Frank Kreith, “Handbook of Solid waste management”, McGraw Hill, New York, 2002.

Course Code: 24CEP013	**Course Title: Hydrology and Water Resources Engineering**	
Course Category: PEC	**Credits: 3**	
L:T:P(Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the fundamental concepts of the hydrological cycle and precipitation measurement techniques.
• To analyze runoff characteristics and estimation methods for effective water resource planning.
• To understand the hydrological extremes such as floods and droughts, including their estimation and management.
• To enhance comprehension about reservoir design, sedimentation, and storage estimation techniques.
• To explore groundwater movement, aquifer properties, and artificial recharge techniques for sustainable water management.

UNITI	**PRECIPITATION AND ABSTRACTIONS**	**9**
Hydrological cycle -meteorological measurements - types and forms of precipitation - rain gauges - spatial analysis of rainfall data using thiessen polygon and Iso-hyetal methods - interception - evaporation: measurement, evaporation suppression methods - infiltration: horton's equation - double ring infiltrometer - infiltration indices.		
UNIT II	**RUNOFF**	**9**
Catchment: definition, morphological characteristics - factors affecting runoff - run off estimation using strange's table and empirical methods - SCS-CN method - stage discharge relationship - flow measurements - hydrograph - unit hydrograph -IUH.		
UNIT III	**HYDROLOGICAL EXTREMES**	**9**
Natural disasters - frequency analysis - flood estimation - flood management - definitions of drought: meteorological, hydrological, agricultural and integrated - IMD method - NDVI analysis - drought prone area programme (DPAP).		
UNIT IV	**RESERVOIRS**	**9**
Classification of reservoirs - site selection - design principles - spillways -elevation-area-		

capacity curve - storage estimation - sedimentation - life of reservoirs - rule curve.

UNIT V	**GROUNDWATER AND MANAGEMENT**	**9**
Origin - classification and types - properties of aquifers - governing equations - steady and unsteady flow - artificial recharge - RWH in rural and urban areas.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain the hydrological cycle and apply different methods for measuring precipitation and its abstractions.
CO2: Analyze runoff characteristics using empirical and hydrological methods for effective water resource assessment.
CO3: Evaluate flood and drought occurrences using frequency analysis and mitigation strategies.
CO4: Design reservoirs, estimate storage capacity, and assess sedimentation impacts on reservoir life.
CO5: Apply principles of groundwater flow, artificial recharge, and rainwater harvesting techniques for sustainable groundwater management.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2		2		1	1			2		1	2	1	
CO2	2	3	2	2						3		1	2	1	
CO3	2	2	2	1		1				2			1	1	
CO4	2	2	1	1		1	1	2		2				1	
CO5	2	2	2	2		1	1	2		2		1	2	1	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Subramanya K, “Engineering Hydrology”, Tata McGraw Hill, 2010.
T2.	Jayarami Reddy P, “Hydrology”, Tata McGraw Hill, 2008.

REFERENCE BOOK(S)	
R1.	DavidKeithTodd,“Groundwater Hydrology”,JohnWiley&Sons,Inc.2007
R2.	BhaguR. Chahar,“Groundwater Hydrology”, McGrawHillEducation(India)Pvt. Ltd,New Delhi, 2017.

Course Code: 24CEP014	Course Title: Structural Design and Drawing	
Course Category: PEC	Credits: 3	
L:T:P(Hours/Week) 2:0:2	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES
• To understand the fundamental principles of structural design, including retaining walls, slabs, bridges, liquid storage structures, industrial structures, and girders.
• To familiarize students with codal provisions such as IS codes and IRC specifications for various structural elements.
• To develop skills in analyzing and designing different types of reinforced concrete and steel structures.
• To gain practical knowledge in preparing design calculations and structural drawings.
• To enhance problem-solving abilities related to real-world structural engineering challenges.

UNITI	RETAINING WALLS	9+3
Reinforced concrete cantilever and counter fort retaining walls - horizontal backfill with surcharge - design of shear key - design and drawing.		
UNIT II	FLAT SLAB and BRIDGES	9+3
Design of flat slabs with and without drops by direct design method of IS code- design and drawing - IRC specifications and loading - RC solid slab bridge - steel foot-over bridge-design and drawing.		
UNIT III	LIQUID STORAGE STRUCTURES	9+3
RCC water tanks - on ground, elevated circular, underground rectangular tanks - hemispherical bottomed steel water tank - design and drawing		
UNIT IV	INDUSTRIAL STRUCTURES	9+3
Structural steel framing - steel roof trusses - roofing elements - beam columns -codal provisions - design and drawing.		
UNIT V	GIRDERS AND CONNECTIONS	9+3
Plate girders -behaviour of components-deign of welded plate girder-design of industrial gantry girders - design of eccentric shear and moment resisting connections.		

Design and Drawing Exercises for practical component	
1.	Design of Cantilever Retaining wall
2.	Design of Rectangular column and footing & Combined footing with two columns
3.	Design of RCC one way & two way slab
4.	Design of RCC T beam bridge deck
5.	Design of Underground Rectangular Water Tank & Elevated circular water Tank
6.	Design of Simple Steel Roof Trusses & Industrial Building Elements
7.	Design of Plate Girder (welded) and gantry girder
	Total: 60 Hours

COURSE OUTCOMES

At the end of this course, students will be able to

CO1: Understand the principles behind reinforced concrete cantilever and counterfort retaining walls.

CO2: Apply the direct design method for flat slabs with and without drops following IS code provisions.

CO3: Develop structural drawings for various storage tanks.

CO4: Design steel roof trusses, beam-columns, and roofing elements following relevant codes.

CO5: Analyze the behavior of plate girders and design welded plate girders for industrial applications.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1		2		2	1	1		2	2	1	
CO2	3	2	2	1		2		2	1	2		2	1	1	
CO3	3	2	1	1		2		2	2	2		2	2	2	
CO4	3	2	1	1		2		2	2	2		2	1	2	
CO5	3	2	2	1		2		2	2	2		2	2	2	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Krishnaraju N, “Structural Design and Drawing”, Universities Press, 2009.
T2.	PunmiaB.C, Ashok Kumar Jain and Arun Kumar Jain, “Comprehensive Design of Steel Structures”, Laxmi Publications Pvt. Ltd., 2003.

REFERENCE BOOK(S)	
R1.	Krishnamurthy D, “Structural Design and Drawing Vol. I, II and III”, CBS Publishers, 2010.
R2.	SP34 Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi.
R3.	IS 800 (2007) Indian Standard General Construction In Steel—Code of Practice, Bureau of Indian Standards, New Delhi.
R4.	IS 456(2000) Indian Standard Plain and Reinforced Concrete-Code of Practice, Bureau of Indian Standards, New Delhi IS 456(2000) Indian Standard Plain and Reinforced Concrete-Code of Practice, Bureau of Indian Standards, New Delhi..
R5.	IS 875 Part 3 (2003) Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures, Code of Practice-Wind Load, Bureau of Indian Standards, New Delhi.
R6.	IRC 112-2011, Code of Practice for Concrete Road Bridges, The Indian Roads Congress, New Delhi.
R7.	IRC 6-2014, Standard Specifications and Code of Practice for Road Bridges Section: Loads and Stresses, The Indian Roads Congress, New Delhi.

Course Code: 24CEP015	**Course Title: Industrial Wastewater Engineering**	
Course Category: PEC	**Credits: 3**	
L:T:P(Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the industrial scenario in India and its impact on water resources and the environment.
• To analyze the sources, types, and characteristics of industrial wastewater and associated pollutants.
• To explore pollution prevention and waste minimization strategies for sustainable industrial practices.
• To investigate multiple industrial wastewater treatment methods, encompassing physical, chemical, and biological processes.
• To evaluate wastewater reuse, sludge management, and case studies on industrial wastewater treatment.

UNIT I	**INDUSTRIAL WASTEWATER TREATMENT TECHNIQUES**	**8**
Industrial scenario in India - industrial activity and environment - uses of water by industry - sources and types of industrial wastewater - nature and origin of pollutants - industrial wastewater and environmental impacts - regulatory requirements for treatment of industrial wastewater - industrial waste survey - industrial wastewater monitoring and sampling - generation rates, characterization and variables -toxicity of industrial effluents and bioassay tests - major issues on water quality management.		
UNIT II	**INDUSTRIAL POLLUTION PREVENTION & WASTE MINIMISATION**	**8**
Prevention and control of industrial pollution - benefits and barriers - waste management hierarchy - source reduction techniques - periodic waste minimization assessments - evaluation of pollution prevention options - cost benefit analysis - pay-back period - implementing & promoting pollution prevention programs in industries.		
UNIT III	**INDUSTRIAL WASTE WATER TREATMENT**	**10**
Flow and load equalization - solids separation - removal of fats, oil & grease- neutralization-removal of inorganic constituents - precipitation, heavy metal removal, nitrogen & phosphorous removal, ion exchange, adsorption, membrane filtration, electro dialysis &evaporation -removal of organic constituents - biological treatment processes, chemical		

oxidation processes, advanced oxidation processes - treatability studies.		
UNIT IV	**WASTEWATER REUSE AND RESIDUAL MANAGEMENT**	**9**
Individual and common effluent treatment plants - joint treatment of industrial and domestic wastewater - zero effluent discharge systems - quality requirements for wastewater reuse industrial reuse , present status and issues - disposal on water and land - residuals of industrial wastewater treatment - quantification and characteristics of sludge - thickening, digestion, conditioning, dewatering and disposal of sludge - management of RO projects.		
UNIT V	**CASE STUDIES**	**10**
Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for textiles - tanneries - pulp and paper - metal finishing - sugar and distilleries		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain the source and types of industrial wastewater and their environmental impacts and choose the regulatory laws pertaining to environmental protection.
CO2: Identify industrial wastewater pollution and implement pollution prevention, waste minimization in industries
CO3: Apply knowledge and skills to design industrial wastewater treatment schemes
CO4: Analyze environmental performance of industries to internal, external client, regulatory bodies and design water reuse management techniques
CO5: Conduct research to develop effective management systems for industrial wastewater that are technically sound, economically feasible and socially acceptable

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3										3	1	2		1
CO2		2	2	2				3	2	2				2	2
CO3	2	2	3						2	2	2	3		2	2
CO4	2		3		2		2	3	2						
CO5	2	2	2	3		1	2			2	3		3		1

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Metcalf, George Tchobanoglous, Franklin L. Burton and H. David Stensel, "Wastewater engineering, treatment and reuse", Fourth Edition, McGraw-Hill, 2017.
T2.	Soli. J. Arceivala, Shyam. R. Asolekar, "Waste water Treatment for pollution control and reuse", Tata McGraw Hill, 2007.

REFERENCE BOOK(S)	
R1.	Paul L. Bishop, "Pollution Prevention: Fundamentals and Practice", Mc-Graw Hill International, Boston, 2000.
R2.	Wesley Eckenfelder W, "Industrial Water Pollution Control", Second Edition, Mc Graw Hill, 2000.

Course Code:24CEP016	Course Title: Traffic Engineering and Management	
Course Category: PEC	Credits:3	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To understand traffic characteristics, survey methods, and data analysis techniques for effective traffic management.
• To analyze traffic flow characteristics, roadway capacity, and level of service for efficient road design.
• To explore cost-effective traffic management techniques, including regulatory measures and traffic control devices.
• To understand the design principles of road intersections, including at-grade and grade-separated intersections.
• To examine the planning and design of parking, pedestrian facilities, and cycle tracks for sustainable urban mobility.

UNIT I	TRAFFIC SURVEYS AND ANALYSES	8
Traffic characteristics - human, vehicular, and pavement characteristics, problems-presentation of traffic volume data, annual average daily traffic, average daily traffic, design hourly traffic volume - speed- spot speed, presentation of spot speed data, speed and delay studies, methods of conducting spot-speed studies and speed and delay studies - problems origin and destination - methods of conducting the survey and presentation of data - parking surveys, presentation of data and analyses, determination of parking demand; accident studies and analyses - different problems.		
UNIT II	TRAFFIC FLOW AND ROAD WAY CAPACITY	8
Traffic flow characteristics - basic traffic manoeuvres, traffic stream flow characteristics, speed - flow- density relations; passenger car units - mixed traffic flow and related issues - concept of PCU value- factors affecting PCU values- recommended PCUvalues for different conditions - capacity and level of service - factors affecting practical capacity - design service volumes.		
UNIT III	COST-EFFECTIVE TRAFFIC MANAGEMENT TECHNIQUES	10
Traffic system management - regulatory techniques- one way street, reversible street,		

reversible lane, turning moment restrictions, closing streets - traffic control devices - traffic signs - road markings, traffic signals, miscellaneous traffic control devices - traffic segregation – vehicle segregation, pedestrian segregation, traffic signals design; bus priority techniques - priority manoeuvres - with-flow bus lane and contra-flow bus lane; self-enforcing techniques- demand management techniques (TDM) road pricing, parking control, tolls, staggering of office/educational institution hours.		
UNIT IV	**DESIGN OF ROAD INTERSECTIONS**	**10**
Importance and classification - intersections at grade - uncontrolled, channelized - rotary intersections (problems) - signalised intersections (problems)- grade separated intersections - merits and demerits, types, pattern of intersections with different types of interchanges-capacity, concept diagrams.		
UNIT V	**DESIGN OF PARKING AND PEDESTRIAN FACILITIES AND CYCLE TRACKS**	**9**
Need for parking studies and its ill effects- parking standards for different land uses, different types of parking - conceptual plans for different types of parking - pedestrians: importance, barriers, behaviour, pedestrian facilities - principles of planning, level of service (LOS), design standards - principles of design, design criteria, design standards for rural expressways.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Apply the knowledge of science and engineering fundamentals in conducting traffic surveys, analyze the problems and relating it with standards.
CO2: Understand the principles of traffic flow characteristics and their relationships.
CO3: Understand various traffic management measures in addressing the demand pricing and applications.
CO4: Design various types of control and regulatory measures to meet an efficient traffic network.
CO5: UnderstandvarioustypeoffacilitiesandplanforNonMotorisedTransport.

COURSE ARTICULATION MATRIX															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1		1	1	1				1	3	3	
CO2	3	3	3	3		2	1		1		2		3	2	
CO3	3	2	3	1		2	1	2	2		2		2	2	
CO4	2	3	3	3		2	2	2	1		2	1	2	3	
CO5	2	2	2	1		1	3	3	1			1	2	2	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Kadiyali.L.R, "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi,2019.
T2.	Khanna.K, Justo C.E.G. and Veeraragavan, "A Highway Engineering", Revised 10th Edition, Nem Chand Bros., Roorkee, 2014.

REFERENCE BOOK(S)	
R1.	Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management.
R2.	KhannaS.K, "Highway Engineering", Nam Chand & Bros, Roorkee, 2014.
R3.	C.JotinKhisty,KentLall,"TransportationEngineering:AnIntroduction",PrenticeHall,1998.
R4.	Taylor and Young W,"Traffic Analysis – New Technology and New Solutions", Hargreen Publishing Company, 1998.

Course Code: 24CEP017	**Course Title: Environmental Health And Safety**	
Course Category: PEC	**Credits: 3**	
L:T:P(Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the importance of Environment, Health, and Safety (EHS) systems in workplaces and the relevant national and international regulations.
• To analyze occupational health hazards, exposure pathways, and control measures for ensuring worker safety.
• To study workplace safety measures, including ergonomic design, hazard prevention, and emergency response planning.
• To explore hazard and risk management techniques, including accident investigation and safety inspections.
• To gain knowledge about Environmental Health and Safety (EHS) management systems, policies, and standards like ISO 45001.

UNITI	**NATIONAL POLICY AND LEGISLATIONS ON EHS IN INDIA**	**9**
Need for developing environment, health and safety systems in work places- international initiatives, national policy and legislations on EHS in India - regulations and codes of practice - role of trade union safety representatives - ergonomics.		
UNIT II	**OCCUPATIONAL HEALTH AND HYGIENE**	**10**
Definition of occupational health and hygiene - categories of health hazards - exposure pathways and human responses-exposure assessment-occupational exposure limits - hierarchy of control measures - role of personal protective equipment and the selection criteria.		
UNIT III	**WORKPLACE SAFETY AND SAFETY SYSTEMS**	**11**
Features of satisfactory and safe design of work premises - good housekeeping - lighting and color, ventilation and heat control, noise, chemical and radiation safety - electrical safety - fire safety - safety at construction sites, ETP - machine guarding - process safety and working at different levels.		
UNIT IV	**HAZARDS AND RISK MANAGEMENT**	**8**
Safety appraisal - job safety analysis-control techniques - plant safety inspection - accident investigation - analysis and reporting - hazard and risk management techniques -onsite and		

offsite emergency plans - employee participation- education and training- case studies.		
UNIT V	**ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT**	**7**
Concept of environmental health and safety management - elements of environmental health and safety management policy and implementation and review - ISO 45001-strucure and clauses-case studies.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1:Understand the need for EHS in industries and related Indian regulations
CO2: Identify the various types of Health hazards, effect, assessment and control methods
CO3: Demonstrate knowledge of various workplace safety systems and apply them to ensure a secure working environment.
CO4: Formulate the methodology for preparation of Emergency Plans and Accident investigation.
CO5: Assess the components of an EHS Management System and develop strategies for its effective implementation.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3		3		3		3	2		1	2		2	
CO2	2	2	2	3					2			3	2	2	
CO3			2		3	3	1	1	2		2	3			
CO4			3	2		1	2						2	2	2
CO5	1				2				1		1		1		

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Dr.K.U.Mistry and Siddhartha Prakashan, “Fundamentals of Industrial Safety and Health ", Tata McGraw Hill, 2012.
T2.	Nicholas P. Cheremisinoff and MadelynL. Graffia, “Environmental and Health and Safety Management”, William Andrew Inc. NY, 1995.

REFERENCE BOOK(S)	
R1.	Industrial Health and Safety Acts and Amendments, by Ministry of Labour and Employment, Government of India.

R2.	Brian Gallant, “The Facility Manager's Guide to Environmental Health and Safety”, Government Inst Publ., 2007.

Course Code: 24CEP018	Course Title: Construction Planning And Scheduling	
Course Category: PEC	Credits: 3	
L:T:P(Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To introduce fundamental concepts of construction planning, including work breakdown structures and resource estimation.
• To develop knowledge of scheduling techniques, including critical path method (CPM) and resource-oriented scheduling.
• To understand cost control, monitoring, and accounting methods for effective project management.
• To explore quality control and safety measures in construction projects using statistical and regulatory approaches.
• To learn the organization and use of project information, including database management and information flow.

UNIT I	CONSTRUCTION PLANNING AND NETWORK ANALYSIS	6
Basic concepts in the development of construction plans-choice of technology and construction method-defining work tasks- work breakdown structure- definition- precedence relationships among activities-estimating activity durations-estimating resource requirements for work activities-coding systems – network analysis-CPM-PERT.		
UNIT II	**SCHEDULING PROCEDURES AND TECHNIQUES**	**12**
Relevance of construction schedules-bar charts - the critical path method-calculations for critical path scheduling-activity float and schedules-presenting project schedules-critical path scheduling for activity-on-node and with leads, lags and windows-calculations for scheduling with leads, lags and windows-resource oriented scheduling-scheduling with resource constraints and precedence -use of advanced scheduling techniques-scheduling with uncertain durations- crashing and time/cost trade-offs -improving the scheduling process - introduction to application software.		
UNIT III	**COST CONTROL MONITORING AND ACCOUNTING**	**9**
The cost control problem-the project budget-forecasting for activity cost control - financial accounting systems and cost accounts-control of project cash flows-schedule control-schedule and budget updates-relating cost and schedule information.		

UNIT IV	QUALITY CONTROL AND SAFETY DURING CONSTRUCTION	9
Quality and safety concerns in construction-organizing for quality and safety-work and material specifications-total quality control-quality control by statistical methods -statistical quality control with sampling by attributes-statistical quality control by sampling and variables-safety.		
UNIT V	**ORGANIZATION AND USE OF PROJECT INFORMATION**	**9**
Types of project information-accuracy and use of information-computerized organization and use of information - organizing information in databases-relational model of data bases-other conceptual models of databases-centralized database management systems-databases and application programs-information transfer and flow.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand basic concepts of construction planning.
CO2: Analyze the construction activities.
CO3:Forecast and control the cost in a construction.
CO4: Understand the quality control and safety during construction.
CO5: Organize information in Centralized database Management systems.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	1	2			1	1		2	1		1	
CO2	2	2	2	1	3			1			2	3		1	
CO3	2	2	1	1	2				2		2		1	1	
CO4	2	3	1	1	2			1	1		2	2	1	1	
CO5	2	3	2	1	3			1	1		2	2	1	1	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Chitkara, K.K, "Construction Project Management Planning, Scheduling and Control", Tata McGraw Hill Publishing Co., New Delhi, 2009.
T2.	Srinath,L.S, "Pert and CPM Principles and Applications", Affiliated East West Press, 2001.

REFERENCE BOOK(S)	
R1.	Chris Hendrickson and Tung Au, “Project Management for Construction – Fundamentals Concepts for Owners, Engineers, Architects and Builders”, Prentice Hall, Pitsburgh, 2000.
R2.	Willis, E.M, “Scheduling Construction projects”, John Wiley and Sons, 1986.

Course Code: 24CEP019	Course Title: Structural Dynamics and Earthquake Engineering	
Course Category: PEC	Credits: 3	
L:T:P(Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To understand the fundamental concepts of structural dynamics and vibration analysis of single-degree-of-freedom (SDOF) systems.
• To study the formulation and response of multi-degree-of-freedom (MDOF) systems under dynamic loading.
• To understand the basics of earthquake engineering, including seismic hazards, seismotectonics, and strong ground motion characteristics.
• To analyze the effects of earthquakes on different types of structures and evaluate earthquake forces using IS codes.
• To analyze the earthquake-resistant design and detailing for masonry and RCC buildings based on Indian standards.

UNITI	SINGLE DEGREE OF FREEDOM SYSTEM	9
Definition of degree of freedom - idealization of structure as single degree of freedom (SDOF)system - formulation of equation of motion for various SDOF system - D' alemberts principles- effect of damping - free and forced vibration of damped and un damped structures- response to harmonic forces and periodic forces.		
UNIT II	MULTI DEGREE OF FREEDOM SYSTEM	9
Formulation of equation of motion for multi degree of freedom (MDOF) system - Evaluation of natural frequencies and modes - Eigen values and Eigen vectors - Response to free and Forced vibration of un damped and damped MDOF systems-modal superposition methods.		
UNIT III	INTRODUCTION TO EARTHQUAKE ENGINEERING	9
Elements of engineering seismology - definitions, introduction to seismic hazard, earthquake phenomenon -seismotectonics- seismic instrumentation - characteristics of strong earthquake motion - estimation of earthquake parameters.		
UNIT IV	EARTHQUAKE EFFECTS ON STRUCTURES	9
effect of earthquake on different types of structures -behaviour of RCC, steel and prestressed concrete structures under earthquake loading - pinching effect - Bouchinger effects –		

evaluation of earthquake forces - is code 1893: 2002 - response spectra - lessons learnt from past earthquakes.

UNIT V	CONCEPTS OF EARTHQUAKE RESISTANT DESIGN	9

Causes of damage - planning considerations/architectural concept- guidelines for earthquake resistant design - earthquake resistant design of masonry buildings – design consideration - guidelines - earthquake resistant design of RCC buildings - lateral load analysis - design and detailing.

Total: 45 Hours

COURSE OUTCOMES

At the end of this course, students will be able to

CO1: Analyze and apply simulation techniques to develop mathematical models for real-world problem-solving.

CO2: Identify, formulate and solve complicated problem.

CO3: Understand the role of natural calamity in the damage of structures.

CO4: Able to develop the skill to analyze data and to apply the same in the practical problems.

CO5: Apply the developed methodologies for the safe and stable design of structures.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2			2		2	3	1		2	3	2	
CO2	2	2	2			2		1	1	1		2	3	2	
CO3	1	3	2			2		2	2	1		2	3	2	
CO4	2	2	1			2		2	2	1		3	3	2	
CO5	2	2	2			2		1	2	1		3	3	2	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Mario Paz, “Structural Dynamics - Theory and Computations”, Fourth Edition, CBS publishers, 1997.
T2.	Agarwal.P and Shrikhande.M, “Earthquake Resistant Design of Structures”, Prentice Hall of India Pvt. Ltd. 2007.

REFERENCE BOOK(S)

R1.	Anil K Chopra, “Dynamics of structures - Theory and applications to Earthquake Engineering”, Prentice Hall Inc., 2007.
R2.	Moorthy.C.V.R, “Earthquake Tips”, NICEE, IIT Kanpur, 2002.

Course Code: 24CEP020	Course Title: Environmental Impact Assessment	
Course Category: PEC	Credits: 3	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To understand the historical development, legal framework, and regulatory requirements of Environmental Impact Assessment (EIA).
• To explore various impact identification and prediction methods, including checklists, matrices, and modeling techniques.
• To analyze the socio-economic impacts of development projects and understand methodologies for impact assessment.
• To study the process of preparing and implementing an Environmental Management Plan (EMP) and post-project monitoring.
• To evaluate real-world case studies of EIA applications in various industrial and infrastructure projects.

UNIT I	HISTORY OF EIA	9
Historical development of environmental impact assessment (EIA). environmental clearance- EIA in project cycle - legal and regulatory aspects in India - types and limitations of EIA - EIA process screening - scoping - terms of reference in EIA- setting - analysis - mitigation. cross sectoral issues -public hearing in EIA- EIA consultant accreditation.		
UNIT II	IMPACT INDENTIFICATION AND PREDICTION	10
Matrices - networks - checklists - cost benefit analysis - analysis of alternatives - expert systems in EIA. prediction tools for EIA - mathematical modelling for impact prediction - assessment of impacts - air - water - soil - noise - biological - cumulative impact assessment.		
UNIT III	SOCIO-ECONOMIC IMPACT ASSESSMENT	8
Socio-economic impact assessment - relationship between social impacts and change in community and institutional arrangements - factors and methodologies- individual and family level impacts - communities in transition–rehabilitation.		
UNIT IV	EIA DOCUMENTATION AND ENVIRONMENTAL MANAGEMENT PLAN	9
Environmental management plan - preparation, implementation and review - mitigation and		

rehabilitation plans - policy and guidelines for planning and monitoring programmes - post project audit - documentation of EIA findings - ethical and quality aspects of environmental impact assessment		
UNIT V	**CASE STUDIES**	**9**
Mining, power plants, cement plants, highways, petroleum refining industry, storage & handling of hazardous chemicals, common hazardous waste facilities, CETPs, CMSWMF, building and construction projects.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Carry out scoping and screening of developmental projects for environmental and social assessments.
CO2: Explain different methodologies for environmental impact prediction and assessment.
CO3: Assess socio-economic investigation of the environment in a project.
CO4: Plan environmental impact assessments and environmental management plans.
CO5: Prepare environmental impact assessment reports for various projects.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2				1				2	1	3	1	
CO2	3	3	3	3				2			3		3	2	
CO3	3	2	3					2			3		2	2	
CO4	2	3	3	3			2	2			3		2		
CO5	2	2	2	1			3	3			2	1	2		

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	K. V. Raghavan and A A. Khan, "Methodologies in Hazard Identification and Risk Assessment", Manual by CLRI, 1990.
T2.	Kolluru Rao, Bartell Steven, Pitblado R and Stricoff, "Risk Assessment and Management Handbook", McGraw Hill Inc., New York, 1996.

REFERENCE BOOK(S)	
R1.	Canter, L.W, "Environmental Impact Assessment", McGraw Hill, New York, 1996.
R2.	Cutter,S.L,"EnvironmentalRiskandHazards",Prentice-HallofIndia,NewDelhi, 1999.

Course Code: 24CEP021	**Course Title: Repair and Rehabilitation of Structures**	
Course Category: PEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the concepts of maintenance, repair, and rehabilitation of structures, including assessment techniques.
• To evaluate the strength and durability aspects of concrete and the factors affecting its deterioration.
• To explore different types of special concretes and their applications in modern construction.
• To understand the various techniques for repair, strengthening, and protection of structures.
• To analyze case studies on rehabilitation, retrofitting, and demolition of distressed structures.

UNIT I	**MAINTENANCE AND REPAIR STRATEGIES**	**9**
Maintenance - repair and rehabilitation - facets of maintenance - importance of maintenance - various aspects of inspection - assessment procedure for evaluating damaged structure - causes of deterioration.		
UNIT II	**STRENGTH AND DURABILITY OF CONCRETE**	**9**
Quality assurance for concrete-strength, durability- cracks, different types, causes-effects due to climate, temperature, sustained elevated temperature, corrosion.		
UNIT III	**SPECIAL CONCRETES**	**9**
Polymer concrete -sulphur infiltrated concrete - fibre reinforced concrete - high strength concrete - high performance concrete - vacuum concrete - self-compacting concrete, geopolymer concrete - reactive powder concrete, concrete made with industrial wastes.		
UNIT IV	**TECHNIQUES FOR REPAIR AND PROTECTION METHODS**	**9**
Non-destructive testing techniques - load test for stability-epoxy injection - shoring, underpinning - corrosion protection techniques - corrosion inhibitors, corrosion resistant steels - coatings to reinforcement - cathodic protection.		

UNIT V	REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES	9
Strengthening of structural elements - repair of structures distressed due to corrosion, fire, leakage, earthquake-transportation of structures from one place to other - structural health monitoring- demolition techniques-engineered demolition methods-case studies.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain the significance of maintenance, repair, and rehabilitation strategies, and assess the causes of structural deterioration.
CO2: Examine the strength and durability characteristics of concrete, analyze different types of cracks, and assess their impact on structures.
CO3: Compare various special concretes, such as polymer concrete, fiber-reinforced concrete, and self-compacting concrete, and apply their uses in construction.
CO4: Identify and apply suitable repair and protection techniques, including non-destructive testing, corrosion protection, and structural strengthening.
CO5: Develop effective repair, rehabilitation, and retrofitting solutions for structures affected by deterioration, and evaluate demolition and structural health monitoring techniques.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1		1		2	1		2	1	1	2	
CO2	3	3	3					3			3	1	1	2	
CO3	3	2	3					3	1		3		2	2	
CO4	3	3	3	1			2	3			3		1	2	
CO5	2	2	2	1		1	3	2	1			1	1	2	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Shetty.M.S, “Concrete Technology-Theory and Practice”, S.Chand and Company, 2008.
T2.	Vidivelli.B, “Rehabilitation of Concrete Structures”,1st edition, Standard Publishes Distribution, 2009.

REFERENCE BOOK(S)	
R1.	DovKominetzky.M.S, “Design and Construction Failures”, Galgotia Publications Pvt.Ltd., 2001.
R2.	Ravishankar.K. Krishnamoorthy.T.S, “Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures”, Allied Publishers, 2004.

Course Code: 24CEP022	Course Title: Prefabricated Structures	
Course Category: PEC	Credits: 3	
L:T:P(Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To introduce the basic concepts of prefabrication
• To acquire the knowledge of prefabrication components and systems
• To understand the design principles in prefabrication
• To perceive the types of joints and connections in structural members
• To impart knowledge about the structural stability.

UNITI	INTRODUCTION	9
Need for prefabrication - advantages and limitations - principles of prefabrication - modular coordination-standardization - loads and load combinations- materials - production - transportation - erection.		
UNIT II	PREFABRICATED COMPONENTS AND SYSTEMS	9
Behaviour and types of structural components- roof and floor slabs - walls panels - shear walls - beams - columns - skeletal system- portal frame system-large panel systems- block system.		
UNIT III	DESIGN PRINCIPLES	9
Design philosophy- design of cross section based on efficiency of material used - problems in design because of joint flexibility - allowance for joint deformation - demountable precast concrete systems- design for stripping , stacking ,transportation and erection of elements.		
UNIT IV	JOINTS AND CONNECTIONS IN STRUCTURAL MEMBERS	9
Types of joints - based on action of forces - compression joints - shear joints - tension joints - based on function - construction joints, contraction joints, expansion joints - design of expansion joints - dimensions and detailing - types of sealants - types of structural connections - beam to column - column to column - beam to beam - column to foundation.		
UNIT V	DESIGN FOR ABNORMAL LOADS	9
Progressive collapse - codal provisions - equivalent design loads for considering abnormal effects (earthquake) - importance of avoidance of progressive collapse -case study.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand concepts about principles of prefabrication, production, transportation, erection.
CO2: Identify and evaluate various panel systems, slabs, beams, shear walls, and columns used in precast construction.
CO3: Apply design principles for cross-sections and assess the flexibility of joints in precast structures.
CO4: Examine different types of joints and connections in precast construction and determine their effectiveness.
CO5: Analyze factors affecting structural stability in precast construction and recommend solutions for improving stability.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1					2		1		2	1	2	1
CO2	2	1	2					3		1		2	2	2	1
CO3	2	3	1				1	2		1		2		2	1
CO4	2	2	2				1	3		1		2	2		1
CO5	2	2	2				1	3		1		2		2	1

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Dr.K.U.Mistry, Siddharth Prakashan, “Fundamentals of Industrial Safety and Health”, Tata McGraw Hill, 2012.
T2.	Nicholas P.Cheremisinoff and MadelynL. Graffia, “Environmental and Health and Safety Management”, William Andrew Inc. NY, 1995.

REFERENCE BOOK(S)	
R1.	Bruggeling A.S. G and Huyghe G.F, “Prefabrication with Concrete”, A.A. Balkema Publishers, USA, 1991.
R2.	Lewitt,M.“PrecastConcrete-Materials, Manufacture, Properties And Usage”, CRCPress,2019.
R3.	Alfred Steinle, HubertBachmann, MathiasTillmann, PhilipThrift, “Precast Concrete Structures”, Ernst & Sohn, Berlin, 2019.

Course Code: 24CEP023	Course Title: Finite Element Analysis	
Course Category: PEC	Credits: 3	
L:T:P(Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To understand the fundamental concepts of mathematical modeling and finite element analysis in engineering.
• To understand the formulation of the stiffness matrix for different structural elements using the direct stiffness method.
• To analyze one-dimensional problems using various element types and interpolation functions.
• To explore two-dimensional problems, including isoparametric elements and numerical integration techniques.
• To apply finite element methods for the analysis of plates, shells, and stress-strain problems using general-purpose software.

UNIT I	INTRODUCTION	9
Historical background - mathematical modeling of field problems in engineering -governing equations - discrete and continuous models - boundary, initial and eigen value problems- weighted residual methods - variation formulation of boundary value problems - RITZ technique - basic concepts of the finite element method.		
UNIT II	STIFFNESS MATRIX FORMULATION	9
Introduction to discrete and continua elements - discrete elements - direct stiffness method - special characteristics of stiffness matrix - assemblage of elements - boundary condition & reaction– 2D - truss element – 2D - beam element - analysis of framed structures - basic steps in finite elementanalysis-differentialequilibriumequations-straindisplacementrelation-linearconstitutive relation - numerical methods in finite element analysis- gauss elimination method.		
UNIT III	ONE DIMENSIONAL PROBLEMS	9
One dimensional second order equations - discretization - element types- linear and higher order elements - continua elements - displacement models - convergence requirements. natural coordinate systems - shape function. interpolation function. linear and quadratic elements - lagrange& serendipity elements. strain displacement matrix - element stiffness		

matrix and nodal load vector. natural frequencies of longitudinal vibration and mode shapes.		
UNIT IV	**TWO DIMENSIONAL PROBLEMS**	**9**
Two dimensional is parametric elements - four noded quadrilateral elements - triangular elements. computation of stiffness matrix for iso-parametric elements - numerical integration (gauss quadrature) convergence criteria for iso-parametric elements.		
UNIT V	**ANALYSIS OF PLATES**	**9**
Introduction to plate bending problems - displacement functions - analysis of thin plate - analysis of thick plate - analysis of skew plate, finite element analysis of shell, plane stress and plane strain analysis, example problem using any general-purpose finite element software.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the basics of finite element formulation.
CO2: Formulate the stiffness matrix for beam, truss and framed structures.
CO3: Apply finite element formulations to solve one-dimensional problems.
CO4: Analyze finite element method to solve two dimensional problems.
CO5: Evaluate plate bending behavior using the Finite Element Method.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1			2		1	1	2	1	1
CO2	3	2	2	1	1	1			2		1	1	2	1	1
CO3	3	3	1	2	2	1			2		1	1	2	1	1
CO4	2	2	1	1	2	1			2		1	2	2	1	1
CO5	3	2	2	1	3	1			2		1	2	2	1	1

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Rao, S.S, “The Finite Element Method in Engineering”, 6th Edition, Butterworth Heinemann, 2018.
T2.	Reddy J.N, “Introduction to the Finite Element Method”, 4thEdition, Tata McGrawHill, 2018.

REFERENCE BOOK(S)	
R1.	DavidHutton,“FundamentalsofFiniteElementAnalysis”,TataMcGrawHillPublishingCompany Limited, New Delhi, 2005.
R2.	G.R. Liu and S.S.Quek, “Finite Element Method: A Practical Course”, 1st edition, Butterworth Heinemann, 2003.
R3.	Chennakesava R. Alavala,“Finite Element Methods: Basic Concepts and Applications”, Prentice Hall Inc., 2010.

Course Code: 24CEP024	Course Title: Tall Structures	
Course Category: PEC	Credits: 3	
L:T:P(Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To understand design and behavior of tall buildings.
• To analyze load effects on high-rise structures.
• To learn about structural systems used in tall buildings.
• To use modeling tools for stability and safety assessment.
• To design considering secondary effects and modern codes.

UNIT I	IDESIGN CRITERIA AND MATERIALS	9
Growth and development of tall buildings - Structural forms and system classification - Serviceability and strength requirements - Human comfort criteria - High-strength concrete - High-strength steel - Self-compacting concrete - Composite materials - Fire resistance and durability - Design challenges in tall buildings.		
UNIT II	**LOADING CONSIDERATIONS**	**9**
Dead load and live load with reduction - Impact loads - Wind load: static and dynamic analysis - Wind tunnel testing - Seismic loads: seismic coefficient method, response spectrum method - Load combinations - Codal provisions as per IS 875 and IS 1893 - Load paths and structural integrity.		
UNIT III	**STRUCTURAL SYSTEMS**	**6**
Braced frames - Rigid frames - Shear wall systems - Coupled shear walls - Infilled frames - Wall-frame interaction systems - Tubular structures: framed tube, bundled tube, tube-in-tube - Outrigger and belt truss systems -Diagrid and hybrid systems - Structural redundancy and energy dissipation.		
UNIT IV	**STRUCTURAL ANALYSIS**	**9**
Approximate analysis techniques - Accurate modeling using software - 3D analysis and simulation - Determination of lateral displacement and drift - Torsional effects and mass irregularities - Computer-aided design - Time-history analysis - Modal and response spectrum analysis.		
UNIT V	**DESIGN CONSIDERATIONS**	**9**

Effects of creep, shrinkage, and temperature - Differential settlement and soil-structure interaction - P-Δ effect - Buckling of slender elements - Foundation types for tall buildings: pile foundation, raft, combined footings - Fire protection - Deflection control - Safety and evacuation design.
Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand materials and structural needs of tall buildings.
CO2: Analyze various loads on tall structures.
CO3: Classify structural systems and their applications.
CO4: Use software and models for analyzing buildings.
CO5: Design tall structures for performance and safety.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	1	1	-	-	-	-	1	2	1	-
CO2	3	2	3	-	-	1	1	-	1	-	-	1	2	1	-
CO3	2	2	2	-	-	1	1	-	1	-	-	1	2	1	-
CO4	3	2	3	-	-	1	1	-	1	-	-	1	2	1	-
CO5	3	2	2	-	-	1	1	-	1	-	-	1	2	1	-

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Bryan Stafford Smith & Alex Coull- Tall Building Structures: Analysis and Design, 1st ed. Wiley Interscience, 1991.
T2.	Bungale S. Taranath- Structural Analysis and Design of Tall Buildings: Steel and Composite Construction, 1st ed., CRC Press, 2012.

REFERENCE BOOK(S)	
R1.	Wolfgang Schueller- High Rise Building Structures, Wiley Eastern Ltd., 1977.
R2.	Lin & Stotesbury- Structural Concepts for Architects and Engineers, Wiley-Newyork, 1981.

MANDATORY COURSES:

Course Code: 24MAC001	**Course Title: Indian Constitution**	
Course Category: MC	**Credits: 0**	
L:T:P (Hours/Week) 1:0:0	**Total Contact Hours: 15**	**Max Marks : 100**

COURSE OBJECTIVES
• To understand evolution of Indian Constitution.
• To analyze the fundamental rights.
• To understand the composition of Parliament.
• To study constitution amendment procedure.
• To know about the powers of high court and supreme court.

UNIT I	**INTRODUCTION**	**2**
Evolution of Indian Constitution, Significance of Constitution, Composition, Preamble and its Philosophy.		
UNIT II	**RIGHTS, DUTIES AND DIRECTIVE PRINCIPLES**	**3**
Fundamental Rights- Writs and Duties, Directive Principles of State Policy.		
UNIT III	**COMPOSITION OF PARLIAMENT AND FEDERALISM**	**4**
Union Government, President and Vice President, Houses of theParliament and their functions, Composition of State Legislature, Powers, Functions and Position of Governor, Function of ChiefMinisters, Council of Ministers, The Indian Federal System, Administrative Relationship between Union and States.		
UNIT IV	**BILLS AND CONSTITUTION AMENDMENT PROCEDURE**	**3**
Types of Bills, Stages of passing of Bill into an Act, Veto Power,Constitution Amendment Procedure, Various Amendments made and their significance for India.		
UNIT V	**JUDICIARY**	**3**
Supreme Court and High Court, Functions and powers, Judicial Review.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Learn the evolution of Indian Constitution.
CO2: Understand the fundamental rights and duties of state policies.
CO3: Understand the functions of Parliament and federalism.
CO4: Learn about constitution amendment procedure.
CO5: Understand the functions of High court and Supreme court.

TEXT BOOK(S)	
T1.	Subash C. Kashyap, "Our Constitution", 5thEdition, NBT, India, New Delhi, 2015.
T2.	Basu D D, "Introduction to the Constitution of India", 20thEdition, Prentice Hall of India, New Delhi, 2011.

REFERENCE BOOK(S)	
R1.	Briji Kishore Sharma, "Introduction to the Constitution of India", 8thEdition, Prentice Hall of India, New Delhi, 2017.
R2.	Hoshiar Singh, "Indian Administration", 1stEdition, Pearson Education, New Delhi, 2011.
R3.	Jain M C, "The Constitution of India", 5thEdition, State Mutual Book & Periodical Service, Limited, New Delhi, 1988.
R4.	Shukla V N, "Constitution of India", 13thEdition, Eastern Book Company Limited, New Delhi, 2017.

Course Code : 24MAC002	Course Name: Industrial Safety	
Course Category : MC	**Credits : 0**	
L:T:P(Hours/Week) : 1:0:0	**Total Contact Hours : 15**	**Max Marks : 100**

COURSE OBJECTIVES
• To understand the Introduction and basic terminologies of safety.
• To learn about the Important Statutory Regulations and standards.
• To conduct and participate the various safety activities in the Industry.
• To have knowledge about Workplace Exposures and Hazards.
• To assess the various Hazards and consequences through various Risk Assessment Techniques.

UNIT I	SAFETY TERMINOLOGIES	3
Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators-Flammability- Toxicity Time-weighted Average (TWA) - Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS.		
UNIT II	**STANDARDS AND REGULATIONS**	**3**
Indian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S).		
UNIT III	**SAFETY ACTIVITIES**	**3**
Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment.		
UNIT IV	**WORKPLACE HEALTH AND SAFETY**	**3**
Noise hazard- Particulate matter- musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA.		
UNIT V	**HAZARD IDENTIFICATION TECHNIQUES**	**3**
Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Learn the safety terminologies and safety policy.
CO2: Understand the occupational health and safety standards.
CO3: Understand the on-site and off-site emergency safety action plans.
CO4: Learn about the health and safety in workplace.
CO5: Expose the hazard identification techniques with qualitative and quantitative risk assessment.

TEXT BOOK(S)	
T1.	R.K. Jain and Prof. Sunil S. Rao "Industrial Safety, Health and Environment Management Systems", Khanna Publisher, 2012.
T2.	L. M. Deshmukh, "Industrial Safety Management: Hazard Identification and Risk Control", McGraw-Hill Education, 2015

REFERENCE BOOK(S)	
R1.	Frank Lees, "Loss Prevention in Process Industries",4^{th}Edition, Butterworth-Heinemann publications, UK, 2012.
R2.	John Ridley and John Channing, "Safety at Work: Routledge", 7^{th}Edition, McGraw-Hill Education, 2015.
R3.	Dan Petersen, "Techniques of Safety Management: A System Approach", Khanna Publisher, 2012.

Course Code: 24MAC003	Course Title: Entrepreneurship	
Course Category: MC	**Credits: 0**	
L:T:P (Hours/Week) 1:0:0	**Total Contact Hours: 15**	**Max Marks : 100**

COURSE OBJECTIVES
• To develop and strengthen the entrepreneurial quality and motivation of learners.
• To impart the entrepreneurial skills and traits essential to become successful entrepreneurs.
• To apply the principles and theories of entrepreneurship and management in Technology oriented businesses.
• To empower the learners to run a Technology driven business efficiently and effectively
• To understand the emerging trends in Entreppreneurship.

UNIT I	INTRODUCTION TO ENTREPRENEURSHIP	3
Entrepreneurship- Definition, Need, Scope - Entrepreneurial Skill & Traits - Entrepreneur vs. Intrapreneur; Classification of entrepreneurs, Types of entrepreneurs -Factors affecting entrepreneurial development – Achievement Motivation – Contributions of Entreprenrship to Economic Development.		
UNIT II	**BUSINESS OWNERSHIP & ENVRIONMENT**	**3**
Types of Business Ownership – Business Environmental Factors – Political-Economic-Sociological-Technological-Environmental-Legal aspects – Human Resources Mobilization-Basics of Managing Finance- Essentials of Marketing Management - Production and Operations Planning – Systems Management and Administration.		
UNIT III	**FUNDAMENTALS OF TECHNOPRENEURSHIP**	**3**
Introduction to Technopreneurship - Definition, Need, Scope- Emerging Concepts-Principles - Characteristics of a technopreneur - Impacts of Technopreneurship on Society – Economy- Job Opportunities in Technopreneurship - Recent trends		
UNIT IV	**APPLICATIONS OF TECHNOPRENEURSHIP**	**3**
Technology Entrepreneurship - Local, National and Global practices - Intrapreneurship and		

Technology interactions, Networking of entrepreneurial activities – Launching - Managing Technology based Product / Service entrepreneurship -– Success Stories of Technopreneurs - Case Studies.		
UNIT V	**EMERGING TRENDS IN ENTREPRENERUSHIP**	**3**
Effective Business Management Strategies For Franchising - Sub-Contracting- Leasing- Technopreneurs – Agripreneurs - Netpreneurs- Portfolio entrepreneurship - NGO Entrepreneurship – Recent Entrepreneurial Developments - Local – National – Global perspectives.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Learn the basics of Entrepreneurship.
CO2: Understand the business ownership patterns and environment.
CO3: Understand the Job opportunities in Industries relating to Technopreneurship.
CO4: Learn about applications of Tehnopreneurship and to become a successful Technopreneurs.
CO5: Acquaint with the recent and emerging trends in entrepreneurship.

TEXT BOOK(S)	
T1.	S.S.Khanka, "Entrepreneurial Development",S.Chand& Co. Ltd., Ram Nagar New Delhi, 2021.
T2.	Donal F Kuratko, "Entrepreneurship Theory, Process, Practice", 11th Edition, Cengage Learning, 2019.
T3.	Daniel Mankani, "Technopreneurship: The successful Entrepreneur in the new Economy", Prentice Hall, 2012.

REFERENCE BOOK(S)	
R1.	Edward Elgar, "Entrepreneurship, Cooperation and the Firm: The Emergence and

	Survival of High-Technology Ventures in Europe", Wiley Publication, 2010.
R2.	S.S.Khanka, "Entrepreneurial Development",S.Chand& Co. Ltd. Ram Nagar New Delhi, 2021.

Course Code: 24MAC004	Course Title: Film Appreciation	
Course Category: MC	**Credits: 0**	
L:T:P (Hours/Week) 1:0:0	**Total Contact Hours: 15**	**Max Marks:100**

COURSE OBJECTIVES
• To understand the historical development of film as an art and entertainment form.
• To learn the language of cinema and its evolution over a century.
• To develop the ability to read a film critically and appreciate its various nuances.
• To cultivate an appreciation for film as a text, exploring its narrative, themes, and stylistic elements.
• To foster a joyful and engaging approach to studying films.

UNIT I	THEME - A: THE COMPONENT OF FILMS	3
A-1: The material and equipment A-2: The story, screenplay and script A-3: The actors, crew members, and the director A-4: The process of film making… structure of a film		
UNIT II	**THEME - B: EVOLUTION OF FILM LANGUAGE**	**3**
B-1: Film language, form, movement etc. B-2: Early cinema… **silent film** (Particularly French) B-3: The emergence of feature films: **Birth of a Nation** B-4: Talkies		
UNIT III	**THEME - C: FILM THEORIES AND CRITICISM/APPRECIATION**	**3**
C-1: Realist theory; Autarkists C-2: Psychoanalytic, Ideological, Feminists C-3: How to read films? C-4: Film Criticism / Appreciation		
UNIT IV	**THEME – D: DEVELOPMENT OF FILMS**	**3**

D-1: Representative Soviet films D-2: Representative Japanese films D-3: Representative Italian films D-4: Representative Hollywood film and the studio system		
UNIT V	**THEME - E: INDIAN FILMS**	**3**
E-1: The early era E-2: The important films made by the directors E-3: The regional films E-4: The documentaries in India		

COURSE OUTCOMES
At the end of this course, students will be able to:
CO1: Understand the historical development of film as an art and entertainment form.
CO2: Learn the language of cinema and its evolution over a century.
CO3: Develop the ability to read a film critically and appreciate its various nuances.
CO4: Cultivate an appreciation for film as a text, exploring its narrative, themes, and stylistic Elements.
CO5: Foster a joyful and engaging approach to studying films.

READING:

A Reader containing important articles on films will be prepared and given to the students. The students must read them and present in the class and have discussion on these.

Course Code: 24MAC005	Course Title: Well Being with Traditional Practices - Yoga, Ayurveda and Siddha	
Course Category: MC	Credits: 0	
L:T:P (Hours/Week) 1:0:0	Total Contact Hours: 15	Max Marks : 100

COURSE OBJECTIVES
• To enjoy life happily with fun filled new style activities that help to maintain health.
• To adapt a few lifestyle changes that will prevent many health disorders.
• To be cool and handbill every emotion very smoothly in every walk of life.
• To learn to eat cost effective but healthy foods that are rich in essential nutrients.
• To develop immunity naturally that will improve resistance against many health disorders.

UNIT I	HEALTH AND ITS IMPORTANCE	3
Health- Definition - Importance of maintaining health - More importance on prevention than treatment, Types of health, Present health status - The life expectancy-present status - mortality rate - dreadful diseases - Non-communicable diseases (NCDs) the leading cause of death - 60% - heart disease – cancer – diabetes - chronic pulmonary diseases - risk factors – tobacco – alcohol - unhealthy diet - lack of physical activities. Types of diseases and disorders - Causes of the diseases / disorders - Importance of prevention of illness - Simple lifestyle modifications to maintain health - Maintaining BMI-Importance and actions to be taken.		
UNIT II	DIET	3
Role of diet in maintaining health - energy one needs to keep active throughout the day - nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, Balanced diet and its 7 Components - Carbohydrates – Proteins – Fats – Vitamins – Minerals - Fibre and Water, Food additives and their merits & demerits - Effects of food additives - Types of food additives - Food additives and processed foods - Food additives and their reactions, Definition of BMI and maintaining it with dietImportance - Consequences of not maintaining BMI - different steps to maintain optimal BM.		

UNIT III	ROLE OF AYURVEDA & SIDDHA SYSTEMS IN MAINTAINING HEALTH	3
AYUSH systems and their role in maintaining health - preventive aspect of AYUSH - AYUSH as a soft therapy, Secrets of traditional healthy living - Traditional Diet and Nutrition - Regimen of Personal and Social Hygiene - Daily routine (Dinacharya) - Seasonal regimens (Ritucharya) - basic sanitation and healthy living environment - Sadvritta (good conduct) - for conducive social life, Principles of Siddha & Ayurveda systems - Macrocosm and Microcosm theory - Pancheekarana Theory / (Five Element Theory) 96 fundamental Principles - UyirThathukkal(Tri-Dosha Theory) - UdalThathukkal.		
UNIT IV	**MENTAL WELLNESS**	**3**
Emotional health - Definition and types - Three key elements: the subjective experience - the physiological response - the behavioral response - Importance of maintaining emotional health - Role of emotions in daily life -Short term and long term effects of emotional disturbances, Stress management - Stress definition - Stress in daily life - How stress affects one's life - Identifying the cause of stress - Symptoms of stress - Managing stress (habits, tools, training, professional help) - Complications of stress mismanagement.		
UNIT V	**YOGA**	**3**
Definition and importance of yoga - Types of yoga - How to Choose the Right Kind for individuals according to their age - The Eight Limbs of Yoga - Simple yogasanas for cure and prevention of health disorders - What yoga can bring to our life.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Learn the importance of different components of health.
CO2: Understand the importance of diet and workouts in maintaining health.
CO3: Learn new techniques of Ayurveda and Siddha systems.
CO4: Understand about emotional health and stress management.
CO5: Understand the concept of Yogasanas.

TEXT BOOK(S)	
T1.	Ashley Martin, “Nutrition and Dietetics”, White Word Publications, New York, NY 10001, USA, 2012
T2.	Cory Martin, “Yoga for Beginners_ 35 Simple Yoga Poses to Calm Your Mind and Strengthen Your Body”, Althea Press, Berkeley, California, 2015.

REFERENCE BOOK(S)	
R1.	Moshe Zeidner, Gerald Matthews, and Richard D. Roberts, “What We Know About Emotional Intelligence - How It Affects Learning, Work, Relationships, and Our Mental Health”, Cambridge, Massachusetts, London, England, 2012
R2.	Kristin Neff and Christopher Germer, “A Bradford Book”, The MIT Press, Cambridge, Massachusetts, London, England, 2015

Course Code: 24MAC007	Course Title: Elements of Literature	
Course Category: MC	**Credits: 0**	
L:T:P (Hours/Week) 1:0:0	**Total Contact Hours: 15**	**Max Marks : 100**

COURSE OBJECTIVES
• To develop an awareness of the finer sensibilities of human existence through art.
• Toappreciate the role of literature in expressing human experience.
• To explore different forms of literature as modes of human expression.
• To understand the elements of drama.

UNIT I	RELEVANCE OF LITERATURE	3
a) Enhances Reading, thinking, discussing and writing skills. b) Develops finer sensibility for better human relationship. c) Increases understanding of the problem of humanity without bias. d) Providing space to reconcile and get a cathartic effect.		
UNIT II	**ELEMENTS OF FICTION**	**3**
a) Fiction, fact and literary truth. b) Fictional modes and patterns. c) Plot character and perspective.		
UNIT III	**ELEMENTS OF POETRY**	**3**
a) Emotions and imaginations. b) Figurative language. c) (Simile, metaphor, conceit, symbol, pun and irony). d) Personification and animation. e) Rhetoric and trend.		
UNIT IV	**ELEMENTS OF DRAMA**	**3**
a) Drama as representational art. b) Content mode and elements.		

c) Theatrical performance. d) Drama as narration, mediation and persuasion. e) Features of tragedy, comedy and satire.

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Develop an awareness of the finer sensibilities of human existence through art
CO2: Appreciate the role of literature in expressing human experience
CO3: Explore different forms of literature as modes of human expression
CO4: Understand the features and varieties of drama

TEXT BOOK(S)	
T1.	W.H. Hudson, “An Introduction to the Study of English Literature”, Atlantic, 2007.
T2.	Mario Klarer, Routledge, “An Introduction to Literary Studies”, Pearson, 2013.

REFERENCE BOOK(S)	
R1.	Graham Mode, “The Experience of Poetry”, Open college of Arts with Open Unv Press, 2012.
R2.	J.L.Styan, “The Elements of Drama”, Literary Licensing, 2011.

MANAGEMENT ELECTIVES

Course Code: 24HSM301	**Course Title: Principles of Management**	
Course Category: HSMC	**Credits: 2**	
L:T:P (Hours/Week) 2:0:0	**Total Contact Hours: 30**	**Max Marks : 100**

COURSE OBJECTIVES
• To outline the fundamental activities of managers.
• To apply the planning techniques and decision making.
• To understand the concept of Human Resource Management.
• To understand motivation, leadership and communication principles.
• Analyze the position of self and company goals towards business.

UNIT I	**INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS**	**6**
Definition of Management – Science or Art – Manager vs Entrepreneur- types of managers-managerial roles and skills – Evolution of Management –Scientific, human relations, system and contingency approaches– Types of Business organization- Sole proprietorship, partnership, company-public and private sector enterprises- Organization culture and Environment – Current trends and issues in Management.		
UNIT II	**PLANNING**	**6**
Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting objectives – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.		
UNIT III	**ORGANISING**	**6**
Nature and purpose – Formal and informal organization – Organization chart – Organization structure – Types – Line and staff authority – Departmentalization – delegation of authority – Centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.		
UNIT IV	**DIRECTING**	**6**

Foundations of individual and group behaviour– Motivation – Motivation theories – Motivational techniques – Job satisfaction – Job enrichment – Leadership – types and theories of leadership – Communication – Process of communication – Barrier in communication – Effective communication – Communication and IT.

UNIT V	CONTROLLING	6

System and process of controlling – Budgetary and non - Budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.

Total: 30Hours

COURSE OUTCOMES

At the end of this course, students will be able to

CO1: Understand the role of managers in an organization.

CO2: Understand the planning process in the organization.

CO3:Examine the managerial functions having an impact on the organizational effectiveness.

CO4:Show the ability in directing, leadership and communicate effectively.

CO5: Analyse the isolate issues and formulate best control methods.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1			1		1	2	2	2	3	3	1	1	1	
CO2	1			2	1	1	1	2	2	2	2	1	1	1	
CO3	1			1	1	1	1	1	2	3	2	1	1	1	
CO4	1			1	1	1	1	1	2	3	2	1	1	1	
CO5	1			1	1	1	1	2	2	2	2	1	1	1	

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Harold Koontz and Heinz Weihrich "Essentials of Management",11th Edition, Tata McGraw Hill, 2020.

T2.	Stephen P. Robbins and Mary Coulter, “Management”, 13th Edition, Prentice Hall Pvt. Ltd., 2017.

REFERENCE BOOK(S)	
R1.	Robert Kreitner and MamataMohapatra, “Management”, Biztantra, 2008.
R2.	Stephen A. Robbins and David A. Decenzo and Mary Coulter, “Fundamentals of Management”, 7th Edition, Pearson Education, 2011.
R3.	PC Tripathi, P N Reddy and Ashish Bajpai, “Principles of Management”, 7th Edition, Tata McGraw Hill, 2021.

Course Code: 24HSM302	Course Title: Total Quality Management	
Course Category: HSMC	**Credits: 2**	
L:T:P (Hours/Week) 2:0:0	**Total Contact Hours: 30**	**Max Marks : 100**

COURSE OBJECTIVES
• To communicate the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
• To explain the TQM Principles for application.
• To define the basics of Six Sigma and apply traditional tools, new tools, Benchmarking and FMEA.
• To describe Taguchi's Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
• To illustrate and apply QMS and EMS in any organization.

UNIT I	INTRODUCTION	6
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality - Definition of TQM- Basic concepts of TQM - Gurus of TQM - TQM Framework- Barriers to TQM - Benefits of TQM.		
UNIT II	**TQM PRINCIPLES**	**6**
Leadership - Deming Philosophy, Quality Council, Quality statements and Strategic planning- Customer Satisfaction - Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal- Continuous process improvement - Juran Trilogy, PDSA cycle, 5S and Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating and Relationship development.		
UNIT III	**TQM TOOLS & TECHNIQUES I**	**6**

The seven traditional tools of quality - New management tools - Six-sigma Process Capability- Bench marking - Reasons to benchmark, Benchmarking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Benchmarking - FMEA - Intent , Documentation, Stages: Design FMEA and Process FMEA.

UNIT IV	**TQM TOOLS & TECHNIQUES II**	**6**

Quality circles - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures - Cost of Quality - BPR.

UNIT V	**QUALITY MANAGEMENT SYSTEM**	**6**

Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards – Sector-Specific Standards - AS 9100, TS16949 and TL 9000 - ISO 9001 Requirements-Implementation – Documentation - InternalAudits-Registration-Environmental Management System: Introduction - ISO 14000 Series Standards - Concepts of ISO 14001 - Requirements of ISO 14001-Benefits of EMS.

Total: 30Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Apply TQM concepts in a selected enterprise.
CO2: Apply TQM principles in a selected enterprise.
CO3: Understand Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
CO4:Understand Taguchi's Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR.
CO5: Apply QMS and EMS in any organization.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1					1	1	1	2	1	3	1	1	1	

CO2	1	1			1	1	1	2	2	1	3	1	1	1	
CO3	1	1		1	3	1	1	2	2	1	3	1	1	1	
CO4		1			1	1	1	2	2	1	3	1	1	1	
CO5					3	3	3	3	2	1	3	1	1	1	

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	Dale H. Besterfield, Carol Besterfield-Michna, Glen H. Besterfield, Mary Besterfield-Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, “Total Quality Management”, Revised Third Edition, Pearson Education, Indian Reprint, 2018.
T2.	Joel.E. Ross, “Total Quality Management – Text and Cases and Readings”, Third Edition, St.Lucie Press, New York, 2017.

REFERENCE BOOK(S)	
R1.	D. R. Kiran, “Total Quality Management: Key concepts and case studies”, Butterworth – Heinemann, 2016.
R2.	John S. Oakland, “Total Quality Management text with cases”, Third Edition, Butterworth – Heinemann, Oxford, 2012.
R3.	L. Suganthi and Anand A. Samuel, “Total Quality Management”, PHI Learning Private Limited, 2011.

Course Code: 24HSM303	Course Title: Engineering Economics and Financial Accounting	
Course Category: HSMC	**Credits: 2**	
L:T:P (Hours/Week) 2:0:0	**Total Contact Hours: 30**	**Max Marks : 100**

COURSE OBJECTIVES
• To understand the concepts of demand and supply analysis.
• To provide the insight on theory of production and cost analysis.
• To understand the different procedures of pricing.
• To acquire in depth knowledge of financial accounting.
• To determine the factor influencing working capital and its importance.

UNIT I	Demand & Supply Analysis	6
Managerial Economics - Relationship with other disciplines - Firms: Types, objectives and goals - Managerial decisions - Decision analysis. Demand - Types of demand - Determinants of demand - Demand function - Demand elasticity - Demand forecasting - Supply - Determinants of supply - Supply function -Supply elasticity.		
UNIT II	**Production and Cost Analysis**	**6**
Production function - Returns to scale - Production optimization - Least cost input - Isoquants - Managerial uses of production function. Cost Concepts - Cost function - Determinants of cost - Short run and Long run cost curves - Cost Output Decision - Estimation of Cost.		
UNIT III	**Pricing**	**6**
Determinants of Price - Pricing under different objectives and different market structures - Price discrimination - Pricing methods in practice.		
UNIT IV	**Financial Accounting (Elementary Treatment)**	**6**
Balance sheet and related concepts - Profit & Loss Statement and related concepts - Financial Ratio Analysis - Cash flow analysis - Funds flow analysis - Comparative financial statements - Analysis & Interpretation of financial statements.		
UNIT V	**Capital Budgeting (Elementary Treatment)**	**6**

Investments - Risks and return evaluation of investment decision - Average rate of return - Payback Period - Net Present Value - Internal rate of return.
Total: 30 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Describe the overall functions of Demand, Supply, Price and Income of the firms.
CO2: Evaluate the production function and identifies the least cost combination to control the costs of production.
CO3: Understand the structures of various market types and their pricing policies.
CO4:Understand the basic concepts of financial accounting and evaluation of company performance using ratio analysis.
CO5: Understand the types of business forms and also be able to evaluate the investments using capital budgeting techniques.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		1			2		1	2	1	2	1	1	1	
CO2	1		1			2		1	2	1	2	1	1	1	
CO3	1		1			2		1	2	1	2	1	1	1	
CO4	1		1			1	1	1	2	1	3	1	1	1	
CO5	1		1			1	1	1	2	1	2	1	1	1	

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	R. PanneerSelvam, "Engineering Economics", Second Edition, PHI Learning Private Limited, New Delhi, 2013.
T2.	Lila J.Truett and Dale B. Truett, "Managerial Economics: Analysis, Problems and

	Cases", Eighth Edition, Wiley-India, 2008.

REFERENCE BOOK(S)	
R1.	Chan S. Park, "Contemporary Engineering Economics", Global Edition, Pearson Education, 2016.
R2.	Donald G. Newnan, Ted G. Eschenbach, Jerome P. Lavelle and Neal A. Lewis, "Engineering Economics and Analysis" Oxford University Press, 2017.
R3.	William G. Sullivan, Elin M.Wicks and C. Patrick Koelling, "Engineering Economy", 14th Edition, Pearson Education, 2011.

Course Code: 24HSM304	**Course Title: Human Resource Management**	
Course Category: HSMC	**Credits: 2**	
L:T:P (Hours/Week) 2:0:0	**Total Contact Hours: 30**	**Max Marks : 100**

COURSE OBJECTIVES
• To understand the functions, systems and policies of human resource management.
• To recruit and interview job candidates and appraise the performance of the employees.
• To train using various methods of training and implement management development techniques.
• To learn the factors determining the pay rates and salary administration.
• To provide knowledge about management issues related to human factors consideration and compliance with human resource requirements.

UNIT I	**INTRODUCTION TO HUMAN RESOURCE MANAGEMENT**	**6**
Importance of Human Resources - Objective of Human Resource Management - Human Resource Policies - Role of Human Resource Manager.		
UNIT II	**HUMAN RESOURCE PLANNING**	**6**
Importance of Human Resource Planning - Internal and External sources of Human Resources -Recruitment - Selection - Socialization.		
UNIT III	**TRAINING AND EXECUTIVE DEVELOPMENT**	**6**
Types of training and Executive Development methods -Purpose -Benefits.		
UNIT IV	**EMPLOYEE COMPENSATION**	**6**
Compensation plan - Reward - Motivation - Career Development - Mentor -Protege relationships.		
UNIT V	**PERFORMANCE EVALUATION AND CONTROL**	**6**
Performance evaluation - Feedback - the control process - Importance - Methods - Grievances - Causes - Redressal methods.		

Total: 30Hours

COURSE OUTCOMES

At the end of this course, students will be able to

CO1: Develop understanding of the basic concepts, functions and processes of human resource management.

CO2: Apply knowledge of human resource planning and implement techniques of job design.

CO3:Design HRM processes such as Recruitment/Selection/Training/Performance appraisals/Reward Systems etc.

CO4:Implement Employee benefits and Welfare measures.

CO5: Handle employee issues and evaluate the new trends in HRM.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			1	1		2	1	2	2	1	3	1	1	1	
CO2		1	1	1		1		2	2	2	3	1	1	1	
CO3	1			3	1	1		2	2	2	3	1	1	1	
CO4	1			3		1		2	2	1	3	1	1	1	
CO5		1		3	1	1	1	2	2	2	3	1	1	1	

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1. David A. DeCenzo and Stephen P. Robbins, “Fundamentals of Human Resource Management”, 8th Edition, Wiley, 2007.

T2. H John Bernardin, “Human Resource Management – An Experimental Approach”, 5th Edition, Tata McGraw Hill, New Delhi, 2010.

REFERENCE BOOK(S)

R1. Luis R, Gomez-Mejia, David B. Balkin and Robert L. Cardy, “Managing Human Resources”, 8th Edition, Pearson Education, India, 2016.

R2.	Gary Dessler, "Human Resource Management", 13^{th}Edition, Pearson Education, 2013.
R3.	BiswajeetPattanayak, "Human Resource Management", 6^{th}Edition, PHI Learning Private Limited, Delhi, 2020.

Course Code: 24HSM305	Course Title: Knowledge Management	
Course Category: HSMC	**Credits: 2**	
L:T:P (Hours/Week) 2:0:0	**Total Contact Hours: 30**	**Max Marks : 100**

COURSE OBJECTIVES
• To understand the basic concept of knowledge management and knowledge management systems.
• To know the Organizational Structure, Culture, Communities and KM practices, Information Technology as an enabler.
• To identify some of the key tools and techniques used in knowledge management applications.
• To analyse the recent trends in Knowledge Management.
• To formulate a framework for thinking about knowledge intensive organizations.

UNIT I	INTRODUCTION	6
Introduction to knowledge management - foundations of knowledge management- including cultural issues- technology applications organizational concepts and processes- management aspects- and decision support systems. The evolution of knowledge management: From information management to knowledge management - Key challenges facing the evolution of knowledge management - Ethics for knowledge management.		
UNIT II	**CREATING THE CULTURE OF LEARNING AND KNOWLEDGE SHARING**	**6**
Organization and Knowledge Management - Building the Learning Organization. Knowledge Markets: Cooperation among distributed technical specialists - Tacit Knowledge and Quality Assurance.		
UNIT III	**KNOWLEDGE MANAGEMENT-THE TOOLS**	**6**
Telecommunications and Networks in Knowledge Management - Internet Search Engines and Knowledge Management - Information Technology in Support of Knowledge Management - Knowledge Management and Vocabulary Control - Information Mapping in Information		

Retrieval - Information Coding in the Internet Environment - Repackaging Information.		
UNIT IV	**KNOWLEDGE MANAGEMENT APPLICATION**	**6**
Components of a knowledge strategy - Case Studies from Library to Knowledge Center, Knowledge Management in the Health Sciences, Knowledge Management in Developing Countries.		
UNIT V	**FUTURE TRENDS AND CASE STUDIES**	**6**
Advanced topics and case studies in knowledge management - Development of a knowledge management map/plan that is integrated with an organization's strategic and business plan - A case study on Corporate Memories for supporting various aspects in the process life -cycles of an organization.		
		Total: 30Hours

COURSE OUTCOMES

At the end of this course, students will be able to

CO1: Analyse the issues in knowledge management.

CO2: Discuss the various levels in knowledge sharing and learning.

CO3:Express effectively about knowledge management systems, tools and portals.

CO4:Apply the knowledge management in library and information centers.

CO5: Create a knowledge management plan to leverage opportunities to create, capture, represent and share knowledge within an organization.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								3			3	1	1	1	
CO2	1	1				2	1	3	2	3	3	1	1	1	
CO3	1	1	1		2	2	1	3	2		3	1	1	1	
CO4	1	1	1	1	2		1	3	1	1	3	1	1	1	
CO5			1	1	1			3	1	1	3	1	1	1	

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	T. KantiSrikantaiah and Michael E.D.Koenig, “Knowledge Management for the Information Professional”, Information Today, Inc., 2000.
T2.	Mohammad Nazim and Bhaskar Mukherjee, “Knowledge Management in Libraries Concepts, Tools and Approaches”, Chandos Publications, 2016.

REFERENCE BOOK(S)	
R1.	KimizDalkir, “Knowledge Management in Theory and Practice”, 4^{th}Edition, the MIT Press, 2023.
R2.	Donald Hislop, Rachelle Bosua and Remko Helms, “Knowledge Management in Organizations a critical Introduction”, 4^{th}Edition, Oxford University Press, 2018.

Course Code: 24HSM306	Course Title: Industrial Management	
Course Category: HSMC	**Credits: 2**	
L:T:P (Hours/Week) 2:0:0	**Total Contact Hours: 30**	**Max Marks : 100**

COURSE OBJECTIVES
• To study the basic concepts of management, approaches to management, contributors to management studies; various forms of business organization and professional organizations.
• To study the planning, organizing and staffing functions of management in professional organization.
• To study the leading, controlling and decision making functions of management in professional organization.
• To learn the organizational theory in professional organization.
• To learn the principles of productivity and modern concepts in management in professional organization.

UNIT I	INTRODUCTION TO MANAGEMENT	6
Management : Introduction; Definition and Functions - Approaches to the study of Management - Mintzberg's Ten Managerial Roles - Principles of Taylor; Fayol; Weber; Parker - Forms of Organization : Sole Proprietorship; Partnership; Company (Private and Public); Cooperative - Public Sector vs Private Sector Organization - Business Environment : Economic; Social; Political; Legal - Trade Union : Definition; Functions; Merits & Demerits.		
UNIT II	**FUNCTIONS OF MANAGEMENT - I**	**6**
Planning: Characteristics; Nature; Importance; Steps; Limitation; Planning Premises; Strategic Planning; Vision & Mission statement in Planning - Organizing : Organizing Theory; Principles; Types; Departmentalization; Centralization and Decentralization; Authority & Responsibility - Staffing : Systems Approach; Recruiting and Selection Process; Human Resource Development (HRD) Concept and Design.		
UNIT III	**FUNCTIONS OF MANAGEMENT - II**	**6**
Directing (Leading): Leadership Traits; Style; Morale; Managerial Grids (Blake-Mounton,		

Reddin) - Communication: Purpose; Model; Barriers - Controlling: Process; Types; Levels; Guidelines; Audit (External, Internal, Merits); Preventive Control - Decision Making: Elements; Characteristics; Nature; Process; Classifications.		
UNIT IV	**ORGANIZATION THEORY**	**6**
Organizational Conflict : Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management - Maslow's hierarchy of needs theory; Herzberg's motivation-hygiene theory;McClelland's three needs motivation theory; Vroom's valence-expectancy theory -Change Management : Concept of Change; Lewin's Process of Change Model; Sources of Resistance; Overcoming Resistance; Guidelines to managing Conflict.		
UNIT V	**PRODUCTIVITY AND MODERN TOPICS**	**6**
Productivity : Concept; Measurements; Affecting Factors; Methods to Improve - Modern Topics (concept, feature/characteristics, procedure, merits and demerits) : Business Process Reengineering (BPR); Benchmarking; SWOT/SWOC Analysis; Total Productive Maintenance; Enterprise Resource Planning (ERP); Management of Information Systems (MIS).		
		Total: 30Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.
CO2: Discuss the planning; organizing and staffing functions of management in professional organization.
CO3:Apply the leading; controlling and decision making functions of management in professional organization.
CO4:Discuss the organizational theory in professional organization.
CO5: Apply principles of productivity and modern concepts in management in professional organization.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1							1	2	2	3	1	1	1	
CO2	1	1		1	2	1	1	1	2	2	3	1	1	1	1
CO3	1	1		1	2	1	1	1	2	2	3	1	1	1	1
CO4	1		2	1		1		1	2	2	3	1	1	1	1
CO5	1		2	1	2	1		1	2	2	3	1	1	1	

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	M. Govindarajan and S. Natarajan, “Principles of Management”, PHI Learning Private Limited, New Delhi, 2012.
T2.	Harold Koontz and Heinz Weihrich and Mark V. Cannice, “Essentials of Management: An International, Innovation and Leadership Perspective”, 11th Edition, Mc Graw Hill, New Delhi, 2020.

REFERENCE BOOK(S)

R1.	Joseph L Massie, “Essentials of Management”, 4th Edition, Prentice-Hall, 1987.
R2.	Saxena, P. K., “Principles of Management: a Modern Approach”, Global India Publications Private Limited, New Delhi, 2009.
R3.	Samuel C. Certo and S.TrevisCerto, “Modern Management: Concepts and Skills (What’s New in Management)”, 15th Edition, Pearson Education, 2018.

OPEN ELECTIVES OFFERED BY ECE DEPARTMENT

Course Code: 24ECO001	**Course Title: Introduction To Control Engineering**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks : 100**

COURSE OBJECTIVES
• To introduce the control system components and transfer function model with their graphical representation
• To understand the analysis of system in time domain along with steady state error.
• To introduce frequency response analysis of systems.
• To accord basic knowledge in design of compensators.
• To introduce the state space models.

UNIT I	**MATHEMATICAL MODELLING**	**9**
Introduction – transfer function – simple electrical, mechanical, ,pneumatic , hydraulic and thermal systems–analogies		
UNIT II	**FEEDBACK CONTROL SYSTEMS**	**9**
Control system components - Block diagram representation of control systems, Reduction of block diagrams, Signal flow graphs, Output to input ratios		
UNIT III	**TIME DOMAIN ANALYSIS**	**9**
Response of systems to different inputs viz., Step impulse, pulse, parabolic and sinusoidal inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit.		
UNIT IV	**STABILITY ANALYSIS**	**9**
Necessary and sufficient conditions, Routh - Hurwitz criteria of stability, Root locus and Bode techniques ,Concept and construction, frequency response.		
UNIT V	**STATE SPACE TECHNIQUE**	**9**
State vectors–state space models-Digital Controllers–design aspects.		

Total: 45 Hours

COURSE OUTCOMES

At the end of this course, students will be able to

CO1: Represent and develop systems in different forms using the knowledge gained.

CO2: Analyses the system in time and frequency domain and the stability of physical systems.

CO3: Ability to Derive Transfer function Model of Electrical and Mechanical Systems.

CO4: Ability to Obtain the transfer Function by the Reduction of Block diagram & Signal flow graph.

CO5: Acquire and analyze knowledge in State variable model for MIMO systems.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3				1		1		1			
CO2	3	3	3	2				1		1		1			
CO3	2	1	2	1				1		1		1			
CO4	3	3	3	3				1		1		1			
CO5	3	3	3	2				1		1		1			

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1. Nagarath, I.J. and Gopal, M., “Control Systems Engineering”, New Age International Publishers,2017.

T2. Benjamin C. Kuo, “Automatic Control Systems”, Wiley, 2014

REFERENCE BOOK(S)

R1. Katsuhiko Ogata, “Modern Control Engineering”, Pearson, 2015.

R2. John J.D., Azzo Constantine, H. and HoupisSttuart, N Sheldon, “Linear Control System Analysis and Design with MATLAB”, CRC Taylor& Francis Reprint 2009.

R3.	RamesC.Panda and T. Thyagarajan, “An Introduction to Process Modelling Identification and Control of Engineers”, Narosa Publishing House, 2017.

Course Code: 24ECO002	Course Title: SEMICONDUCTOR MANUFACTURING	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand basic semiconductor manufacturing technology
• To know Integrated Circuit Fabrication
• To introduce the basic semiconductor manufacturing processes
• To familiarize with steps involved in CMOS IC chip fabrication
• To explain major processing technology used IC manufacturing.

UNIT I	INTRODUCTION TO SEMICONDUCTOR MANUFACTURING	9
Historical perspective, processing overview, semiconductor materials, semiconductor devices, process technology, fabrication steps.		
UNIT II	**MANUFACTURING PROCESS: CRYSTAL GROWTH, SILICON OXIDATION, PHOTOLITHOGRAPHY**	**9**
Silicon crystal growth, material characterization, thermal oxidation process, impurity redistribution, masking properties of silicon dioxide, oxidation thickness characteristics.		
UNIT III	**MANUFACTURING PROCESS: ETCHING, DIFFUSION, ION IMPLANTATION, FILM DEPOSITION**	**9**
Wet chemical etching, Dry etching, basic diffusion process, extrinsic diffusion, lateral diffusion, Photolithography, Ion Implantation, implanted damage and annealing, epitaxial growth techniques, structures and defects, dielectric deposition, metallization.		
UNIT IV	**PROCESS INTEGRATION**	**9**
Passive components, bipolar technology, MOSFET Technology, MESFET Technology, MEMS Technology.		
UNIT V	**IC MANUFACTURING**	**9**
Electrical testing, packing, statistical process control, computer integrated manufacturing,		

challenges for integration, system-on-a-chip.

COURSE OUTCOMES

At the end of this course, students will be able to

CO1: Relate technology changes from semiconductor manufacturing industry.

CO2: Explain steps for making silicon wafers from sand.

CO3: Apply various technology involved in manufacturing.

CO4: Analyze the integration of steps in CMOS IC chip fabrication.

CO5: Build CMOS-based used in the electronics industry.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1									1	2	
CO2	1	1	2	1										2	
CO3	1	2	1	1										2	
CO4	2	1	2	2									1	1	
CO5		2	2	1									1		

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1. G. S. May and S. M. Sze, "Fundamentals of Semiconductor Fabrication", Wiley India, 2004.

T2. Hong Xiao, "Introduction to Semiconductor Manufacturing Technology", 2nd Edition, SPIE Press, 2012.

REFERENCE BOOK(S)

R1. W. R. Runyan and K. E. Bean, "Semiconductor Integrated Circuit Processing Technology", Addison Wesley Publishing Company, 2010.

R2.	S. A. Campbell, “The Science and Engineering of Microelectronic Fabrication”, Oxford University Press, 2012.
R3.	M. J. Madou, “Fundamentals of Micro fabrication”, CRC Press, 2^{nd} Edition, 2011.
R4.	S. M. Sze, “Semiconductor Devices: Physics and Technology”, 2^{nd}Edition., Wiley India, 2011.

Course Code: 24ECO003	Course Title: Mechatronics	
Course Category:OEC	Credits: 3	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To illustrate the selecting the sensors to develop mechatronics systems.
• To explain the architecture and timing diagram of microprocessor, and also interpret and develop programs.
• To design appropriate interfacing circuits to connect I/O devices with microprocessor.
• To apply PLC as a controller in mechatronics system.
• To design and develop the apt mechatronics system for an application.

UNIT I	INTRODUCTION AND SENSORS	9
Introduction to Mechatronics – Systems – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers: Static and Dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance Sensors – Strain Gauges – Eddy Current Sensor – Hall Effect Sensor –Temperature Sensors – Light Sensors.		
UNIT II	**8085 MICROPROCESSOR**	**9**
Introduction – Pin Configuration - Architecture of 8085 – Addressing Modes – Instruction set, Timing diagram of 8085.		
UNIT III	**PROGRAMMABLE PERIPHERAL INTERFACE**	**9**
Introduction – Architecture of 8255, Keyboard Interfacing, LED display – Interfacing, ADC and DAC Interface, Temperature Control – Stepper Motor Control – Traffic Control Interface.		
UNIT IV	**PROGRAMMABLE LOGIC CONTROLLER**	**9**
Introduction – Architecture – Input / Output Processing – Programming with Timers, Counters and Internal relays – Data Handling – Selection of PLC.		
UNIT V	**ACTUATORS AND MECHATRONICS SYSTEM DESIGN**	**9**
Types of Stepper and Servo motors – Construction – Working Principle – Characteristics,		

Stages of Mechatronics Design Process – Comparison of Traditional and Mechatronics Design Concepts with Examples – Case studies of Mechatronics Systems – Pick and Place Robot – Engine Management system – Automatic Car Park Barrier.

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Select sensors to develop mechatronics systems.
CO2: Explain the architecture and timing diagram of microprocessor, and also interpret and develop programs.
CO3: Design appropriate interfacing circuits to connect I/O devices with microprocessor.
CO4: Apply PLC as a controller in mechatronics system.
CO5: Design and develop the apt mechatronics system for an application.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1								2			
CO2	1	2	1	1								2			
CO3	1	2	1	1								2			
CO4	1	2	1	1								2			
CO5	2	2	1	1								2			

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	Bolton W., “Mechatronics”, 6th Edition, Pearson Education, 2015.
T2.	Ramesh S Gaonkar, “Microprocessor Architecture, Programming and Applications with the 8085”, 6th Edition,Penram International Publishing Private Limited, 2013.

REFERENCE BOOK(S)

R1.	Bradley D.A., Dawson D., Buru N.C. and Loader A.J., “Mechatronics”, Chapman and Hall, 2012.
R2.	Davis G. Alciatore and Michael B. Histand, “Introduction to Mechatronics and Measurement systems”, McGraw Hill Education, 2011.
R3.	Devadas Shetty and Richard A. Kolk, “Mechatronics Systems Design”, Cengage Learning, 2010.

Course Code: 24ECO004	**Course Title: Sensors and Actuators**	
Course Category:OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To illustrate the fundamental concepts of Instrument types and its Sensors
• To analyze the variable resistance and the Inductance Sensors
• To study about the Variable Sensors and the Special Sensors.
• To understand about theAutomotive Actuators
• To study about the Automatic Temperature Control Actuators.

UNIT I	**INTRODUCTION TO MEASUREMENTS AND SENSORS**	**9**
Sensors: Functions- Classifications- Main technical requirement and trends Units and standards-Calibration methods- Classification of errors- Error analysis- Limiting error-Probable error-Propagation of error- Odds and uncertainty- principle of transduction-Classification. Static characteristics- mathematical model of transducers- Zero, First and Second order transducers-Dynamic characteristics of first and second order transducers for standard test inputs.		
UNIT II	**VARIABLE RESISTANCE AND INDUTANCE SENSORS**	**9**
Principle of operation- Construction details- Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezo resistive sensors Inductive potentiometer- Variable reluctance transducers:- EI pick up and LVDT		
UNIT III	**VARIABLE AND OTHER SPECIAL SENSORS**	**9**
Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magnetostrictive, Hall Effect, semiconductor sensor- digital transducers-Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.		
UNIT IV	**AUTOMOTIVE ACTUATORS**	**9**
Electromechanical actuators- Fluid-mechanical actuators- Electrical machines- Direct-current machines- Three-phase machines- Single-phase alternating-current Machines - Duty-type		

ratings for electrical machines. Working principles, construction and location of actuators viz. Solenoid, relay, stepper motor etc.

UNIT V	AUTOMATIC TEMPERATURE CONTROL ACTUATORS	9

Different types of actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system.

COURSE OUTCOMES

At the end of this course, students will be able to

CO1: List common types of sensor and actuators used in vehicles.

CO2: Design measuring equipment's for the measurement of pressure force, temperature and flow.

CO3: Generate new ideas in designing the sensors and actuators for automotive application

CO4: Understand the operation of the sensors, actuators and electronic control.

CO5: Design temperature control actuators for vehicles.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2										1			
CO2	3	2		2	1										
CO3	3	2		2	1										
CO4	3	2		2	1										
CO5	3	2		2	1		2					1			

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Doebelin, Ernest O. Doebelin DhaneshN.Manik, " Measurement Systems", 7th Edition, McGraw Hill Publishers, 2019.
T2.	Robert Brandy, "Automotive Electronics and Computer System", Prentice Hall, 2001.

T3.	Bosch,"Automotive Electrics, Automotive Electronics Systems and Components, Networking and Hybrid Drive", 5th Edition, McGraw Hill Publishers, 2007.

REFERENCE BOOK(S)	
R1.	James D Halderman, " Automotive Electrical and Electronics", Prentice Hall, USA, 2013.
R2.	Tom Denton, "Automotive Electrical and Electronics Systems," 3rd Edition, SAE International, 2004.
R3.	William Ribbens, "Understanding Automotive Electronics -An Engineering Perspective," 7thEdition, Elsevier Butterworth-Heinemann Publishers, 2012.

Course Code: 24ECO005	**Course Title: Wireless Networks**	
Course Category:OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the concept about Wireless networks, protocol stack and standards
• To understand and analyze the network layer solutions for Wireless networks
• To study about fundamentals of 3G Services, its protocols and applications
• To have in depth knowledge on internetworking of WLAN and WWAN
• To learn about evolution of 4G Networks, its architecture and applications

UNIT I	**WIRELESS LAN**	**9**
Introduction-WLAN technologies: - IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee, 6LoWPAN, WirelessHART.		
UNIT II	**MOBILE NETWORK LAYER**	**9**
Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc		

network: Routing: Destination Sequence distance vector, IoT: CoAP.		
UNIT III	**3G OVERVIEW**	**9**
Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3GPP Architecture, User equipment, CDMA2000 overview- Radio and Network components, Network structure, Radio Network, TD-CDMA, TD – SCDMA.		
UNIT IV	**INTERNETWORKING BETWEEN WLANS AND WWANS**	**9**
Internetworking objectives and requirements, Schemes to connect WLANS and 3G Networks, Session Mobility, Internetworking Architecture for WLAN and GPRS, System Description, Local Multipoint Distribution Service, Multichannel Multipoint Distribution System		
UNIT V	**4G & BEYOND**	**9**
Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, IMS Architecture, LTE, Advanced Broadband Wireless Access and Services, MVNO.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Identify and choose wireless transmission standard, physical layer protocol and MAC layer protocol on the basis of various network applications.
CO2: Understand and explain mobile IP and data routing using it. Classify ad hoc network protocols
CO3: Understand the TCP protocol for wireless networks and able to do congestion free transmission over wireless networks.
CO4: Understand the major concepts involved in wireless wide-area networks and its architecture.
CO5: Have knowledge of 4G technologies and analyze various smart antenna techniques, modulation and coding techniques used in 4G technology.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3													
CO2	3	3													
CO3	3	3													
CO4	2	3													
CO5	2														

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Jochen Schiller, ”Mobile Communications”, 2nd Edition, Pearson Education 2012.
T2.	Vijay Garg, “Wireless Communications and Networking”, 1stEdition, Elsevier 2007.

REFERENCE BOOK(S)

R1.	Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband”, 2ndEdition, Academic Press, 2008.
R2.	Anurag Kumar, D.Manjunath, Joy kuri, “Wireless Networking”, 1st Edition, Elsevier 2011.
R3.	Simon Haykin , Michael Moher, David Koilpillai, “Modern Wireless Communications”, 1stEdition, Pearson Education 2013

OPEN ELECTIVES OFFERED BY MECHANICAL DEPARTMENT

Course Code: 24MEO001	**Course Title: Drone Technologies**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks : 100**

COURSE OBJECTIVES
• To understand the basics of drone technology concepts.
• To learn and understand the fundamental of design, fabrication and programming of drone.
• To impart the knowledge of a flying and operation of drone.
• To know about the various applications of drone.
• To understand the safety risks and guidelines of fly safely.

UNIT I	**INTRODUCTION TO DRONE TECHNOLOGY**	**9**
Drone Concept - Vocabulary Terminology- History of drone - Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses- Drone business through entrepreneurship- Opportunities/applications for entrepreneurship and employability.		
UNIT II	**DRONE DESIGN, FABRICATION AND PROGRAMMING**	**9**
Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts -Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations -The methods of programming drone- Download program - Install program on computer-Running Programs- Multi rotor stabilization- Flight modes -Wi-Fi connection.		
UNIT III	**DRONE FLYING AND OPERATION**	**9**
Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment- Drone controls Flight operations –management tool –Sensors-Onboard storage capacity -Removable storage devices- Linked mobile devices and applications.		
UNIT IV	**DRONE COMMERCIAL APPLICATIONS**	**9**
Choosing a drone based on the application -Drones in the insurance sector- Drones in delivering mail, parcel sand other cargo- Drones in agriculture- Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing.		

UNIT V	FUTURE DRONES AND SAFETY	9
The safety risks- Guidelines to fly safely -Specific aviation regulation and standardization-Drone License-Miniaturization of drones- Increasing autonomy of drones -The use of drones in swarms.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO 1: Understand the various types of drone technology, drone fabrication and programming.
CO 2: Apply the suitable operating procedures for functioning a drone.
CO 3: Understand appropriate sensors and actuators for Drones.
CO 4: Apply the drone mechanism for specific applications.
CO 5: Create the programs for various drones.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1					2			1		1	
CO2	3	3	1	1					2			1		1	
CO3	3	3	1	1					2			1		1	
CO4	3	3	1	1					2			1		1	
CO5	3	3	1	1					2			1		1	

(1 -Low, 2 -Medium, 3 -High)

TEXT BOOK(S)	
T1.	Daniel Tal and John Altschuld, “Drone Technology in Architecture, Engineering and construction a Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation”, John Wiley & Sons, Inc, 2021.
T2.	Terry Kilby and Belinda Kilby, “Make: Getting Started with Drones”, Maker Media, Inc, 2016.

REFERENCE BOOK(S)	
R1.	John Baichtal, “Building Your Own Drones: A Beginners Guide to Drones, UAVs, and ROVs”, Que Publishing, 2020.

Course Code: 24MEO002	**Course Title: Introduction to Six Sigma**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks : 100**

COURSE OBJECTIVES
• To understand the core concepts of Six Sigma, including its history, philosophy, and principles.
• To explore various tools and techniques used in Six Sigma for defining, measuring, analysing, improving, and controlling processes.
• To learn Six Sigma methodologies like DFSS and FMEA for designing and optimizing processes.
• To comprehend the strategies for effective implementation of Six Sigma and the challenges faced during its deployment.
• To examine evaluation strategies and continuous improvement techniques, focusing on lean manufacturing and waste reduction.

UNIT I	**SIX SIGMA BACKGROUND AND FUNDAMENTALS**	**9**
Historical Overview -Definition of quality -What is six sigma -TQM and Six sigma - lean manufacturing and six sigma- six sigma and process tolerance -Six sigma and cultural changes -six sigma capability -six sigma need assessments - implications of quality levels, Cost of Poor Quality (COPQ), Cost of Doing Nothing -assessment questions.		
UNIT II	**THE SCOPE OF TOOLS AND TECHNIQUES**	**9**
Tools for definition -IPO diagram, SIPOC diagram, Flow diagram, CTQ Tree, Project Charter -Tools for measurement -Check sheets, Histograms, Run Charts, Scatter Diagrams, Cause and effect diagram, Pareto charts, Control charts, Flow process charts, Process Capability Measurement, Tools for analysis -Process Mapping, Regression analysis, RU/CS analysis, SWOT, PESTLE, Five Whys, interrelationship diagram, overall equipment effectiveness, TRIZ innovative problem solving -Tools for improvement -Affinity diagram, Normal group technique, SMED, 5S, mistake proofing, Value stream Mapping, forced field analysis -Tools		

for control -Radar chart, PDCA cycle, Milestone tracker diagram, Earned value management.		
UNIT III	**SIX SIGMA METHODOLOGIES**	**9**
Design For Six Sigma (DFSS), Design for Six Sigma Method - Failure Mode Effect Analysis (FMEA), FMEA process - Risk Priority Number (RPN) - Six Sigma and Leadership, committed leadership -Change Acceleration Process (CAP) - Developing communication plan -Stakeholder.		
UNIT IV	**SIX SIGMA IMPLEMENTATION AND CHALLENGES**	**9**
Tools for implementation -Supplier Input Process Output Customer (SIPOC) -Quality Function Deployment or House of Quality (QFD) -alternative approach –implementation -leadership training, close communication system, project selection -project management and team -champion training -customer quality index -challenges -program failure, CPQ vs six sigma, structure the deployment of six sigma -cultural challenge -customer/internal metrics.		
UNIT V	**EVALUATION AND CONTINUOUS IMPROVEMENT METHODS**	**9**
Evaluation strategy -the economics of six sigma quality, return on six Sigma (ROSS), ROI, poor project estimates -continuous improvement -lean manufacturing -value, customer focus, Perfection, focus on waste, overproduction -waiting, inventory in process (IIP), processing waste, transportation, motion, making defective products, underutilizing people -Kaizen -5S.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the concepts of Six Sigma and various tools.
CO2: Analyze the solutions and corrective actions to improve process performance and reduce defects using tools like DOE and mistake-proofing.
CO3: Evaluate and develop the control plans and monitor key performance indicators (KPIs) to ensure sustained improvement in processes.
CO4: Create the process documentation, Standard Operating Procedures (SOPs), and regular reviews to maintain improvements over time.
CO5: Understand about the Gain leadership and team management skills for leading Six Sigma projects, including project planning, execution, and resource management.

COURSE ARTICULATION MATRIX															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	1					2			1			
CO2	3	3	1	1					2			1			
CO3	3	3	1	1					2			1			
CO4	3	3	1	1					2			1			
CO5	3	3	1	1					2			1			

(1 -Low, 2 -Medium, 3 -High)

TEXT BOOK(S)	
T1.	Thomas Pyzdek and Paul A. Keller, “The Six Sigma Handbook”, McGraw-Hill, 2018.
T2.	Mikel Harry and Richard Schroeder, “Six Sigma the Breakthrough Management Strategy Revolutionizing the World's Top Corporations”, double day, 2006.

REFERENCE BOOK(S)	
R1.	Michael George, David Rowlands, and Bill Kastle, “What is Lean Six Sigma”, McGraw -Hill 2003.
R2.	Thomas Pyzdek, “The Six Sigma Handbook”, McGraw-Hill, 2000.
R3.	Fred Soleimannejed, “Six Sigma, Basic Steps and Implementation”, Author House, 2004.
R4.	Forrest W. Breyfogle, III and James M. Cupello, Becki Meadows, “Managing Six Sigma a Practical Guide to Understanding, Assessing, and Implementing the Strategy That Yields Bottom-Line Success”, John Wiley & Sons, 2000.

Course Code: 24MEO003	Course Title: Sustainable Engineering	
Course Category: OEC	Credits: 3	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks : 100

COURSE OBJECTIVES
• To be acquainted with sustainability in engineering and its evaluation.
• To provide knowledge in environment and social sustainability.
• To provide the student with the knowledge of strategy to achieve sustainability.
• To familiarize with trends in sustainable operations.
• To create awareness in current sustainable practices in manufacturing industry.

UNIT I	ECONOMIC SUSTAINABILITY	9
Industrial Revolution-Economic sustainability: globalization and international issues Sustainability status - Emerging issues- Innovative products- Reconfiguration manufacturing enterprises - Competitive manufacturing strategies - Performance evaluation- Management for sustainability -Assessments of economic sustainability.		
UNIT II	SOCIAL AND ENVIRONMENTAL SUSTAINABILITY	9
Social sustainability -Introduction-Work management -Human rights - Societal Commitment-Customers -Business practices -Modelling and assessing social sustainability. Environmental issues pertaining to the manufacturing sector: Pollution - Use of resources - Pressure to reduce costs - Environmental management: Processes that minimize negative environmental impacts - environmental legislation and energy costs - need to reduce the carbon footprint of manufacturing Operations-Modelling and assessing environmental sustainability.		
UNIT III	SUSTAINABILITY PRACTICES	9
Sustainability awareness - Measuring Industry Awareness-Drivers and barriers -Availability of sustainability indicators -Analysis of sustainability practicing -Modeling and assessment of sustainable practicing -Sustainability awareness -Sustainability drivers and barriers - Availability of sustainability indicators- Designing questionnaires- Optimizing Sustainability Indexes-Elements –Cost and time model.		
UNIT IV	MANUFACTURING STRATEGY FOR SUSTAINABILITY	9
Concepts of competitive strategy and manufacturing strategies and development of a strategic improvement programme - Manufacturing strategy in business success strategy formation and formulation - Structured strategy formulation - Sustainable manufacturing system design		

options - Approaches to strategy formulation - Realization of new strategies/system designs.

UNIT V	TRENDS IN SUSTAINABLE OPERATIONS	9

Principles of sustainable operations - Life cycle assessment manufacturing and service activities - Influence of product design on operations - Process analysis -Capacity management - Quality management -Inventory management - Just-In-Time systems -Resource efficient design - Consumerism and sustainable well-being.

Total: 45 Hours

COURSE OUTCOMES

At the end of this course, students will be able to

CO 1: Apply the importance of economic sustainability.

CO 2: Understand the importance of sustainable practices.

CO 3: Analyze the drivers and barriers for the given conditions.

CO 4: Apply strategy in sustainable manufacturing.

CO 5: Create the plan for sustainable operation of industry with environmental, cost consciousness.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1					2			1	1	2	
CO2	3	3	1	1					2			1	1	2	
CO3	3	3	1	1					2			1	1	2	
CO4	3	3	1	1					2			1	1	2	
CO5	3	3	1	1					2			1	1	2	

(1 -Low, 2 -Medium, 3 -High)

TEXT BOOK(S)

T1. Davim J.P., “Sustainable Manufacturing”, John Wiley & Sons., United States, 2019.

T2. Ibrahim Garbie, “Sustainability in Manufacturing Enterprises Concepts, Analyses and Assessments for Industry 4.0”, Springer International Publishing., United States, 2021.

REFERENCE BOOK(S)

R1. Jovane F., Ęmper, W.E. and Williams, D.J., “The Manufuture Road towards Competitive and Sustainable High-Adding-Value Manufacturing”, Springer, United

	States, 2019.
R2.	Kutz M., “Environmentally Conscious Mechanical Design”, John Wiley & Sons., United States, 2021
R3.	Seliger G., “Sustainable Manufacturing: Shaping Global Value Creation”, Springer, United States, 2020.

Course Code: 24MEO004	**Course Title: Foundation Skills in Integrated Product Development**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks : 100**

COURSE OBJECTIVES
• To understand the fundamentals of product development, including global trends and product decision-making.
• To explore requirement engineering, system design, and modelling for effective product development.
• To learn various design, testing, and prototyping techniques for product development.
• To understand the concepts of sustenance engineering, product validation, and end-of-life (EoL) support.
• To comprehend the business dynamics of the engineering services industry.

UNIT I	**FUNDAMENTALS OF PRODUCT DEVELOPMENT**	**9**
Global Trends Analysis and Product decision - Social Trends - Technical Trends- Economic Trends -Environmental Trends - Political/Policy Trends - Introduction to Product Development Methodologies and Management - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle - Product Development Planning and Management.		
UNIT II	**REQUIREMENTS AND SYSTEM DESIGN**	**9**
Requirement Engineering - Types of Requirements - Requirement Engineering - traceability Matrix and Analysis -Requirement Management - System Design & Modeling - Introduction to System Modeling - System Optimization -System Specification - Sub-System Design - Interface Design.		
UNIT III	**DESIGN AND TESTING**	**9**
Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques –Challenges in Integration of Engineering Disciplines -Concept Screening & Evaluation - Detailed Design -Component Design and Verification -Mechanical, Electronics and Software Subsystems - High Level Design/Low Level Design of S/W Program - Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and		

Hardware Testing -Prototyping - Introduction to Rapid Prototyping and Rapid Manufacturing - System Integration, Testing, Certification and Documentation		
UNIT IV	**SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT**	**9**
Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation- Sustenance -Maintenance and Repair -Enhancements - Product EoL -Obsolescence Management -Configuration Management - EOL Disposal.		
UNIT V	**BUSINESS DYNAMICS -ENGINEERING SERVICES INDUSTRY**	**9**
The Industry - Engineering Services Industry - Product Development in Industry versus Academia -The IPD Essentials - Introduction to Vertical Specific Product Development processes -Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems - Product Development Trade-offs -Intellectual Property Rights and Confidentiality -Security and Configuration Management.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1. Apply product life cycle concepts to plan and manage product development effectively.
CO2. Analyse system design and optimization techniques for subsystem and interface design.
CO3. Understand the concepts using concept generation techniques.
CO4. Formulate the strategies for product maintenance, repair, and enhancements.
CO5. Evaluate the integration of mechanical, embedded, and software systems in product manufacturing and assembly.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1					2			1	2	1	
CO2	3	3	1	1					2			1	2	1	
CO3	3	3	1	1					2			1	2	1	
CO4	3	3	1	1					2			1	2	1	
CO5	3	3	1	1					2			1	2	1	

(1 -Low, 2 -Medium, 3 -High)

TEXT BOOK(S)	
T1.	Ulrich, Karl T.; Eppinger, Steven D.; Yang, Maria C.; Product Design and Development; 7th Edition; McGraw-Hill Education; 2020.
T2.	Pugh, Stuart; Total Design: Integrated Methods for Successful Product Engineering; 1st Edition; Addison-Wesley Publishing; 1990.

REFERENCE BOOK(S)	
R1.	Cross, Nigel; Engineering Design Methods: Strategies for Product Design; 4th Edition; John Wiley & Sons; 2008.
R2.	Otto, "Product Design: Techniques in Reverse Engineering and New Product Development" 1st Edition; Pearson Education; 2000.

Course Code: 24MEO005	**Course Title: Maintenance Engineering**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks : 100**

COURSE OBJECTIVES
• To understand the principles, objectives and importance of maintenance adopted in industry for successful progress.
• To introduce different maintenance categories, its merits and types of lubrication.
• To expose the idea of condition monitoring, methods and instruments used for allied measurements.
• To learn about failure analysis and repair methods for few mechanical elements.
• To promote computerization in maintenance and inventory management.

UNIT I	**PRINCIPLES OF MAINTENANCE PLANNING**	**9**
Basic principles of maintenance planning - Objectives and principles of planned maintenance activity - Importance and benefits of sound maintenance systems - Maintenance organization - Maintenance economics.		
UNIT II	**MAINTENANCE CATEGORIES AND LUBRICATION**	**9**
Maintenance categories - Comparative merits of each category - Preventive maintenance, Maintenance schedules, Repair cycle - Total Productive Maintenance - Principles and methods of lubrication.		
UNIT III	**CONDITION MONITORING**	**9**
Condition based maintenance - Cost comparison with and without Condition Monitoring - Methods and instruments for condition monitoring - Noise, vibration, wear and temperature measurement.		
UNIT IV	**FAILURE ANALYSIS AND REPAIR METHODS**	**9**
Failure analysis - Failures and their development - Role of Non Destructive Testing in failure analysis - Repair methods for bearings, cylinder block, fuel pump, shaft.		
UNIT V	**COMPUTER AIDED MAINTENANCE MANAGEMENT**	**9**
Approach towards Computerization in maintenance - computer-aided maintenance management system (CAMMS) - Advantages of CAMMS - spare parts and inventory		

centreperformance reporting.
Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain the principles, objectives and importance of maintenance adopted in industry.
CO2: Select the suitable maintenance category and lubrication type.
CO3: Apply the appropriate methods and instruments for condition monitoring.
CO4: Analyze the failures of mechanical systems and select suitable repair methods.
CO5: Utilize computers in maintenance and inventory management.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1					2			1	2	1	
CO2	3	3	1	1					2			1	2	1	
CO3	3	3	1	1					2			1	2	1	
CO4	3	3	1	1					2			1	2	1	
CO5	3	3	1	1					2			1	2	1	

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	Srivastava S.K, “Maintenance Engineering”, S Chand and Company, 2010.
T2.	Mishra R.C, Pathak K, “Maintenance Engineering and Management”, Second edition, Prentice Hall India Learning Pvt. Ltd., 2012.

REFERENCE BOOK(S)	
R1.	Keith Mobley R, Lindley R. Higgins and Darrin J. Wikoff, “Maintenance Engineering” , Seventh edition, McGraw-Hill Professional, 2008.
R2.	Davies A, “Handbook of Condition Monitoring: Techniques and Methodology”, Springer, 2012.
R3.	Otegui Jose Luis, “Failure Analysis, Fundamentals and Applications in Mechanical Components”, Nineteenth edition, Springer, 2014.

OPEN ELECTIVE OFFERED BY CIVIL DEPARTMENT

Course Code: 24CEO001	**Course Title: Environment and Agriculture**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the environmental basis of agriculture and the impact of globalization on agro-ecosystems.
• To analyze the environmental impacts of irrigation, mechanized agriculture, and urbanization on land and water resources.
• To study the effects of climate change, global warming, and water cycle disruptions on agricultural systems
• To examine the relationship between ecological diversity, agricultural biotechnology, and sustainable farming practices.
• To explore emerging agricultural environmental concerns, including global policies, alternative farming methods, and sustainable agricultural solutions.

UNIT I	**ENVIRONMENTAL CONCERNS**	**9**
Environmental basis for agriculture and food - land use and landscape changes - water quality issues - changing social structure and economic focus - globalization and its impacts - agro ecosystems.		
UNIT II	**ENVIRONMENTAL IMPACTS**	**9**
Irrigation development and watersheds - mechanized agriculture and soil cover impacts - erosion and problems of deposition in irrigation systems - agricultural drainage and downstream impacts - agriculture versus urban impacts.		
UNIT III	**CLIMATE CHANGE**	**9**
Global warming and changing environment - ecosystem changes - changing blue – green - grey water cycles - water scarcity and water shortages - desertification.		
UNIT IV	**ECOLOGICAL DIVERSITY AND AGRICULTURE**	**9**

Ecological diversity, wild life and agriculture - GM crops and their impacts on the environment - insets and agriculture - pollination crisis - ecological farming principles - forest fragmentation and agriculture - agricultural biotechnology concerns.

UNIT V	EMERGING ISSUES	9

Global environmental governance - alternate culture systems - mega farms and vertical farms - virtual water trade and its impacts on local environment - agricultural environment policies and its impacts - sustainable agriculture distributed GIS.

Total: 45 Hours

COURSE OUTCOMES

At the end of this course, students will be able to

CO1: Understand the environmental basis of agriculture, land use changes, and the impact of globalization on agro-ecosystems.

CO2: Analyze the environmental impacts of irrigation, mechanized agriculture, soil erosion, and urbanization on land and water resources.

CO3: Evaluate the effects of climate change, global warming, and water cycle disruptions on agricultural sustainability.

CO4: Assess the role of ecological diversity, GM crops, and agricultural biotechnology in sustainable farming practices.

CO5: Explore emerging environmental challenges in agriculture and assess policies, alternative farming methods, and sustainable agricultural solutions.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1				2	2						2	1	1
CO2	2	2	1	2	2	2	2					1	2	2	2
CO3	2	2	2	2	1	2	2					1			
CO4	2	2	2	2	2	2	2	1				2	2		
CO5	2	2	2	2	2	2	2	1				2	2		

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	M.LakshmiNarasaiah, Environment and Agriculture, Discovery Pub. House, 2006.
T2.	Arvind Kumar, Environment and Agriculture, ABH Publications, New Delhi, 2005.

REFERENCE BOOK(S)	
R1.	T.C. Byerly, Environment and Agriculture, United States. Dept. of Agriculture. Economic Research Service, 2006.
R2.	Environment and agriculture: environmental problems affecting agriculture in the Asia and Pacific region; World Food Day Symposium, Bangkok, Thailand. 1989

Course Code: 24CEO002	**Course Title: Green Building Design**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the environmental implications of buildings, including energy use, carbon emissions, water consumption, and waste disposal
• To analyze the impact of building technologies and materials, considering embodied energy, resource utilization, and sustainable alternatives.
• To evaluate thermal comfort in buildings by examining heat transfer characteristics and the effects of geographical location.
• To explore the role of solar energy in buildings, focusing on solar passive cooling and heating techniques through case studies
• To apply green building principles by implementing efficient water management, waste disposal, and urban sustainability practices.

UNIT I	**ENVIRONMENTAL IMPLICATIONS OF BUILDINGS**	**9**
Energy use - carbon emissions - water use, waste disposal; building materials: sources, methods of production and environmental implications - embodied energy in building materials: transportation energy for building materials; maintenance energy for buildings.		
UNIT II	**IMPLICATIONS OF BUILDING TECHNOLOGIES EMBODIED ENERGY OF BUILDINGS**	**9**
Framed construction - masonry construction - resources for building materials, alternative concepts - recycling of industrial and buildings wastes - biomass resources for buildings.		
UNIT III	**COMFORTS IN BUILDING**	**9**
Thermal comfort in buildings issues; heat transfer - characteristic of building materials and building techniques - incidence of solar heat on buildings - implications of geographical locations.		
UNIT IV	**UTILITY OF SOLAR ENERGY IN BUILDINGS**	**9**

Utility of solar energy in buildings - concepts of solar passive cooling and heating of buildings - low energy cooling - case studies of solar passive cooled and heated buildings.

UNIT V	GREEN COMPOSITES FOR BUILDINGS	9

Concepts of green composites - water utilisation in buildings - low energy approaches to water management - management of solid wastes - management of sullage water and sewage. urban environment and green buildings - green cover and built environment.

Total: 45 Hours

COURSE OUTCOMES

At the end of this course, students will be able to

CO1: Explain the environmental implications of buildings, including energy use, carbon emissions, and waste disposal.

CO2: Examine the impact of building technologies and construction materials on sustainability and embodied energy.

CO3: Assess thermal comfort in buildings and determine the influence of heat transfer characteristics of materials.

CO4: Demonstrate the utility of solar energy in buildings and implement solar passive cooling and heating techniques.

CO5: Develop green building solutions incorporating water management, solid waste disposal, and urban environmental sustainability strategies.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1			2	2	1				1	2	1	2
CO2	2	2	2	2	1	2	2	1		1	1	1	2		
CO3	1	1	2	1		2	2			1		1	2		
CO4	2	2	2	2	1	2	2	1		1	1	2	2		
CO5	2	1	1	1		2	2	1					2	1	2

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 2007.
T2.	Low Energy Cooling For Sustainable Buildings. John Wiley and Sons Ltd, 2009.
T3.	Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.

REFERENCE BOOK(S)	
R1.	Osman Attmann, “Green Architecture Advanced Technologies and Materials”, McGraw. Hill, 2010.
R2.	Jerry Yudelson, McGraw Hil “Green building Through Integrated Design”. 2009.

Course Code: 24CEO003	**Course Title: Geographical Information System**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the basic concepts and significance of GIS.
• To understand different database structures, including relational and object-oriented models
• To understand different methods of spatial data input, including scanning and digitization.
• To understand the importance of metadata in GIS.
• To explore various data management functions and their significance.

UNIT I	**FUNDAMENTALS OF GIS**	**9**
Introduction to GIS - basic spatial concepts - coordinate systems - GIS and information systems - definitions - history of GIS - components of a GIS - hardware, software, data, people, methods - proprietary and open source software - types of data - spatial, attribute data- types of attributes - scales/ levels of measurements.		
UNIT II	**SPATIAL DATA MODELS**	**9**
Database structures - relational, object oriented - entities - ER diagram - data models - conceptual, logical and physical models - spatial data models - raster data structures - raster data compression - vector data structures - raster vs vector models- tin and grid data models.		
UNIT III	**DATA INPUT AND TOPOLOGY**	**9**
Scanner - raster data input - raster data file formats - geo referencing - vector data input - digitizer - datum projection and reprojection -coordinate transformation - topology - adjacency, connectivity and containment - topological consistency - non topological file formats - attribute data linking - linking external databases - GPS data integration.		
UNIT IV	**DATA QUALITY AND STANDARDS**	**9**
Data quality - basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage - metadata - GIS standards –interoperability - OGC -		

spatial data infrastructure		
UNIT V	**DATA MANAGEMENT AND OUTPUT**	**9**
Import/Export - data management functions- raster to vector and vector to raster conversion - data output - map compilation - chart/graphs - multimedia - enterprise vs desktop GIS - distributed GIS.		
Total: 45 Hours		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the fundamental principles and components of a Geographic Information System (GIS).
CO2: Analyze differentiate between raster and vector data models and analyze their suitability for specific applications.
CO3: Apply data input techniques to create and manage spatial data, including establishing topological relationships.
CO4: Evaluate spatial data quality based on established standards and recommend appropriate data sharing practices.
CO5: Createdesign and produce effective GIS outputs, including maps and reports, to communicate spatial information.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		1									1	1	1	1
CO2	2		2	1	1							1	1		
CO3	2		2	1	1							1	1		
CO4	2	1	2	2	1							1			
CO5	2	1	2	2	2							1	1	1	1

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Kang - Tsung Chang, Introduction to Geographic Information Systems, McGraw Hill Publishing, 2nd Edition, 2011.
T2.	Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, “An Introduction Geographical Information Systems, Pearson Education, 2nd Edition, 2007.

REFERENCE BOOK(S)	
R1.	Lo. C. P., Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall India Publishers, 2006.

Course Code: 24CEO004	Course Title: Climate Change and its Impacts	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To provide an understanding of the basic structure, composition, and measurable parameters of the Earth's atmosphere.
• To introduce the principles governing atmospheric motion and energy transfer processes.
• To explore the major components and circulation patterns of the global climate system.
• To examine the physical and chemical processes involved in climate system interactions.
• To introduce climate modeling techniques and the analysis of climate change impacts.

UNIT I	BASICS OF WEATHER AND CLIMATE	9
Shallow film of Air– stratified & disturbed atmosphere – law – atmosphere Engine. Observation of parameters: Temperature – Humidity – Wind - Pressure – precipitation-surface – networks. Constitution of atmosphere: well stirred atmosphere – process around turbopause – in dry air – ozone – carbon Dioxide – Sulphur Dioxide– Aerosol - water. Evolution of Atmosphere. State of atmosphere: Air temperature – pressure – hydrostatic – Chemistry – Distribution – circulation.		
UNIT II	**ATMOSPHERIC DYNAMICS**	**9**
Atmosphere dynamics: law – isobaric heating and cooling – adiabatic lapse rates – equation of motion - solving and forecasting. Forces – Relative and absolute acceleration – Earth"s rotation coriolis on sphere – full equation of motion – Geostrophy;- Thermal winds – departures – smallscale motion. Radiation, convection and advections: sun & solar radiation – energy balance – terrestrial radiation and the atmosphere – Green house effect- Global warming - Global budget – radiative fluxes - heat transport. Atmosphere and ocean systems convecting & advecting heat. Surface and boundary layer – smaller scale weather system – larger scale weather system.		
UNIT III	**GLOBAL CLIMATE**	**9**
Components and phenomena in the climate system: Time and space scales – interaction and		

parameterization problem. Gradients of Radiative forcing and energy transports by atmosphere and ocean – atmospheric circulation – latitude structure of the circulation - latitude – longitude dependence of climate features. Ocean circulation: latitude – longitude dependence of climate features – ocean vertical structure – ocean thermohaline circulation – land surface processes – carbon cycle.		
UNIT IV	**CLIMATE SYSTEM PROCESSES**	**9**
Conservation of motion: Force – coriolis - pressure gradient- velocity equations – Application – geotropic wind – pressure co-ordinates. Equation of State – atmosphere – ocean. Application: thermal circulation – sea level rise. Temperature equation: Ocean – air – Application – decay of sea surface temperature. Continuity equation: ocean – atmosphere. Application: coastal upwelling – equatorial upwelling – conservation of warm water mass. Moisture and salinity equation: conservation of mass – moisture. Source & sinks – latent heat. Moist processes – saturation – convection – Wave processes in atmosphere and ocean.		
UNIT V	**CLIMATE CHANGE MODELS**	**9**
Constructing a climate model – climate system modeling – climate simulation and drift – Evaluation of climate model simulation – regional (RCM) – global (GCM) – Global average response to warming – climate change observed to date.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain the fundamental elements and behaviour of the atmosphere and identify key weather parameters.
CO2: Understand how physical forces and energy processes influence atmospheric dynamics and weather systems.
CO3: Describe global atmospheric and oceanic circulation and their roles in shaping climate patterns.
CO4: Understand the key equations and processes that govern motion, temperature, and moisture in the atmosphere and ocean.
CO5: Describe how climate models are built and used to assess current and future climate change.

COURSE ARTICULATION MATRIX															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1			2	2	1					2	1	2
CO2	2	2	2	1	1	2	2			1	1	1	2		
CO3	1	1	2			2	2	1		1		1	1		
CO4	2	2	2	1	1	2	2	1			1	2			
CO5	2	1	1			2	2	1				1	2	1	2

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 2007.
T2.	Low Energy Cooling For Sustainable Buildings. John Wiley and Sons Ltd, 2009.
T3.	Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.

REFERENCE BOOK(S)	
R1.	Osman Attmann Green Architecture Advanced Technologies and Materials. McGraw Hill, 2010.
R2.	Jerry Yudelson Green building Through Integrated Design. McGraw Hill, 2009.
R3.	Fundamentals of Integrated Design for Sustainable Building By Marian Keeler, Bill Burke.

Course Code: 24CEO005	Course Title: Disaster Management	
Course Category: OEC	Credits: 3	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To provide students an exposure to disasters, their significance and types.
• To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
• To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR).
• To enhance awareness of institutional processes in the country.
• To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

UNIT I	INTRODUCTION TO DISASTERS	9
Definition: disaster, hazard, vulnerability, resilience, risks - disasters: types of disasters - earthquake, landslide, flood, drought, fire etc - classification, causes, impacts including social, economic, political, environmental, health, psychosocial, etc.- differential impacts- in terms of caste, class, gender, age, location, disability - global trends in disasters: urban disasters, pandemics, complex emergencies, climate change- dos and don’ts during various types of disasters.		
UNIT II	APPROACHES TO DISASTER RISK REDUCTION (DRR)	9
Disaster cycle - phases, culture of safety, prevention, mitigation and preparedness community based DRR, structural- non-structural measures, roles and responsibilities of- community, panchayat raj institutions/urban local bodies(PRIS/ULBS), states, centre, and other stakeholders- institutional processes and framework at state and central level- state disaster management authority(SDMA) - early warning system - advisories from appropriate agencies.		
UNIT III	INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT	9
Factors affecting vulnerabilities, differential impacts, impact of development projects such as		

dams, embankments, changes in land-use etc. - climate change adaptation- IPCC scenario and scenarios in the context of India - relevance of indigenous knowledge, appropriate technology and local resources.		
UNIT IV	**DISASTER RISK MANAGEMENT IN INDIA**	**9**
Hazard and vulnerability profile of India, components of disaster relief: water, food, sanitation, shelter, health, waste management, institutional arrangements (mitigation, response and preparedness, disaster management act and policy - other related policies, plans, programmes and legislation - role of GIS and information technology components in preparedness, risk assessment, response and recovery phases of disaster - disaster damage assessment		
UNIT V	**DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS**	**9**
Landslide hazard zonation: case studies, earthquake vulnerability assessment of buildings and infrastructure: case studies, drought assessment: case studies, coastal flooding: storm surge assessment, floods: fluvial and pluvial flooding: case studies; forest fire: case studies, man-made disasters: case studies, space based inputs for disaster mitigation and management and field works related to disaster management.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain key concepts related to disasters, including hazard, vulnerability, resilience, and risk.
CO2: Understand disaster risk reduction (DRR) strategies, including structural and non-structural measures.
CO3: Analyze factors affecting vulnerabilities and their differential impacts on different communities.
CO4: Assess India's hazard and vulnerability profile.
CO5: Assess the vulnerabilities of buildings and infrastructure to earthquakes and other hazards.

COURSE ARTICULATION MATRIX															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1				2	2					2	2	1	1
CO2	2	2	1			2	2	1				2	2		
CO3	1	2	2		1	2	2						2		
CO4	1	1	2	1	1	2	2					1	2		
CO5	1			1		2	2						1	1	2

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-938038642
T2.	Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-12590073
T3.	Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
T4.	KapurAnu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCE BOOK(S)	
R1.	Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005.
R2.	Government of India, National Disaster Management Policy, 2009.

OPEN ELECTIVE OFFERED BY EEE DEPARTMENT

Course Code: 24EEO001	**Course Title: Sustainable and Environmental Friendly HVInsulation system**	
Course Category:OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks : 100**

COURSE OBJECTIVES
• To know about the products related with sustainable application.
• TolearnaboutGreenGaseous insulators and its hazardous effects.
• TolearnaboutGreenliquidinsulators and its hazardous effects.
• TolearnaboutGreensolidinsulators and its hazardous effects.
• Tounderstandthestandards and testing ofgreeninsulationsystems.

UNIT I	**SUSTAINABLEANDENVIRONMENTALENERGYANDPRODUCTS**	**9**
Carbonprint,globalwarmingpotential,environmentrequirementforanyproductandsystem.		
UNIT II	**ALTERNATEGREENGASEOUSINSULATORS**	**9**
SF6gasanditshazardousenvironmentaleffects,alternategases,gaseousmixturesandothersources anditsproperties.		
UNIT III	**ALTERNATEGREENLIQUIDINSULATORS**	**9**
Hazardouseffectsofexistingliquiddielectricmaterials(suchasorganicoil),alternatesourcesof environmentalfriendlyliquidsuchasesteroil,vegetableoilsdielectricanditsproperties.		
UNIT IV	**ALTERNATEGREENSOLIDINSULATORS**	**9**
Hazardouseffectsofexistingsoliddielectricmaterials,alternatesourcesofenvironmentalfriendlysoliddielectricanditsproperties.		
UNIT V	**EVOLVING STANDARDS FOR GREEN INSULATION SYSTEMS**	**9**
Requirements, evolving standards of management, testing, usage and disposal of alternate insulation systems, Major applications and standards.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1:Understand sustainableandenvironmentalenergyandproducts.
CO2: Understand the alternategreengaseousinsulators.
CO3:Understandthealternategreenliquidinsulators.
CO4:Understand thealternategreensolidinsulators.
CO5:Understandthestandards and testing of Greeninsulationsystems.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1			1	1	1	1						1		
CO2	2					2	2						2		
CO3	2					2	2						2		
CO4	2					2	2						2		
CO5	2				2	2	2						2		

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	R. Arora and H.C.W Mosch, “High Voltage Insulation Engineering”, 2nd Edition, New Age International Publishers, 2021.
T2.	Chandra SwaroopMeena, Ashwani Kumar andVarun Pratap Singh, “Sustainable Technologies for Energy Efficient Building”, 2ndEdition, CRC Press, 2021.
T3.	U.Mohan Rao and RamanujamSarathi, “Alternative Liquid Dielectrics for High Voltage Transformer Insulation Systems: Performance Analysis and Applications”, 2nd Edition, Wiley- IEEE press, 2021.

REFERENCE BOOK(S)	
R1.	M.H. Fulekar, Bhawana Pathak and R.K. Kale, “Environment and Sustainable Development”, Springer,2020.
R2.	P. Muthukumar andDilipKumar Sakar, “Innovations in Sustainable Energy and Technology”, Springer, 2020.

Course Code: 24EEO002	Course Title: Smart Grids	
Course Category:OEC	Credits: 3	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks : 100

COURSE OBJECTIVES
• Toacquire knowledge about the evolutionofSmartand Interconnectedenergy systems.
• To gain knowledge about the various challenges and benefits of smart grid and the national andinternationalinitiativestaken.
• Toacquire knowledge ontheconcepts relatedwithtransmissioninsmartgridtechnologies.
• To get an insight into smart grid technologies applied to distribution systems.
• Togain knowledge aboutvariouscomputingtechnologiesforSmartOperationoftheGrid.

UNIT I	SMART GRID	9
Evolution of Energy Systems, Concept, Definitions and Need, Difference between Conventional & SmartGrid, Drivers, structures, functions, opportunities, challenges and benefits of Smart Grid, Basics of Microgrid,NationalandInternationalInitiativesinSmartGrid.		
UNIT II	SMARTMETERING	9
Introduction to AdvancedMeteringinfrastructure (AMI)- drivers and benefits, AMI protocols, standardsandinitiatives,AMIneedsinthesmartgrid,Realtimemanagementandcontrol,PhasorMeasurementUnit(PMU).		
UNIT III	SMART GRID TECHNOLOGIES (Transmission)	9
TechnologyDrivers,Smartenergyresources,Smartsubstations,SubstationAutomation,FeederAutomation,Transmissionsystems:EMS, Wide areaMonitoring,Protectionandcontrol.		
UNIT IV	SMART GRID TECHNOLOGIES (Distribution)	9
DMS,Volt/VArcontrol,FaultDetection,Isolationandservicerestoration,Outagemanagement,High-EfficiencyDistribution Transformers,Phase ShiftingTransformers, ElectricVehicles.		
UNIT V	HIGH PERFORMANCE COMPUTING FOR SMART GRID	9

	APPLICATIONS	
LocalAreaNetwork(LAN),HouseAreaNetwork(HAN),WideAreaNetwork(WAN),Broadbando verPowerline(BPL),IPbasedProtocols,Computingtechnologiesfor SmartGridapplications(Web Service toCLOUD Computing),Role ofbigdata andIoT,CyberSecurityforSmartGrid.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1:UnderstandtheimportanceandobjectivesofPowerSystemGrid.
CO2: Understandtheconceptofasmartgrid.
CO3: Identify and discuss smart metering devices and associated technologies on Transmission Sector.
CO4: Deliver an overview of Micro grid and Electric Vehicle Technology on Distribution Sector.
CO5:Interpret the various computing technologies to understand the roleof Cloud computing and IoT for effective and efficient operation of Smart Grid.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2			1		1	1		1			1	2		
CO2	2		2	1		1	1		2			1	2		
CO3	2	2	2	2		2	1		1			2	2	2	
CO4	2	1	2	2		2	1		2			2	2	2	
CO5	2	1	2	2		2	1		2			2	2		

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Stuart Borlase, "SmartGridsAdvancedTechnologiesandSolutions",2^{nd}Edition,CRC,2018.

T2.	JanakaEkanayake,NickJenkins,KithsiriLiyanage,JianzhongWu and AkihikoYokoyama,“SmartGrid:TechnologyandApplications”,JohnWiley,2012.
T3.	JamesMomoh, “SmartGridFundamentalsof DesignandAnalysis”,IEEEpress,2012.

REFERENCE BOOK(S)	
R1.	Ahmed F. Zobaa and Trevor J. Bihl, “Big data analytics in future power systems”, 1st Edition,CRCpress,2018.
R2.	StuartBorlase,“SmartGrid: Infrastructure,TechnologyandSolutions”,CRCPress,2012.
R3.	Janaka B. Ekanayake , “Smart Grid: Technology and Applications”, 1st Edition, Wiley Publications, 2021.

Course Code: 24EEO003	Course Title: Hybrid Energy Technology	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks : 100**

COURSE OBJECTIVES
• To acquire knowledge about different types of hybrid energy systems.
• To know about the various electrical Generators used for the Wind Energy Conversion Systems.
• To design the power converters used in SPV Systems.
• Togain knowledge about thevariouspowerconvertersusedinhybridenergysystems.
• To get knowledge about the performance of the various hybrid Renewable energy systems.

UNIT I	HYBRIDENERGYSYSTEMS	9
Hybrid Energy Systems - Need for Hybrid Energy Systems - Solar - Wind - Fuel Cell - Diesel, Wind - Biomass - Diesel, Micro - Hydel - PV, Ocean and geyser energy - ClassificationofHybridEnergysystems-Importance of Hybrid Energy systems - Advantages and Disadvantages - Environmental aspects ofrenewable energy - Impacts of renewable energy generation on the environment - Present Indian andinternational energy scenario of conventional and RE sources - Ocean energy, Hydel Energy - Wind Energy, Biomass energy, Hydrogen energy - Solar Photovoltaic (PV) and Fuel cells: Operating principles and characteristics.		
UNIT II	**ELECTRICALMACHINESFORWINDENERGYCONVERSIONSYSTEMS**	**9**
Review of reference theory fundamentals - Construction, Principle of operation and analysis: SquirrelCageInduction Generator(SCIG),Doubly Fed Induction Generator(DFIG)- PermanentMagnetSynchronousGenerator(PMSG).		
UNIT III	**POWER CONVERTERS AND ANALYSIS OF SOLAR PV SYSTEMS**	**9**
Power Converters for SPV Systems - Line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing -		

Analysis of SPV Systems - BlockdiagramofthesolarPVsystems-Types of SolarPVsystems:Stand-alonePVsystems.		
UNIT IV	**ANALYSIS OF POWER CONVERTERS FOR HYBRID ENERGY SYSTEMS**	**9**
IntroductiontoPowerConverters-Stand-aloneConverters-AC - DC - ACconverters:uncontrolledrectifiers, PWM Inverters - Bi-Directional Converters - Grid-Interactive Inverters - Matrix converter -MeritsandLimitations.		
UNIT V	**CASESTUDIESFORHYBRIDRENEWABLEENERGYSYSTEMS**	**9**
HybridSystems-RangeandtypeofHybridsystems-PerformanceAnalysis-CostAnalysis-CasestudiesofDiesel - PV,Wind - PV - Fuel - cell,Micro - hydel - PV,Biomass-Diesel - Fuel - cellsystems.		
		Total: 45Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Analyze the impacts of hybrid energy technologies on the environment and demonstrate them to harness electrical power.
CO2: Select a suitable Electrical machine for Wind Energy Conversion Systems and simulate wind energy conversion system.
CO3: Design the power converters such as AC-DC, DC-DC, and AC-AC converters for SPV systems.
CO4: Analyze the power converters such as AC-DC, DC-DC, and AC-AC converters for Hybrid energy systems.
CO5: Interpret the hybrid renewable energy systems.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		2	1		1	1		1			1	2	1	
CO2	2	1	2	1		1	1		1			1	2	2	
CO3	2	2	2	1		1	1		1				2	2	
CO4	2	2	1	2		1	1		1				2	2	
CO5	2	2	2	2		1	1		1			1	1	1	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T 1.	BahmanZohuri,“HybridEnergySystems”,Springer,1st Edition,2018.
T 2.	S.M.Muyeen,“WindEnergyConversionSystems”,1st Edition,Springer, 2012.
T 3.	Md.RabiulIslam,Md.RakibuzzamanShah andMohdHasanAli,“EmergingPowerConvertersforRenewableEnergyandElectricVehicles”,1st Edition,CRCPress,2021.

REFERENCE BOOK(S)	
R1.	ErnstJoshua,“WindEnergyTechnology”, 3rd Edition,PHI,India,2018.
R2.	Rashid.M.H,“PowerelectronicsHandbook”, 4th Edition,Academicpress,2018.
R3.	Rai.G.D,“Non-conventionalenergysources”,6th Edition,Khannapublishers,2017.

Course Code: 24EEO004	Course Title: Introduction to PLC Programming	
Course Category: PEC	Credits: 3	
L:T:P(Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To understandbasicPLCterminologies,PLCarchitectureandoperation.
• To configure and integrate sensors, switches, and solid-state relays in PLC-based control systems.
• To develop PLC logic for simple applications using ladder logic.
• To understand the hardware and software behind PLC and SCADA.
• To gain exposure to the applications of PLC programming.

UNIT I	INTRODUCTION TOPLC	9
Introduction to PLC: Microprocessor, I/O Ports, Isolation, Filters, Drivers, Microcontrollers/DSP,PLC/DDC- PLC Construction: What is a PLC, PLC Memories, PLC I/O, PLC Special I/O, PLCTypes.		
UNIT II	PLCINSTRUCTIONS	9
PLC Basic Instructions: PLC Ladder Language- Function block Programming-Ladder/FunctionBlock functions- PLC Basic Instructions, Basic Examples (Start/Stop Rung, Entry/Reset Rung)-Configuration of Sensors, Switches, Solid State Relays-Interlock examples- Timers, Counters,Examples.		
UNIT III	PLCPROGRAMMING	9
Different types of PLC program, Basic Ladder logic, logic functions, PLC module addressing,registersbasics,basicrelayinstructions,LatchingRelays,arithmeticfunctions,comparisonfunctions,datahandling,datamovefunctions,timer-counterinstructions,input-outputinstructions,sequencer instructions.		
UNIT IV	COMMUNICATIONOFPLCANDSCADA	9
Communication Protocol- Modbus, HART, Profibus. SCADA:-Hardwareandsoftware,Remoteterminalunits,MasterStationandCommunicationarchitectures.		

UNIT V	CASE STUDIES	9
StepperMotorControl-ElevatorControl-CNCMachineControl-conveyorcontrol-InterlockingProblems.		
Total: 45 Hours		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Identify the basic requirements of PLC input/output devices and architecture.
CO2: ApplytheInstructionSetusedforladderLogicandFunctionBlockProgramming.
CO3:Design PLC Programmes by Applying Timer/Counter and Arithmetic and Logic Instructions Studied for Ladder Logic and Function Block.
CO4:Analyze SCADA hardware, software, remote terminal units, master stations, and communication architectures.
CO5:Understand the applications of PLC programming.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1					1		1					
CO2	3	3	2					1		1	2				2
CO3	3	3	3	3	1			1		1					
CO4	3	3		3	3			1		1			3	3	
CO5	3	3	3	2	1			1		1			3	3	3

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	FrankPetruzzula,"ProgrammableLogicControllers",6th Edition, TataMc-GrawHill,2023.
T2.	JohnW.Webb and RonaldA.Reis, "ProgrammableLogicControllersPrinciplesandApplications", 3rd Edition,PHIpublication, 2011.

T3.	Madhuchhanda Mitra and Samarjit Sen Gupta, "Programmable Logic Controllers and Industrial Automation: An Introduction", 2nd Edition, Penram International Publishing () Pvt. Ltd, 2017.

REFERENCE BOOK(S)	
R1.	MadhuchandMitraandSamerjitSengupta,"ProgrammableLogicControllersIndustrial AutomationanIntroduction",2nd Edition, PenramInternationalPublishingPvt.Ltd, 2005.
R2.	J.R.HackworthandF.D.Hackworth,"ProgrammableLogicControllersPrinciplesand Applications",Pearsonpublication, 2004.

Course Code: 24EEO005	**Course Title:Flexible AC Transmission Systems**	
Course Category: OEC	**Credits: 3**	
L:T:P(Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To know about the Power control in Electrical Transmission lines.
• To impart knowledge about static VAR Compensator and its applications.
• To gain knowledge on Thyristor Controlled Series Capacitor and its applications.
• To understand the performanceofpowersystems withFACTScontrollers.
• To acquire knowledge about advanced FACTScontrollers.

UNIT I	**REAL AND REACTIVE POWER COMPENSATION**	**9**
Real and reactive power control in electrical power transmission lines - loads & system compensation-Uncompensated transmission line - shunt and series compensation.		
UNIT II	**STATICVARCOMPENSATOR(SVC)ANDAPPLICATIONS**	**9**
Voltage control by SVC-Advantages of slope in dynamic characteristics-Influence of SVC on system voltage-Design of SVC voltage regulator-TCR-FC-TCR-Modeling of SVC for power flow and fast transient stability- Applications: Enhancement of transient stability - Steadystatepowertransfer- Enhancementofpowersystem damping.		
UNIT III	**THYRISTORCONTROLLEDSERIESCAPACITOR(TCSC)ANDAPPLICATIONS**	**9**
Operation of the TCSC - Different modes of operation - Modelling of TCSC, Variability reactance model - Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit-Enhancement of system damping.		
UNIT IV	**VOLTAGESOURCECONVERTERBASEDFACTS CONTROLLERS**	**9**

Static Synchronous Compensator (STATCOM) - Principle of operation - VI Characteristics. Applications: Steady state power transfer-enhancement of transient stability-prevention of voltage instability. SSSC-operation of SSSC and the control of power flow - modelling of SSSC in load flow and transient stability studies- Dynamic voltage restorer (DVR).		
UNIT V	**ADVANCEDFACTS CONTROLLERS**	**9**
Interline DVR(IDVR) - Unified Power flow controller (UPFC) - Interline power flow controller(IPFC) - Unified Power quality conditioner (UPQC).		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain Power control in Electrical Transmission lines.
CO2: Analyzeanddevelop StaticVARCompensator(SVC) for Steadystatepowertransfer.
CO3: Analyzeanddevelop ThyristorControlledSeriesCapacitor (TCSC) for system stability.
CO4: Analyzetheperformance of steady stateand dynamics offactscontrollers.
CO5: Explain aboutadvanced FACTS controllers.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2					2				2		
CO2	2	1	2	1					2				2		1
CO3	2	2		2					2				2		
CO4	2	2	1	1					2				2		
CO5	2	1	2	2					2				2		1

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	R.MohanMathur andRajivK.Varma,“Thyristor-BasedFactsControllersforElectricalTransmission Systems”, IEEE press andJohnWiley&Sons,Inc,2002.
T2.	NarainG.Hingorani,“UnderstandingFACTS-ConceptsandTechnologyofFlexibleAC Transmission Systems”, Standard Publishers Distributors,2011.

REFERENCE BOOK(S)	
R1.	K.R.Padiyar,“FACTSControllersinPowerTransmissionandDistribution”,New Age International (P) Limited, Publishers, New Delhi, 2008.
R2.	V.K.Sood,“ HVDCandFACTScontrollers-ApplicationsofStaticConvertersinPower System”, KluwerAcademic Publishers, April 2004.

OPEN ELECTIVE OFFERED BY CSE DEPARTMENT

Course Code: 24CSO001	**Course Title: Generative AI**	
Course Category: PEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To Understand the capabilities, evolution, benefits, challenges, and applications of Generative AI.
• To Learn techniques for writing effective prompts and explore different prompt engineering approaches.
• To Study the fundamentals of generative models, including RNNs, LSTMs, GANs, VAEs, transformers, and diffusion models.
• To Explore Generative AI platforms, pre-trained models, and applications for text, image, and code generation.
• To Analyze the ethical, social, and economic implications, along with the limitations and future of Generative AI.

UNIT I	**INTRODUCTION TO GENERATIVE AI**	**9**
Capabilities - History and Evolution -Benefits- Challenges - Applications of Generative AI – Tools for Text, Image Code, Audio and Video generation– Economic Potential of Generative AI - Use cases.		
UNIT II	**PROMPT ENGINEERING TECHNIQUES AND APPROACHES**	**9**
Prompt Creation -Writing effective prompts -Techniques for using text prompts: Zero shot and few-shot prompt techniques – Prompt engineering approaches: Interview pattern, Chain-of Thought, Tree-of Thought - Benefits of using text prompts - Challenges in generating meaningful and coherent prompts.		
UNIT III	**MODELS FOR GENERATIVE AI**	**9**
Basics of Sequential data processing – Building blocks of Generative AI - Discriminative modelling – Generative modelling –Recurrent Neural Networks – Long Short-Term Memory (LSTM) Networks - Generative Adversarial Networks (GANs) - Variational Auto encoders (VAEs) – Transformer–based Models - Diffusion models Applications.		
UNIT IV	**PLATFORMS FOR GENERATIVE AI**	**9**

Introduction to Platforms – Features of platforms – Capabilities -Applications - Pre-trained Models - Challenges – Generation of Text to Text – Generation of Text to Image – Text to Code Generation – Explainable AI – Benefits – Use cases.

UNIT V	ETHICAL ISSUES AND LIMITATIONS OF GENERATIVE AI	9

Limitations of Generative AI – Issues and concerns – Considerations for Responsible Generative AI – Economic Implications – Social Implications – Future and professional Growth of Generative AI.

Total: 45 Hours

COURSE OUTCOMES

At the end of this course, students will be able to

CO1: Understand the capabilities, evolution, benefits, challenges, and applications of Generative AI.

CO2: Apply effective prompt engineering techniques for improving AI-generated outputs.

CO3: Analyze various generative models, including RNNs, LSTMs, GANs, VAEs, transformers, and diffusion models.

CO4: Explore Generative AI platforms, pre-trained models, and multimodal AI generation techniques.

CO5: Evaluate ethical, social, and economic implications along with the future potential of Generative AI.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3			2									2
CO2			2		2			2					1	
CO3		2		2	2									2
CO4					3		3		2				1	
CO5						2		1		1		1		

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	David Foster, "Deep Learning: Teaching Machines to Paint, Write",2nd edition. O'Reilly Media, Inc 2023.
T2.	Joseph Babcock, Raghav Bali, "Generative AI with Python and TensorFlow 2: Create Images, Text, and Music with VAEs, GANs, LSTMs, Transformer

	Models",PacktPublishing,2021

REFERENCE BOOK(S)	
R1.	Ian Good fellow, Joshua Bengio, Aaron Courville, "Deep Learning", MIT Press,2016.
R2.	Ben Auffarth"Generative AI with LangChain: Build Large Language Model (LLM) Apps with Python, ChatGPT, and Other LLMs",2023
R3.	Rajeev Kapur, "AI Made Simple: A Beginner's Guide to Generative Intelligence",2023

Course Code: 24CSO002	Course Title: Game Programming	
Course Category: PEC	Credits: 3	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To understand the concepts of Game design and development.
• To learn the processes, mechanics and issues in Game Design.
• To be exposed to the Core architectures of Game Programming.
• To know about Game programming platforms, frame works and engines.
• To learn to develop games.

UNIT I	3D GRAPHICS FOR GAME PROGRAMMING	9
3D Transformations, Quaternions, 3D Modeling and Rendering, Ray Tracing, Shader Models, Lighting, Color, Texturing, Camera and Projections, Culling and Clipping, Character Animation,Physics-based Simulation, Scene Graphs.		
UNIT II	**GAME ENGINE DESIGN**	**9**
Game engine architecture, Engine support systems, Resources and File systems, Game loop and real-time simulation, Human Interface devices, Collision and rigid body dynamics, Game profiling.		
UNIT III	**GAME PROGRAMMING**	**9**
Application layer, Game logic, Game views, managing memory, controlling the main loop, loading and caching game data, User Interface management, Game event management.		
UNIT IV	**GAMING PLATFORMS AND FRAMEWORKS**	**9**
2D and 3D Game development using Flash, DirectX, Java, Python, Game engines - Unity. DX Studio,		
UNIT V	**GAME DEVELOPMENT**	**9**
Developing 2D and 3D interactive games using DirectX or Python – Isometric and Tile Based Games, Puzzle games, Single Player games, Multi Player games.		
Total: 45 Hours		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Discuss the concepts of Game design and development.
CO2: Design the processes, and use mechanics for game development.
CO3: Explain the Core architectures of Game Programming.
CO4: Use Game programming platforms, frame works and engines.
CO5: Create interactive Games.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3			2									2
CO2			2		2			2					1	
CO3		2		2	2									2
CO4					3		3		2				1	
CO5						2		1		1		1		

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Mike Mc Shaffrfy and David Graham, “Game Coding Complete”, Fourth Edition, Cengage Learning, PTR, 2012.
T2.	David H. Eberly, “3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics” 2 nd Editions, Morgan Kaufmann, 2006.

REFERENCE BOOK(S)

R1.	Ernest Adams and Andrew Rollings, “Fundamentals of Game Design”, 2 nd Edition Prentice Hall / New Riders, 2009.
R2.	Eric Lengyel, “Mathematics for 3D Game Programming and Computer Graphics”, 3 rd Edition, Course Technology PTR, 2011.
R3.	David H. Eberly, “3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics” 2 nd Editions, Morgan Kaufmann, 2006.

Course Code: 24CSO003	Course Title: Neural Networks and Deep Learning	
Course Category: PEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the fundamental concepts of artificial neural networks and their applications.
• To explore different deep learning architectures and their significance in real-world problems.
• To study optimization techniques for training deep neural networks effectively.
• To analyze various deep learning frameworks and tools used for implementation.
• To apply deep learning techniques to solve problems in areas such as image processing, NLP, and speech recognition.

UNIT I	INTRODUCTION TO NEURAL NETWORKS	9
Biological vs. Artificial Neural Networks - Perceptron and Multilayer Perceptron (MLP) - Activation Functions (Sigmoid, ReLU, Tanh, Softmax) - Gradient Descent and Backpropagation Algorithm		
UNIT II	**DEEP LEARNING ARCHITECTURES**	**9**
Introduction to Deep Neural Networks (DNN) - Convolutional Neural Networks (CNN) - Architecture and Applications - Recurrent Neural Networks (RNN) - LSTMs and GRUs - Autoencoders and Generative Adversarial Networks (GANs)		
UNIT III	**OPTIMIZATION TECHNIQUES IN DEEP LEARNING**	**9**
Loss Functions and Cost Functions - Regularization Techniques (Dropout, L1/L2 Regularization) - Batch Normalization and Data Augmentation - Adam, RMSprop, and other Optimization Methods		
UNIT IV	**TOOLS AND FRAMEWORKS FOR DEEP LEARNING**	**9**
Overview of Deep Learning Frameworks (TensorFlow, PyTorch, Keras) - Model Training, Validation, and Hyperparameter Tuning - Transfer Learning and Pretrained Models (ResNet, VGG, BERT) - Deployment of Deep Learning Models		
UNIT V	**APPLICATIONS OF DEEP LEARNING**	**9**
Image Processing and Object Detection (YOLO, Faster R-CNN) - Natural Language Processing (NLP) and Speech Recognition - Reinforcement Learning and AI in Robotics -		

Case Studies in Healthcare, Finance, and Autonomous Systems
Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain the architecture and functioning of different types of neural networks.
CO2: Design and implement deep learning models using different architectures.
CO3: Optimize deep learning models using various training strategies.
CO4: Utilize deep learning frameworks such as Tensor Flow and PyTorch for problem-solving.
CO5: Apply deep learning techniques to domains such as computer vision and natural language processing.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	3	2	2										
CO3	3	3	3	2	2									
CO4	3	3	3	3	2	2								
CO5	3	3	3	3	3	2	1							

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	Ian Goodfellow, YoshuaBengio, Aaron Courville, Deep Learning, MIT Press, 2016.
T2.	Simon Haykin, Neural Networks and Learning Machines, Pearson, 2018.
T3.	François Chollet, Deep Learning with Python, Manning Publications, 2021.

REFERENCE BOOK(S)	
R1.	AurelienGéron, Hands-On Machine Learning with Scikit-Learn, Keras, andTensorFlow, O'Reilly, 2022.
R2.	Charu C. Aggarwal, Neural Networks and Deep Learning: A Textbook, Springer, 2018.
R3.	Satish Kumar, Neural Networks: A Classroom Approach, McGraw-Hill, 2017.

Course Code:24CSO004	Course Title: Introduction to Augmented Reality (AR) / Virtual Reality (VR)	
Course Category: PEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To know the basic concepts of virtual reality.
• To understand visual computation in computer graphics.
• To understand the interaction between the system and the computer.
• To know the application of VR in Digital Entertainment.
• To know the basic concepts of augmented reality.

UNIT I	INTRODUCTION OF VIRTUAL REALITY	9
Fundamental Concept and Components of Virtual Reality - Primary Features and Present Development on Virtual Reality - Multiple Models of Input and Output Interface in Virtual Reality: Input - Tracker - Sensor - Digital Glove - Movement Capture - Video-based Input - 3D Menus & 3DScanner – Output - Visual /Auditory / Haptic Devices.		
UNIT II	**VISUAL COMPUTATION IN VIRTUAL REALITY**	**9**
Fundamentals of Computer Graphics - Software and Hardware Technology on Stereoscopic Display - Advanced Techniques in CG: Management of Large-Scale Environments & Real Time Rendering.		
UNIT III	**INTERACTIVE TECHNIQUES IN VIRTUAL REALITY**	**9**
Body Track - Hand Gesture - 3D Manus - Object Grasp. Development Tools and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR.		
UNIT IV	**APPLICATION OF VR IN DIGITAL ENTERTAINMENT**	**9**
VR Technology in Film & TV Production - VR Technology in Physical Exercises and Games - Demonstration of Digital Entertainment by VR.		
UNIT V	**AUGMENTED AND MIXED REALITY**	**9**
Taxonomy - technology and features of augmented reality - difference between AR and VR - Challenges with AR - AR systems and functionality - Augmented reality methods - visualization techniques for augmented reality - wireless displays in educational augmented		

reality applications - mobile projection interfaces - marker-less tracking for augmented reality - enhancing interactivity in AR environments - evaluating AR systems.
Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain the architecture and functioning of different types of neural networks.
CO2: Design and implement deep learning models using different architectures.
CO3: Optimize deep learning models using various training strategies.
CO4: Utilize deep learning frameworks such as TensorFlow and PyTorch for problem-solving.
CO5: Apply deep learning techniques to domains such as computer vision and natural language processing.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	3	2	2										
CO3	3	3	3	2	2									
CO4	3	3	3	3	2	2								
CO5	3	3	3	3	3	2	1							

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	Burdea, G. C., P. Coffet., “Virtual Reality Technology”, Second Edition, Wiley-IEEE Press, 2003/2006.
T2.	Alan B. Craig, “Understanding Augmented Reality, Concepts and Applications”, Morgan Kaufmann, 2013.

REFERENCE BOOK(S)	
R1.	Alan Craig, William Sherman, Jeffrey Will, “Developing Virtual Reality Applications, Foundations of Effective Design”, Morgan Kaufmann, 2009.
R2.	Jason Jerald, “The VR Book: Human-Centered Design for Virtual Reality”, ACM Books,2015
R3.	Paul Mealy, “Virtual & Augmented Reality For Dummies”, For dummies, 2018

Course Code:24CSO005	**Course Title: High Speed Networks**	
Course Category: OEC	**Credits: 3**	
L:T:P(Hours/Week): 3:0:0	**Total Contact Hours: 45**	**Max Marks : 100**

COURSE OBJECTIVES
• Understand High-Speed Network Technologies
• Analyze Congestion and Traffic Management
• Explore TCP and ATM Congestion Control Mechanisms
• Study Integrated and Differentiated Services
• Learn About QoS-Supporting Protocols

UNIT I	**HIGH SPEED NETWORKS**	**9**
Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture,ATM logical Connection – ATM Cell – ATM Service Categories – AAL. High Speed LAN's: Fast Ethernet – Gigabit Ethernet– Fibre Channel – Wireless LAN's, WiFi and WiMax Networks applications, requirements – Architecture of 802.11.		
UNIT II	**CONGESTION AND TRAFFIC MANAGEMENT**	**9**
Queuing Analysis – Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.		
UNIT III	**TCP AND ATM CONGESTION CONTROL**	**9**
TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm – Window management – Performance of TCP over ATM. Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats – ABR Capacity allocations – GFR traffic management.		
UNIT IV	**INTEGRATED AND DIFFERENTIATED SERVICES**	**9**
Integrated Services Architecture – Approach, Components, Services- Queuing Discipline – FQ – PS – BRFQ – GPS – WFQ – Random Early Detection – Differentiated Services.		
UNIT V	**PROTOCOLS FOR QOS SUPPORT**	**9**
RSVP – Goals & Characteristics, Data Flow, RSVP operations – Protocol Mechanisms–		

Multiprotocol Label Switching – Operations, Label Stacking – Protocol details – RTP – Protocol Architecture – Data Transfer Protocol– RTCP.
Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: compare and analyse the fundamental principles of various high speed communication networks and their protocol architectures
CO2: Analyse the methods adopted for performance modeling of traffic flow and estimation
CO3: Examine the congestion control issues and traffic management in TCP/IP and ATM networks
CO4: Compare, analyse and implement the various routing protocols in simulation software tools examine the various services.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2		1				1	1		1	1	
CO2	1	2	1		1				2	1		1	1	
CO3	1	2	2		1				2	1		1	1	
CO4	1	2	1		1				1	2		1	1	
CO5	1	2	2		1				1	2		1	1	

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	William Stallings, “High speed networks and internet”, Second Edition, PearsonEducation, 2002.

REFERENCE BOOK(S)	
R1.	Warland, Pravin Varaiya, “High performance communication networks”, 2 ndEdition , Jean Harcourt Asia Pvt. Ltd., , 2001.
R2.	IrvanPepelnjk, Jim Guichard, Jeff Apcar, “MPLS and VPN architecture”,Cisco Press, Volume 1 and 2, 2003.
R3.	Abhijit S. Pandya, Ercan Sea, “ATM Technology for Broad BandTelecommunication Networks”, CRC Press, New York, 2004.

EMPLOYABILITY ENHANCEMENT COURSES

Course Code: 24CDC101	**Course Title: Career Development Skills I**	
Course Category: EEC	**Credits: 1**	
L:T:P (Hours/Week) 1:0:0	**Total Contact Hours: 15**	**Max Marks: 100**

COURSE OBJECTIVES
• Learn about the career planning and goal setting to meet the corporate world.
• Develop motivational skills and personality development.
• Develop the methodologies for team building.

UNIT I	**CAREER PLANNING AND GOAL SETTING**	3

Career planning: Self-Assessment – Skills Development – Networking – Professional Development – Flexibility and Adaptability – Work-Life Balance – Seeking Feedback – Stay Updated

Goal Settings: - Set SMART > Specificity – Measurability – Achievability – Relevance – Time-bound – Breakdown into Steps – Review and Adjust – Accountability – Celebrate Achievements

UNIT II	**MOTIVATION**	**3**

Motivation I – Purpose – Learningmind-set – Stay Organized – Embrace Responsibility – Stay appositive – Reflect and Adapt – Peer Recognition and Support – Inspirational Guest Speakers of Role Models

Personality Effectiveness - Self –Awareness **–** Emotional Intelligence – Adaptability – Conflict Resolution – Leadership Skills – Time Management – Continuous Learning – Positive Attitude

i) Building Personality – Self-Reflection and Awareness – Assertiveness and Confidence – Relationship Building – Personal Branding

ii) Discipline – Consistency and Persistence – Self-Control and Delayed Gratification – Accountability – Resilience – Interpersonal Skills and Collaboration – Presentation skills – Learning from Mistakes

UNIT III	PERSONALITY DEVELOPMENT	3
i) Grooming – Dress Code Etiquette – Personal Appearance – Body Language and Posture **ii) Hygiene –** Practices & clothing care **iii) Cleanliness –** Workspace maintenance – Environmental Awareness & Digital hygiene Overall preparation – Role of confidence & Cultural Sensitivity		
UNIT IV	**PRESENTATION AND PUBLIC SPEAKING SKILLS**	**3**
Presentation Speaking Skills – Know the audience – Clear objective – Content structure – Postures and Gestures – Voice projection – Eye contact – appropriate language – Speech Clarity – Visual aids interaction **Public Speaking skills** – Research – audience pulse – Pace and Pause – Expertise – Authenticity – Adaptability to unexpected situations **SWOT Analysis –** EnhancedSelf-awareness – Benchmarking with Strength, Weakness, Challenges and Opportunities – Risk management – Versatility – Decision making		
UNIT V	**TEAM BUILDING**	**3**
Team building – Openness – Cooperation – Building trust – Respect – Diversity and Inclusion – Cohesion – Prioritisation – Learning team culture – Celebrate success **Activity Sessions- i) Debate –** Critical thinking – Confidence building – Persuasive techniques – Ethical reasoning – Empathy **ii)Picture connector –** Imagination and Innovation –Analysis – Societalawareness – Expression – Cognitive development – Playful exploration		
		Total : 15 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Learn about the career planning and goal setting to meet the corporate world.
CO2: Develop motivational skills and personality development.

CO3: Develop the methodologies for team building

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1								3			
CO2								2	2	3		2			
CO3	1	1	1					1	2	2					

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Dr.R.S.Aggarwal,“AModernApproachtoVerbalandNon-verbalReasoning”,SChand Publishing, 2023.
T2.	Arun Sharma and Meenakshi Upadhyay,“Verbal Ability and Reading comprehension”, Tata McGraw Hill Education, 2014.
T3.	Sanjay Kumar and PushpLata,“Communicationskills”,OxfordHigherEducation, 2011.

REFERENCE BOOK(S)

R1.	Arun Sharma,“Logical Reasoning for CAT”, Tata McGraw Hill Education, 2024.
R2.	Peeyush Bhardwaj,“The Hand on Guide to Analytical and Logical Reasoning”, Arihant Publication, 2023.
R3.	NiraKonar,“Communication Skills for Professionals”,PHI learning Pvt.Ltd, 2011.

Course Code: 24CDC102	Course Title: Career Development Skills II	
Course Category: EEC	Credits: 1	
L:T:P (Hours/Week) 1:0:0	Total Contact Hours: 15	Max Marks: 100

COURSE OBJECTIVES
• Develop interpersonal skills.
• Develop Listening and Speaking skills.
• Make interferences and predictions about spoken discourse that enhance RW skills.

UNIT I	MOTIVATION AND INTERPERSONAL SKILLS	3
Motivation II – Offer personalised guidance and support – Engage active learning methods – Create a supportive environment personally – Highlight success stories – Celebrate progress – Follow ups. **Interpersonal Skills** – Verbal, Non-verbal and Listening skills – Analysing problems – Contributing ideas – Positive relationships – Mutual respect – Negotiation.		
UNIT II	**LISTENING AND CONVERSATION SKILLS**	**3**
Listening skills – Focus and attention – Non-verbal cues – Paraphrasing – Understanding emotions – Reflecting feelings – Allowing pause – Avoiding interruption – Respond appropriately – Clarifying and Confirming – Maintaining open-mindedness **Conversation skills –** Openinglines – Ice-breakers – Sharing and expressing ideas – Clarity and relevance – Smooth translations – Articulate thoughts - Avoid judgement – Polite language – Express appreciation – Open to feedback		
UNIT III	**TYPES OF SKILLS**	**3**
Reading skills – Speed and Accuracy – Understanding main ideas – Skimming and Scanning – Word recognition – Expanding vocabulary – Analysing text – Making connections – Evaluate and Synthesise – Academic / Professional/ Personal reading **Writing skills –** Clear communication – Logical organization – Grammar and Mechanics – Avoiding redundancy – Choosing strong words – Tone and Style – Concluding structure –		

Editing and Revision – Originality – Academic/ Professional/ Personal writing **Attitudes –** PositiveAttitudes - Preparedness – Adaptability – Professionalism – Resilience – Listening skills – Teamwork and Collaboration – Curiosity and Learning orientation – Gratitude and Humility **Manners & Behaviour –** Politeness and Courtesy – Confidence without arrogance – Respect for personal space and boundaries – Flexibility and Conflict Resolution skills		
UNIT IV	**TIME AND STRESS MANAGEMENT**	**3**
i) Self-awareness – Understanding Strengths and Weaknesses – Personal values – Emotional intelligence – Self-Reflection and Learning Style **ii) Self-confidence –** building a Positive Self – Image – Overcoming fear of failure – Assertiveness **Time management –** Setting Priorities – Planning and Scheduling – Time Estimation and Budgeting – Minimizing Procrastination – Effective decision making **Stress management** – Stressors Identification - Relaxation techniques – Mindfulness-Physical Activity – Positive thinking - Healthy lifestyle – Sound sleep – Hobbies and leisure activities – Humour and laughter – Say 'no' to unwanted **Emotional intelligence** – Self-regulation – empathy – Societal bearing – Understanding causes and consequences of emotions		
UNIT V	**HIGHER EDUCATION AND ENTREPRENEURSHIP**	**3**
i) Introduction to Higher Education – Specialization – Research opportunities – Career advancement – Employability – **ii) Competitive exams –** Merit recognition – Validation of academic abilities – Global recognition (GRE, GMAT, SAT) – Competitive edge – Global career opportunities – Excel, Grow and Achieve professionally **Introduction to Entrepreneurship –** Independence and autonomy – Opportunity to pursue passion – Innovation and creativity – Creating jobs – Sharing and Mutual growth via collaborations and partnerships.		
		Total : 15 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Develop strong interpersonal skills.
CO2: Develop strong listening and speaking skills.
CO3: Make predictions about spoken discourse that enhance RW skills

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1								3			
CO2								2	2	3		2			
CO3	1	1	1			1		1	2	2		1			

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Dr.R.S.Aggarwal,“AModernApproachtoVerbalandNon-verbalReasoning”,SChand Publishing, 2023.
T2.	ArunSharma and MeenakshiUpadhyay,“VerbalAbilityandReadingcomprehension”,Tata McGraw Hill Education, 2014.
T3.	Sanjay Kumar and PushpLata,“Communicationskills”,OxfordHigherEducation, 2011.

REFERENCE BOOK(S)

R1.	ArunSharma,“LogicalReasoningforCAT”,TataMcGrawHillEducation, 2024.
R2.	PeeyushBhardwaj,“TheHandonGuidetoAnalyticalandLogicalReasoning”, Arihant Publication, 2023.
R3.	NiraKonar,“CommunicationSkillsforProfessionals”,PHIlearningPvt.Ltd, 2011.

Course Code: 24CDC201	Course Title: Career Development Skills III	
Course Category: EEC	**Credits: 1**	
L:T:P (Hours/Week) 1:0:0	**Total Contact Hours: 15**	**Max Marks: 100**

COURSE OBJECTIVES
• To enhance numerical, analytical, and logical reasoning skills.
• To develop professional workplace etiquette and effective email communication skills.

UNIT I	QUANTITATIVE APTITUDE AND REASONING	12
Quantitative Aptitude – Number System – HCF and LCM – Average – AP&GP – Logarithm. Data Interpretation and Logical Reasoning Skills – Tabulations – Logical Sequence – Puzzle Test. Verbal and Non-Verbal Reasoning – Logical Sequence of Words – Truth Verification – Analogy – Figure Matrix. Verbal Ability – Grammar Concepts – Antonyms and Synonyms – Reading Comprehension.		
UNIT II	**BUSINESS ETIQUETTE**	**3**
Workplace Etiquette –Punctuality and Time Management – Professional Attire and Grooming – Respectful Communication – Workspace Cleanliness and Organization – Ethical Behaviour and Integrity. E-Mail Etiquette – Importance of Professional Email Communication – Crafting an Effective Subject Line – Maintaining a Polite and Respectful Tone – Respond with Proper Salutations and Closings–Responding Promptly to Emails – Avoid Excessive Formatting or Emojis – Proper Use of Reply All and Forward Functions – Handling Sensitive or Confidential Information. Activities – RolePlay, Presentation, CaseStudy, MockTeam Meeting, Discussion, Responding to Email.		
		Total: 15 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Develop strong analytical, reasoning, and verbal skills across quantitativeaptitude, data interpretation, logical reasoning, and verbal ability.
CO2: Apply professional workplace etiquette and exhibit proficiency in crafting clear,

respectful, and effective email communication.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1								3			
CO2								2	2	3		2			

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Dr.R.S.Aggarwal,“AModernApproachtoVerbalandNon-verbalReasoning”,SChand Publishing, 2023.
T2.	ArunSharma and MeenakshiUpadhyay,“VerbalAbilityandReadingcomprehension”,Tata McGraw Hill Education, 2014.
T3.	Sanjay Kumar and PushpLata,“Communicationskills”,OxfordHigherEducation, 2011.

REFERENCE BOOK(S)

R1.	ArunSharma,“LogicalReasoningforCAT”,TataMcGrawHillEducation, 2024.
R2.	PeeyushBhardwaj,“TheHandonGuidetoAnalyticalandLogicalReasoning”, Arihant Publication, 2023.
R3.	NiraKonar,“CommunicationSkillsforProfessionals”,PHIlearningPvt.Ltd, 2011.

Course Code: 24CDC202	**Course Title: Career Development Skills IV**	
Course Category: EEC	**Credits: 1**	
L:T:P (Hours/Week) 1:0:0	**Total Contact Hours: 15**	**Max Marks: 100**

COURSE OBJECTIVES
• To strengthen numerical, analytical, and logical reasoning abilities.
• To improve business communication abilities.

UNIT I	**QUANTITATIVE APTITUDE AND REASONING**	**12**
Quantitative Aptitude – Percentage – Profit and Loss – Ratio and Proportion –Pipes and Cistern–Time and Work. Data Interpretation and Logical Reasoning Skills – Bar Graphs–Coding and Decoding – Venn Diagram. Verbal and Non-Verbal Reasoning – Critical Reasoning– Types of Reasoning – Cube and Dice –Pattern Completion. Verbal Ability – Grammar Concepts – Enhancing Vocabulary – One Word Substitution.		
UNIT II	**BUSINESSCOMMUNICATIONSKILLS**	**3**
Business Communication – Effective Listening Skills – Summarizing and Paraphrasing – Presentation, Planning and Delivery. Sales and Negotiations – Understanding Customers' Needs, Building Rapport and Trust – Negotiation Techniques and Closing the Deal – Continuous Improvement and Professional Development. Customer Service – Importance and Key Elements of Effective Customer Service – Empowering Frontline Employees and Leveraging Technology – Measuring and Improving Customer Satisfaction. Activities – Paraphrasing, Self-Introduction, Presentation, Role Play, Group Discussion.		
		Total: 15 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Solveproblemsusingnumerical,analytical,andlogicalreasoningskills.
CO2: Utilize communication techniques for effective business interactions for improving professional efficiency.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1								3			
CO2								2	2	3		2			

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Dr.R.S.Aggarwal,“AModernApproachtoVerbalandNon-verbalReasoning”,SChand Publishing, 2023.
T2.	ArunSharma and MeenakshiUpadhyay,“VerbalAbilityandReadingcomprehension”,Tata McGraw Hill Education, 2014.
T3.	Sanjay Kumar and PushpLata,“Communicationskills”,OxfordHigherEducation, 2011.

REFERENCE BOOK(S)

R1.	ArunSharma,“LogicalReasoningforCAT”,TataMcGrawHillEducation, 2024.
R2.	PeeyushBhardwaj,“TheHandonGuidetoAnalyticalandLogicalReasoning”, Arihant Publication, 2023.
R3.	NiraKonar,“CommunicationSkillsforProfessionals”,PHIlearningPvt.Ltd, 2011.

leaxbercises.

Course Code: 24CDC301	Course Title: Career Development Skills V	
Course Category: EEC	Credits: 1	
L:T:P (Hours/Week) 1:0:0	Total Contact Hours: 15	Max Marks: 100

COURSE OBJECTIVES
• To extend logical reasoning, analytical, and numerical skills.
• To learn how to create effective resumes and job applications.

UNIT I	QUANTITATIVE APTITUDE AND REASONING	12
Quantitative Aptitude – Time and Distance – Boats and Streams– Mixture– Simple Interest– Compound Interest. Data Interpretation and Logical Reasoning Skills – Pie Chart – Blood Relation – Direction Sense. Verbal and Non-Verbal Reasoning – Verbal Analogy– Syllogism–Series –Counting of Figures. Verbal Ability – Word Roots, Affixes and Foreign Words – Idioms and Phrases – Spotting Common Errors.		
UNIT II	**EMPLOYABILITYSKILLS**	**3**
Resume Building –Basic Facts – Resume Types – Sections of Resume – Resume Format – Ordinary Resume "Do's and Don'ts" – Electronic Resume Formats – Using Resume Keywords –Online Resume Banks. Job Application Basic Formats –Personal Information – Work History –Education – Skills and Qualifications – Achievements and Awards – References – Examples. Activities –DevelopingCorporate Resume, DraftingJob Application, RenderingPresentation, Discussion.		
		Total: 15 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Use the logical reasoning, analytical thinking, and numerical skills to find answers for complex problems.
CO2:Apply appropriateformats, sections andkeywordstoeffectively present their qualifications while preparing resume and job application.

COURSE ARTICULATION MATRIX															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	1								3			
CO2								2	2	3		2			

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	Dr.R.S.Aggarwal,“AModernApproachtoVerbalandNon-verbalReasoning”,SChand Publishing, 2023.
T2.	ArunSharma and MeenakshiUpadhyay,“VerbalAbilityandReadingcomprehension”,Tata McGraw Hill Education, 2014.
T3.	Sanjay Kumar and PushpLata,“Communicationskills”,OxfordHigherEducation, 2011.

REFERENCE BOOK(S)	
R1.	ArunSharma,“LogicalReasoningforCAT”,TataMcGrawHillEducation, 2024.
R2.	PeeyushBhardwaj,“TheHandonGuidetoAnalyticalandLogicalReasoning”, Arihant Publication, 2023.
R3.	NiraKonar,“CommunicationSkillsforProfessionals”,PHIlearningPvt.Ltd, 2011.

Course Code: 24CDC302	**Course Title: Career Development Skills VI**	
Course Category: EEC	**Credits: 1**	
L:T:P (Hours/Week) 1:0:0	**Total Contact Hours: 15**	**Max Marks: 100**

COURSE OBJECTIVES
• To broaden logical reasoning, analytical and numerical skills.
• To equip studentswithessentialleadership traits.

UNIT I	**QUANTITATIVE APTITUDE AND REASONING**	**12**
Quantitative Aptitude – Area –Calendar–Clocks–Permutation &Combination–Probability. Data Interpretation and Logical Reasoning Skills – Line Graph-Data Sufficiency–Seating Arrangement. Verbal and Non-Verbal Reasoning – Cause and Effect – Cloze Test –Mirror and Water Images– Mathematical Operator. Verbal Ability – Sentence Formation, Completion, Correction and Improvement – Change of Voice and Speech– Jumbled Sentences and Paragraph Formation.		
UNIT II	**LEADERSHIPETIQUETTE**	**3**
Leadership – Characteristics and Styles – Developing Leadership Skills – Communication and Interpersonal Skills – Motivating and Inspiring Teams – Ethical Leadership – Decision Making – Problem Solving. Behavioural Skills (Using Star Method – Situation, Task, Action and Result) – Introduction – Defining the Context – Identifying the Objectives – Describing the Steps to be Taken – Highlighting the Outcome – Developing Behavioral Skills – STAR Method in Interviews and Benefits. Specific Technical Knowledge – Specialized Skills – Foundational Concepts and Principles – Practical Applications – Industry-Specific Regulations and Standards – Emerging Trends and Innovations – Continuous Learning and Professional Development – Troubleshooting and Problem– Solving Techniques – Collaboration and Knowledge Sharing. Activities – Role Play, Presentation, Case Study, Group Discussion.		
		Total: 15 Hours

COURSE OUTCOMES

At the end of this course, students will be able to
CO1: Utilize logical reasoning, analytical thinking, and numerical skills to solve complex problems.
CO2: Demonstratekeyleadership traitstoeffectivelylead teams.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1								3			
CO2								2	2	3		2			

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Dr.R.S.Aggarwal,“AModernApproachtoVerbalandNon-verbalReasoning”,SChand Publishing, 2023.
T2.	Arun Sharma and Meenakshi Upadhyay, “Verbal Ability and Reading comprehension”, Tata McGraw Hill Education, 2014.
T3.	Sanjay Kumar and Pushp Lata,“Communication skills”,Oxford Higher Education, 2011.

REFERENCE BOOK(S)

R1.	ArunSharma,“LogicalReasoningforCAT”,TataMcGrawHillEducation, 2024.
R2.	PeeyushBhardwaj,“TheHandonGuidetoAnalyticalandLogicalReasoning”, Arihant Publication, 2023.
R3.	NiraKonar,“CommunicationSkillsforProfessionals”,PHIlearningPvt.Ltd, 2011.

Course Code: 24CDC401	Course Title: Career Development Skills VII	
Course Category: EEC	Credits: 1	
L:T:P (Hours/Week) 2:0:0	Total Contact Hours: 30	Max Marks: 100

COURSE OBJECTIVES
• To build skillstoprepareforinterviews,focusingonprofessionalism,clearcommunication, and making a positive impression.
• To enhance studentsabilityfor effective communicationandprofessional success.

UNIT I	INTERVIEW SKILLS	15
Preparing for the Interview – Company and Role – Common Interview Questions – Skills and Experience – Maintain Positive Mind-Set. Before the Interview – Practice Critical Interview Questions – Genuine Questions to Ask the Interviewer – Reviewing Resume – Dress code – Early Arrival – Keep Enough Copies of Resume. During the Interview – Professional Look – Greeting the Interviewer – Answering Questions Confidently. The Interviewee's Behavior – Importance – Creating Good Impression – Body Language – Eye Contact – Tone – Voice – Confidence and Composure – Enthusiasm and Engagement – Responding to Questions. Taking Questions-Types of Questions Expected – Strategies for Answering Questions – Avoiding Pitfalls While Answering-Turning Questions into Opportunities – Maintaining Emotional Control – Leaving a Positive Impression. Tackling Questions – Answering to Behavioural Questions – Responding to Technical Questions – Handling Situational and Hypothetical Questions – Handling Weaknesses and Challenges. Questioning the Interviewer – Demonstrating Interest and Engagement – Showcasing Talents, Knowledge and Research Expertise –Exploring the Company Culture and Values – Inquiring about Growth Opportunities – Addressing Concerns or Challenges – Closing the Interview on a Strong Positive Note. Farewell and Follow-Up – Expressing gratitude – Offering Resources and Support – Importance of Staying in Touch – Contact Information – Inviting Feedback and Follow-Up – Closing Wishes.		
UNIT II	GROUPDISCUSSIONANDMOCKINTERVIEW	15
Group Discussion – Introduction & Importance – Effective Communication in Group Discussion – Roles and Responsibilities – Strategies for Active Participation - Overcoming		

Challenges in Group Discussion – Evaluating the Process – Conclusion and Key Takeaways. Body Language, Voice Modulation – Importance &Techniques for Effective Voice Modulation – Pitch Variation – Tone and Inflection – Volume Control – Pace and Pause – Practical Applications of Voice Modulation. Content and Creativity – Importance of Engaging Content –Leveraging Creativity to Stand Out – Crafting Compelling Narratives – Optimizing for Different Platforms – Measuring and Analyzing Content Performance – Staying Ahead of Trends and Innovations. Basic Mock Interview Sessions – Introduction – Purpose and Benefits – Interview Preparation – Common Interview Questions –Behavioral Interview Techniques–Technical Interview Strategies– Mock Interview Feedback and Reflection – Steps and Resources. Activities – Group Discussion, Role Play, Presentation, Mock Interview.
Total: 30 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Show professionalism, apply clear communication strategies, and effectively present themselves during interviews to make a positive impression.
CO2: Apply effective communication strategies and professional behaviour to enhance their success in various workplace scenarios.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								3	2	3		2			
CO2								3	2	3		2			

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	Marry Stella, “Facing Job Interviews”,Lotus Press, New Delhi, 2007.
T2.	UcoJillertWiersma, “Interview Charisma”, Career Knows Publishing, Norwalk, Connecticut, 2016.
T3.	Theodore Kingsley, “Interviewing Skills 3 in 1”, Indy Pub, 2023.

Course Code : 24CDC221	**Course Title : Mini Project I**	
Course Category : EEC	**Credits : 1**	
L:T:P(Hours/Week) : 0:0:2	**Total Contact Hours : 30**	**Max Marks : 100**

REFERENCE BOOK(S)	
R1.	Stephen R Covey, "SevenHabitsof HighlyEffectivePeople", G.K Hall, 1997.
R2.	Sanjay Kumar and PushpLata,"Communicationskills",OxfordHigherEducation, 2011.
R3.	NiraKonar,"CommunicationSkillsforProfessionals",PHIlearningPvt.Ltd, 2011.

COURSE OBJECTIVES
• To enhance students' analytical skills for better problem understanding and evaluation.
• To foster a passion for problem-solving through engaging and challenging tasks.
• To develop students' ability to apply engineering concepts in real-world scenarios effectively.

COURSE OUTCOMES
At the end of this course, students will be able to:
CO 1: Formulate a real-world problem, identify the requirements, and design solutions.
CO 2: Identify technical ideas, strategies, and methodologies.
CO 3: Utilize new tools, algorithms, and techniques to contribute to the solution.
CO 4: Test and validate the prototype for cost-effectiveness.
CO 5: Prepare a report and deliver oral demonstrations.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1	2	-	-	2	2	2	-	-			
CO2	1	2	1	1	2	-	-	2	2	2	-	-			
CO3	1	2	1	1	2	-	-	2	2	2	2	-			
CO4	1	2	1	1	2	-	-	2	2	2	2	-			
CO5	1	2	-	-	2	-	-	2	2	2	-	-			

Course Code :24CDC222	Course Title: Mini Project II	
Course Category: EEC	Credits:1	
L:T:P(Hours/Week) : 0:0:2	Total Contact Hours:30	Max Marks:100

COURSE OBJECTIVES
• To enhance students' analytical skills for better problem understanding and evaluation.
• To foster a passion for problem-solving through engaging and challenging tasks.
• To develop students' ability to apply engineering concepts in real-world scenarios effectively.

COURSE OUTCOMES
At the end of this course, students will be able to:
CO 1: Formulate a real-world problem, identify the requirements, and design solutions.
CO 2: Identify technical ideas, strategies, and methodologies.
CO 3: Utilize new tools, algorithms, and techniques to contribute to the solution.
CO 4: Test and validate the prototype for cost-effectiveness.
CO 5: Prepare a report and deliver oral demonstrations.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1	2	-	-	2	2	2	-	-			
CO2	1	2	1	1	2	-	-	2	2	2	-	-			
CO3	1	2	1	1	2	-	-	2	2	2	2	-			
CO4	1	2	1	1	2	-	-	2	2	2	2	-			
CO5	1	2	-	-	2	-	-	2	2	2	-	-			

Course Code :24CDC321	Course Title: Mini Project III	
Course Category: EEC	Credits:1	
L:T:P(Hours/Week) : 0:0:2	Total Contact Hours:30	Max Marks:100

COURSE OBJECTIVES
• To enhance students' analytical skills for better problem understanding and evaluation.
• To foster a passion for problem-solving through engaging and challenging tasks.
• To develop students' ability to apply engineering concepts in real-world scenarios effectively.

COURSE OUTCOMES
At the end of this course, students will be able to:
CO 1: Formulate a real-world problem, identify the requirements, and design solutions.
CO 2: Identify technical ideas, strategies, and methodologies.
CO 3: Utilize new tools, algorithms, and techniques to contribute to the solution.
CO 4: Test and validate the prototype for cost-effectiveness.
CO 5: Prepare a report and deliver oral demonstrations.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1	2	-	-	2	2	2	-	-			
CO2	1	2	1	1	2	-	-	2	2	2	-	-			
CO3	1	2	1	1	2	-	-	2	2	2	2	-			
CO4	1	2	1	1	2	-	-	2	2	2	2	-			
CO5	1	2	-	-	2	-	-	2	2	2	-	-			

Course Code :24CDC322	Course Title: Mini Project IV	
Course Category: EEC	**Credits:1**	
L:T:P(Hours/Week) : 0:0:2	**Total Contact Hours:30**	**Max Marks:100**

COURSE OBJECTIVES
• To enhance students' analytical skills for better problem understanding and evaluation.
• To foster a passion for problem-solving through engaging and challenging tasks.
• To develop students' ability to apply engineering concepts in real-world scenarios effectively.

COURSE OUTCOMES
At the end of this course, students will be able to:
CO 1: Formulate a real-world problem, identify the requirements, and design solutions.
CO 2: Identify technical ideas, strategies, and methodologies.
CO 3: Utilize new tools, algorithms, and techniques to contribute to the solution.
CO 4: Test and validate the prototype for cost-effectiveness.
CO 5: Prepare a report and deliver oral demonstrations.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1	2	-	-	2	2	2	-	-			
CO2	1	2	1	1	2	-	-	2	2	2	-	-			
CO3	1	2	1	1	2	-	-	2	2	2	2	-			
CO4	1	2	1	1	2	-	-	2	2	2	2	-			
CO5	1	2	-	-	2	-	-	2	2	2	-	-			

Course Code : 24CDC422	Course Title : Project Work Phase I	
Course Category : EEC	**Credits : 2**	
L:T:P(Hours/Week) : 0:0:4	**Total Contact Hours :60**	**Max Marks :100**

COURSE OBJECTIVES
• To enable students to apply learned technologies in the design, analysis, and simulation of physical systems.
• To help students integrate various systems into a cohesive and functional product.
• To develop students' ability to work effectively in teams and manage time constraints.
• To improve students' skills in presenting and documenting technical work clearly in both oral and written formats.

COURSE OUTCOMES
At the end of this course, students will be able to:
CO 1: Design, analyze, realize/simulate a physical system by using the technology they learned during the program.
CO 2: Integrate various systems into a single product.
CO 3: Work in a team with confined time duration.
CO 4: Disseminate their work both in oral and written format.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	2	2	-	-	-	3			
CO2	3	3	3	3	3	2	2	2	-	-	-	3			
CO3	-	-	-	-	-	-	-	-	3	-	-	-			
CO4	-	-	-	-	-	-	-	-	-	3	3	-			

COURSE ASSESSMENT METHODS:

Direct	Indirect
1. Interdisciplinary work 2. Innovation 3. Working model/ simulation result 4. Report with good referencing 5. End Semester Viva Voce	1. Course end survey
Students are required to work in groups of up to 4 members to complete their main project. Special exceptions may be granted for interdisciplinary projects and computer-based simulations, with prior approval from the department committee. Management-related projects will not be permitted. Interdisciplinary projects will be given higher weightage.	

Course Code : 24CDC423	Course Title : Project Work Phase II	
Course Category : EEC	Credits : 2	
L:T:P(Hours/Week) : 0:0:4	Total Contact Hours :60	Max Marks : 100

COURSE OBJECTIVES
• To enable students to apply learned technologies in the design, analysis, and simulation of physical systems.
• To help students integrate various systems into a cohesive and functional product.
• To develop students' ability to work effectively in teams and manage time constraints.
• To improve students' skills in presenting and documenting technical work clearly in both oral and written formats.

COURSE OUTCOMES
At the end of this course, students will be able to:
CO 1: Design, analyze, realize/simulate a physical system by using the technology they learned during the program.
CO 2: Integrate various systems into a single product.
CO 3: Work in a team with confined time duration.
CO 4: Disseminate their work both in oral and written format.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	2	2	-	-	-	3			
CO2	3	3	3	3	3	2	2	2	-	-	-	3			
CO3	-	-	-	-	-	-	-	-	3	-	-	-			
CO4	-	-	-	-	-	-	-	-	-	3	3	-			
Max															

COURSE ASSESSMENT METHODS:

Direct	Indirect
1. Interdisciplinary work 2. Innovation 3. Working model/ simulation result 4. Report with good referencing 5. End Semester Viva Voce	1. Course end survey
Students are required to work in groups of up to 4 members to complete their main project. Special exceptions may be granted for interdisciplinary projects and computer-based simulations, with prior approval from the department committee. Management-related projects will not be permitted. Interdisciplinary projects will be given higher weightage.	

Course Code: 24MAC221	Course Title: Summer Internship I	
Course Category: MC	**Credits: 0**	
L:T:P (Hours/Week):0:0:0	**Total Contact Hours: 2weeks**	**Max Marks: 100**

COURSE OBJECTIVES
• To enable students to apply theoretical knowledge to real-world engineering challenges.
• To expose students to industry-standard tools, technologies, and practices.
• To enhance professional skills such as teamwork, communication, and time management in a workplace environment

COURSE OUTCOMES
At the end of this course, students will be able to:
CO 1: Apply engineering principles to design and solve real-world problems using acquired knowledge.
CO 2: Analyze industry processes and technologies to evaluate their effectiveness in solving engineering challenges.
CO 3: Evaluate the performance of engineering systems and propose enhancements based on hands-on experience.
CO 4: Design and implement innovative solutions in collaborative projects, demonstrating leadership and teamwork.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	1	1	2	1	2	1			
CO2	3	3	2	3	2	2	2	1	2	2	2	2			
CO3	3	2	3	3	2	2	2	2	2	2	2	2			
CO4	3	2	3	2	3	2	3	1	3	3	3	2			

Course Code: 24MAC321	Course Title: Summer Internship II	
Course Category: MC	Credits: 0	
L:T:P (Hours/Week):0:0:0	Total Contact Hours: 2 Weeks	Max Marks: 100

COURSE OBJECTIVES
• To enable students to apply theoretical knowledge to real-world engineering challenges.
• To expose students to industry-standard tools, technologies, and practices.
• To enhance professional skills such as teamwork, communication, and time management in a workplace environment

COURSE OUTCOMES
At the end of this course, students will be able to:
CO 1: Apply engineering principles to design and solve real-world problems using acquired knowledge.
CO 2: Analyze industry processes and technologies to evaluate their effectiveness in solving engineering challenges.
CO 3: Evaluate the performance of engineering systems and propose enhancements based on hands-on experience.
CO 4: Design and implement innovative solutions in collaborative projects, demonstrating leadership and teamwork.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	1	1	2	1	2	1			
CO2	3	3	2	3	2	2	2	1	2	2	2	2			
CO3	3	2	3	3	2	2	2	2	2	2	2	2			
CO4	3	2	3	2	3	2	3	1	3	3	3	2			