SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY
An Autonomous Institution, Affiliated to Anna University
Coimbatore - 641 008

DEPARTMENT OF CIVIL ENGINEERING

CURRICULUM AND SYLLABI

BE CIVIL ENGINEERING

REGULATION 2022

SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY

An Autonomous Institution affiliated to Anna University, Chennai

Kuniamuthur, Coimbatore - 641 008

DEPARTMENT OF CIVIL ENGINEERING

BE CIVIL ENGINEERING

CURRICULUM AND SYLLABIREGULATION 2022 (B:2022-2026)

CHOICE BASED CREDIT SYSTEM

SRI KRISHNA COLLEGE OF ENGNEERING AND TECHNOLOGY

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VISION AND MISSION OF THE DEPARTMENT

Our Vision

To be a center of excellence in Civil Engineering Education through full-fledged learning experience along with research.

Our Mission

To accomplish our vision, we are committed to

M1: Faculty experts from all specialization of Civil Engineering to facilitate teaching learning process

M2: Excellent infrastructure facilities to apply Civil Engineering knowledge and perform societal based research

M3: Exposure to latest technologies in Civil Engineering through industry-institute interaction and professional bodies

M4: Environs to develop their innovative thoughts, ethics, communication, inter- and intra-personal skills

M5: Enthusiasm towards self-learning, social responsibility and entrepreneurship

Program Outcomes (POs):-

At the time of their graduation students of Civil Engineering Program should be in possession of the following Program Outcomes

PO 1. **Engineering knowledge:** Apply the knowledge of mathematics, science and engineering fundamentals for the solution of complex Civil Engineering problems.

PO 2. **Problem analysis:** Identify, formulate and analyse complex Civil Engineering problems reaching substantiated conclusions using first principles of mathematics and engineering sciences.

PO 3. **Design/development of solutions:** Design solutions for complex Civil Engineering problems and design system components with appropriate consideration for public health & safety, cultural, societal and environmental considerations.

PO 4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis & interpretation of data and synthesis of the information to provide valid conclusions.

PO 5. **Modern tool usage:** Create, select & apply appropriate techniques, resources, modern engineering and IT tools, including prediction and modeling to complex Civil Engineering activities, with an understanding of the limitations.

PO 6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal & cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 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.

PO 8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities as well as norms of the engineering practice.

PO 9. **Individual and team work:** Function effectively as an individual, a member or leader in diverse teams and in multidisciplinary settings.

PO 10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with the 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.

PO 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.

PO 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.

Program Educational Objectives (PEOs):-

The following Program Educational Objectives are designed based on the department mission

1. To apply knowledge of mathematics, science and engineering to solve existing problems in the area of Structural, Geotechnical, Water Resources, Environmental, Transportation, Urban Planning, Construction Materials and Management in Civil Engineering
2. To analyze, design, construct Civil Engineering traditional and modern structures

3. To perform investigation on any complicated Civil Engineering problems by conducting research using modern equipment's and software tools
4. To communicate and develop strong inter- and intra- personal skills to prepare them for placement and higher studies
5. To be self-motivated towards lifelong learning and entrepreneurship

Mapping of POs to PEOs

Program Educational Objectives	Program Outcomes											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
PEO 1	**3**	**2**	**3**	2	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**2**
PEO 2	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**3**
PEO 3	**3**	**3**	**3**	**2**	3	**3**	**2**	**2**	**2**	**3**	**2**	**3**
PEO 4	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**3**
PEO 5	**3**	**3**	**3**	**2**	3	**3**	**2**	**2**	**2**	**3**	**2**	**3**

1	Reasonably agreed	**2**	Moderately agreed	**3**	Strongly agreed

Program Specific Outcomes (PSOs):-

At the end of the Program, Graduate shall have

PSO 1	**Analytical Knowledge and Practical Skills**	The ability to analyse, design and interpret by applying the concepts of mathematics and physical sciences in the core areas of Civil Engineering.
PSO 2	**Civil Engineer and Sustainability**	The propensity to excel in portfolio of waste management, sanitation, housing and construction management for the sustainable environment.
PSO 3	**Environment and Social Commitment**	The ability to acquire and update knowledge continuously and offer engineering solutions to meet the environmental and societal needs.

B.E. CIVIL ENGINEERING - REGULATION 2022 (B:2022-2026)

CHOICE BASED CREDIT SYSTEM
I – VIII SEMESTER CURRICULUM AND SYLLABI

SEMESTER I									
SL. No.	**Course Code**	**Course**	**L**	**T**	**P**	**Contact hrs./wk.**	**C**	**Ext / Int**	**Cat.**
1.	22CE101	Introduction to Civil Engineering	3	0	0	3	3	60 / 40	HSMC
2.	22MA101	Engineering Mathematics I	3	1	0	4	4	60 / 40	BSC
3.	22EE113	Fundamentals of Electrical and Electronics Engineering	3	0	0	3	3	60 / 40	ESC
4.	22PH104	Applied Physics	3	0	2	5	4	50 / 50	BSC
5.	22EN101	Technical Communication Skills	2	0	2	4	3	50 / 50	BSC
6.	22CS101	Problem solving using C++	3	0	2	5	4	50 / 50	ESC
7.	22CE102	Engineering Practices Laboratory	0	0	4	4	2	40/60	ESC
8.	22EE115	Fundamentals of Electrical and Electronics Engineering Laboratory	0	0	2	2	1	40/60	ESC
9.	22MC101	Mandatory Course I	3 WEEKS				0	0/100	MC
		Total	**17**	**1**	**12**	**30**	**24**	**900**	

SEMESTER II									
SL. No.	**Course Code**	**Course**	**L**	**T**	**P**	**Contact hrs./wk.**	**C**	**Ext / Int**	**Cat.**
1.	22GE201	Universal Human Values	3	0	0	3	3	60/40	HSMC
2.	22ME101	Engineering Mechanics	3	0	0	3	3	60/40	ESC
3.	22MA201	Engineering Mathematics II	3	1	0	4	4	60/40	BSC
4.	22CH101	Engineering Chemistry	3	0	2	5	4	50/50	BSC
5.	22CS201	Data Structures and Algorithms	3	0	2	5	4	50/50	ESC
6.	22TA101	Heritage of Tamils	1	0	0	1	1	60/40	HSMC
7.	22CE201	Engineering Graphics Laboratory	0	0	4	4	2	40/60	ESC
8.	22MCxxx	Mandatory Course II	2	0	0	2	0	0/100	MC
		Total	**18**	**1**	**8**	**27**	**21**	**800**	

SEMESTER III									
SL. No.	**Course Code**	**Course**	**L**	**T**	**P**	**Contact hrs./wk.**	**C**	**Ext / Int**	**Cat.**
1.	22CE301	Surveying and Geomatics	3	1	0	4	4	60/40	PCC
2.	22MA301	Probability and Numerical Methods	3	1	0	4	4	60/40	BSC
3.	22CE302	Architectural Planning and Building Drawing	3	0	3	6	4.5	50/50	ESC
4.	22CE303	Strength of Materials	3	0	3	6	4.5	50/50	PCC
5.	22IT311	Introduction to Python programming	1	0	4	5	3	50/50	ESC
6.	22TA201	Tamils and Technology	1	0	0	1	1	60/40	HSMC
7.	22CE304	Surveying and Geomatics Laboratory	0	0	3	3	1.5	40/60	PCC
8.	22MCxxx	Mandatory Course III	2	0	0	2	0	0/100	MC
		Total	**16**	**2**	**13**	**31**	**22.5**	**800**	

SEMESTER IV									
SL. No.	**Course Code**	**Course**	**L**	**T**	**P**	**Contact hrs./wk.**	**C**	**Ext / Int**	**Cat.**
1.	22CE401	Environmental Engineering	3	0	0	3	3	60/40	PCC
2.	22xxxxx	Open Elective I	1 or 3	0 or 0	4 or 0	5 or 3	3	50/50 or 60/40	OEC
3.	22CE402	Construction Materials and Technology	3	0	3	6	4.5	50/50	PCC
4.	22CE403	Fluid Mechanics and Hydraulic Machinery	3	0	3	6	4.5	50/50	PCC
5.	22CE404	Structural Analysis	3	0	3	6	4.5	50/50	PCC
6.	22CE405	Environmental Engineering Laboratory	0	0	3	3	1.5	40/60	PCC
7.	22EES101	Employability Enhancement Skills (Internship / Training – 2 weeks)					1	40/60	EES
8.	22MCxxx	Mandatory Course IV	2	0	0	2	0	0/100	MC
		Total	**15**	**0**	**16**	**31**	**22**	**800**	

SEMESTER V									
SL. No.	**Course Code**	**Course**	**L**	**T**	**P**	**Contact hrs./wk.**	**C**	**Ext / Int**	**Cat.**
1.	22CE501	Geotechnical Engineering	3	1	0	4	4	60/40	PCC
2.	22CExxx	Professional Elective I	3	0	0	3	3	60/40	PEC
3.	22xxxxx	Open Elective II	1 or 3	0 or 0	4 or 0	5 or 3	3	50/50 or 60/40	OEC
4.	22CE502	Design of Reinforced Concrete Structures	3	0	3	6	4.5	50/50	PCC
5.	22CE503	Transportation Engineering	3	0	3	6	4.5	50/50	PCC
6.	22CE504	Soil Mechanics Laboratory	0	0	3	3	1.5	40/60	PCC
7.	22EES102	Employability Enhancement Skills (Internship / Training – 2 weeks)					1	40/60	EES
		Total	**13**	**1**	**13**	**27**	**21.5**	**700**	

SEMESTER VI									
SL. No.	**Course Code**	**Course**	**L**	**T**	**P**	**Contact hrs./wk.**	**C**	**Ext / Int**	**Cat.**
1.	22CE601	Construction Planning and Management	3	1	0	4	4	60/40	PCC
2.	22Cexxx	Professional Elective II	3	0	0	3	3	60/40	PEC
3.	22Cexxx	Emerging Elective I	3	0	0	3	3	60/40	EEC
4.	22Cexxx	Emerging Elective II	3	0	0	3	3	60/40	EEC
5.	22CE602	Construction Cost Estimation and Valuation	3	0	3	6	4.5	50/50	PCC
6.	22CE603	Design of Steel Structures	3	0	3	6	4.5	50/50	PCC
7.	22CE604	Project Planning and Development Laboratory	0	0	2	2	1	40/60	PCC
		Total	**18**	**1**	**8**	**27**	**23**	**700**	

SEMESTER VII									
SL. No.	**Course Code**	**Course**	**L**	**T**	**P**	**Contact hrs./wk.**	**C**	**Ext / Int**	**Cat.**
1.	22Cexxx	Professional Elective III	3	0	0	3	3	60/40	PEC
2.	22Cexxx	Professional Elective IV	3	0	0	3	3	60/40	PEC
3.	22Cexxx	Professional Elective V	3	0	0	3	3	60/40	PEC
4.	22Cexxx	Professional Elective VI	3	0	0	3	3	60/40	PEC
5.	22Cexxx	Emerging Elective III	3	0	0	3	3	60/40	EEC
6.	22Cexxx	Emerging Elective IV	3	0	0	3	3	60/40	EEC
7.	22CE701	Design Comprehensive Project	0	0	4	4	2	40/60	PROJ
		Total	**18**	**0**	**4**	**22**	**20**	**700**	

SEMESTER VIII									
SL. No.	**Course Code**	**Course**	**L**	**T**	**P**	**Contact hrs./wk.**	**C**	**Ext / Int**	**Cat.**
PROJECT WORK									
1.	22CE801	Project Work	0	0	24	24	12	40/60	PROJ
		Total	**0**	**0**	**24**	**24**	**12**	**100**	

L: Lecture **T:** Tutorial **P:** Practical **C:** Credit **O:** Outside Class hours **Cat.:** Category

HSMC : Humanities and Social Sciences including Management
BSC : Basic Science Courses
ESC : Engineering Science Courses
PCC : Professional Core Courses
PEC : Professional Elective Courses
OEC : Open Elective Courses
EEC : Emerging Elective Courses
EC : Emerging Courses
PROJ : Project Work
EES : Employability Enhancement Skills
MC : Mandatory Course

Definition of Credit:

L – Lecture	1 Hr. Lecture (L) per week 1 credit
T – Tutorial	1 Hr. Tutorial (T) per week 1 credit
P - Practical/Practice (Project and Industry based Courses)	1 Hr. Practical (P) per week 0.5 credit

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

SL. No.	Stream	Credits/Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1.	Humanities & Social Sciences Including Management (HSMC)	3	4	1						8
2.	Basic Sciences (BSC)	11	8	4						23
3.	Engg. Sciences (ESC)	10	9	7.5						26.5
4.	Professional Core (PCC)			10	18	14.5	14			56.5
5.	Professional Electives (PEC)					3	3	12		18
6.	Open Electives (OEC) / Emerging Elective Courses (EEC)				3	3	6	6		18
7.	Project Work (PROJ) / (EES)				1	1		2	12	16
8.	Mandatory Course (MC)	Non-credit								0
	Total	**24**	**21**	**22.5**	**22**	**21.5**	**23**	**20**	**12**	**166**

SEMESTER WISE CREDIT DISTRIBUTION: -

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	24	21	22.5	22	21.5	23	20	12	166

Total Credits: 166

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAMME

SL. No.	Course Work – Subject Area	AICTE Suggested Breakdown of Credits	SKCET Suggested Breakdown of Credits	Civil-SKCET Credits
1.	Humanities and Social Sciences including Management courses	12*	6-12	8
2.	Basic Science courses	25*	20-29	23
3.	Engineering Science courses including Workshop, Drawing, Basics of Electrical / Mechanical / Computer etc.	24*	15-32	26.5
4.	Professional core courses	48*	53-106.5	56.5
5.	Professional Electives courses relevant to the chosen specialization / branch	18*	15-18	18
6.	Open Subjects – Electives from other technical and / or emerging subjects	18*	6-18	18
7.	Project Work, Seminar and / or Internship in Industry or elsewhere.	15*	13-18 / 27	14
8.	Industrial Practice / Employability Enhancement Skills		2/1.5	2
9.	Mandatory Courses	Non-credit	Non-credit	Non-credit
Total		160*	167	166
**Minor Variations is allowed as per need of the respective disciplines*				

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT (8 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	22GE201	Universal Human Values	3/0/0	3	3	HSMC
2.	20CE101	Introduction to Civil Engineering	3/0/0	3	3	HSMC
3.	22TA101	Heritage of Tamils	1/0/0	1	1	HSMC
4.	22TA201	Tamils and Technology	1/0/0	1	1	HSMC

BASIC SCIENCE COURSES (23 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	22EN101	Technical Communication Skills	2/0/2	4	3	BSC
2.	22PH104	Applied Physics	3/0/2	5	4	BSC
3.	22CH101	Engineering Chemistry	3/0/2	5	4	BSC
4.	22MA101	Engineering Mathematics I	3/1/0	4	4	BSC
5.	22MA201	Engineering Mathematics II	3/1/0	4	4	BSC
6.	22MA301	Probability and Numerical Methods	3/1/0	4	4	BSC

ENGINEERING SCIENCE COURSES (26.5 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	22EE111	Fundamentals of Electrical and Electronics Engineering	3/0/0	3	3	ESC
2.	22EE115	Fundamentals of Electrical and Electronics Engineering Laboratory	0/02	2	1	ESC
3.	22CS101	Problem solving using C++	3/0/2	5	4	ESC
4.	22CS201	Data Structures and Algorithms	3/0/2	5	4	ESC
5.	22IT311	Introduction to Python programming	1/0/4	5	3	ESC
6.	22ME101	Engineering Mechanics	3/0/0	3	3	ESC
7.	22CE102	Engineering Practices Laboratory	0/0/4	4	2	ESC
8.	22CE201	Engineering Graphics Laboratory	0/0/4	4	2	ESC
9.	22CE302	Architectural Planning and Building Drawing	3/0/3	6	4.5	ESC

PROFESSIONAL CORE COURSES (51 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	22CE301	Surveying and Geomatics	3/1/0	4	4	PCC
2.	22CE303	Strength of Materials	3/0/3	6	4.5	PCC
3.	22CE401	Environmental Engineering	3/0/0	3	3	PCC
4.	22CE402	Construction Materials and Technology	3/0/3	6	4.5	PCC
5.	22CE403	Fluid Mechanics and Hydraulic Machinery	3/0/3	6	4.5	PCC
6.	22CE404	Structural Analysis	3/0/3	6	4.5	PCC
7.	22CE501	Geotechnical Engineering	3/1/0	4	4	PCC
8.	22CE502	Design of Reinforced Concrete Structures	3/0/3	6	4.5	PCC
9.	22CE503	Transportation Engineering	3/0/3	6	4.5	PCC

10.	22CE601	Construction Planning and Management	3/1/0	4	4	PCC
11.	22CE602	Construction Cost Estimation and Valuation	3/0/3	6	4.5	PCC
12.	22CE603	Design of Steel Structures	3/0/3	6	4.5	PCC

PROFESSIONAL LABORATORY COURSES (5.5 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	22CE304	Surveying and Geomatics Laboratory	0/0/3	3	1.5	PCC
2.	22CE405	Environmental Engineering Laboratory	0/0/3	3	1.5	PCC
3.	22CE504	Soil Mechanics Laboratory	0/0/3	3	1.5	PCC
4.	22CE604	Project Planning and Development Laboratory	0/0/2	2	1	PCC

PROFESSIONAL ELECTIVE COURSES (18 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	22CE901	Bridge Engineering and Design of Special Elements	3/0/0	3	3	PEC
2.	22CE902	Conditional Assessment and Rehabilitation of Structures	3/0/0	3	3	PEC
3.	22CE903	Design of Foundations and Retaining Structures	3/0/0	3	3	PEC
4.	22CE904	Green Building Technology	3/0/0	3	3	PEC
5.	22CE905	Ground Improvement and Geosynthetics	3/0/0	3	3	PEC
6.	22CE906	Prefabricated Structures	3/0/0	3	3	PEC
7.	22CE907	Pre-stressed Concrete Structures	3/0/0	3	3	PEC
8.	22CE908	Soil Dynamics and Earthquake Engineering	3/0/0	3	3	PEC
9.	22CE909	Smart Materials and Structures	3/0/0	3	3	PEC
10.	22CE910	Air and Noise Pollution	3/0/0	3	3	PEC
11.	22CE911	Assessment of Contaminated Site and Remediation	3/0/0	3	3	PEC
12.	22CE912	Computing Techniques In Environmental Engineering	3/0/0	3	3	PEC
13.	22CE913	Groundwater and surface water pollution	3/0/0	3	3	PEC
14.	22CE914	Irrigation and water resources engineering	3/0/0	3	3	PEC
15.	22CE915	Remote Sensing and GIS for Civil Engineering	3/0/0	3	3	PEC
16.	22CE916	Surface Water Hydrology	3/0/0	3	3	PEC
17.	22CE917	Solid and Hazardous waste Management	3/0/0	3	3	PEC

18.	22CE918	Operation and Maintenance of Water and Wastewater Treatment Systems	3/0/0	3	3	PEC
19.	22CE919	Computer Simulation Applications in Transportation Engineering	3/0/0	3	3	PEC
20.	22CE920	Construction Personnel Management	3/0/0	3	3	PEC
21.	22CE921	Economics and Business Finance	3/0/0	3	3	PEC
22.	22CE922	Highway Construction and Management	3/0/0	3	3	PEC
23.	22CE923	Marketing Management	3/0/0	3	3	PEC
24.	22CE924	Lean Startup Management	3/0/0	3	3	PEC
25.	22CE925	Risk and Reliability Analysis of Civil Infrastructure Systems	3/0/0	3	3	PEC
26.	22CE926	Road Transport Management and Economics	3/0/0	3	3	PEC
27.	22CE927	Valuation of Real Properties	3/0/0	3	3	PEC
28.	22CE928	Finite Element Analysis	3/0/0	3	3	PEC
29.	22CE929	Advanced Structural Analysis	3/0/0	3	3	PEC
30.	22CE930	Design of Substructures	3/0/0	3	3	PEC
31.	22CE931	Seismic Design of Structures	3/0/0	3	3	PEC
32.	22CE932	Coastal Engineering	3/0/0	3	3	PEC
33.	22CE933	Supply Chain Management and Logistics in Construction	3/0/0	3	3	PEC
34.	22CE934	Formwork Engineering	3/0/0	3	3	PEC
35.	22CE935	Intelligent transportation system	3/0/0	3	3	PEC
36.	22CE936	Building Services and Management	3/0/0	3	3	PEC

PROFESSIONAL ELECTIVE COURSES - VERTICALS					
Vertical I Structural Engineering	**Vertical II Geotechnical Engineering**	**Vertical III Construction Management**	**Vertical IV Environmental Engineering**	**Vertical V Infrastructures Engineering**	**Vertical VI Diversified Courses**
Bridge Engineering and Design of Special Elements	Design of Foundations and Retaining Structures	Construction Personnel Management	Air and Noise Pollution	Green Building Technology	Smart Materials and Structures
Conditional Assessment and Rehabilitation of Structures	Ground Improvement and Geosynthetics	Economics and Business Finance	Assessment of Contaminated Site and Remediation	Computer Simulation Applications in Transportation Engineering	Computing Techniques In Environmental Engineering
Prefabricated Structures	Soil Dynamics and Earthquake Engineering	Lean Startup Management	Groundwater and surface water pollution	Highway Construction and Management	Surface Water Hydrology
Pre-stressed Concrete Structures	Design of Substructures	Risk and Reliability Analysis of Civil Infrastructure Systems	Irrigation and water resources engineering	Remote Sensing and GIS for Civil Engineering	Marketing Management
Finite Element Analysis	Seismic Design of Structures	Supply Chain Management and Logistics in Construction	Solid and Hazardous waste Management	Road Transport Management and Economics	Valuation of Real Properties
Advanced Structural Analysis	Coastal Engineering	Formwork Engineering	Operation and Maintenance of Water and Wastewater Treatment Systems	Intelligent transportation system	Building Services and Management

EMERGING ELECTIVE COURSES (12 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	22CE007	Applications of Sensors and IoT in Civil Engineering	3/0/0	3	3	EEC
2.	22CE008	Building and Town Planning	3/0/0	3	3	EEC
3.	22CE009	Environmental Ethics and Management	3/0/0	3	3	EEC
4.	22CE010	Environmental Geotechnics	3/0/0	3	3	EEC
5.	22CE011	Low carbon Building Materials and Systems	3/0/0	3	3	EEC
6.	22CE012	Metro Rail Engineering and Infrastructure	3/0/0	3	3	EEC
7.	22CE013	Nanotechnology in Civil and Environmental Engineering	3/0/0	3	3	EEC
8.	22CE014	Project Formulation and Implementation	3/0/0	3	3	EEC
9.	22CE015	Rural Water Supply and Onsite Sanitation Systems	3/0/0	3	3	EEC
10.	22CE016	Smart City Planning and Development	3/0/0	3	3	EEC
11.	22CE017	Sustainable Construction Materials and Methods	3/0/0	3	3	EEC
12	22CE018	Waste to Energy	3/0/0	3	3	EEC

OPEN ELECTIVE COURSES (6 Credits) [Offered to Other Branches]

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	22CE001	Disaster Management	3/0/0	3	3	OEC
2.	22CE002	Engineering Risk and Uncertainty	3/0/0	3	3	OEC
3.	22CE003	Environmental Pollution and Global issues	3/0/0	3	3	OEC
4.	22CE004	Project Management	3/0/0	3	3	OEC
5.	22CE005	Industrial Safety	3/0/0	3	3	OEC
6.	22CE006	Research Methodology and IPR	3/0/0	3	3	OEC

PROJECT WORK (14 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	22CE701	Design Comprehensive Project	0/0/4	4	2	PROJ
2.	22CE801	Project Work	0/0/24	24	12	PROJ

EMPLOYABILITY ENHANCEMENT SKILLS (2 Credits)

SL. No.	Course Code	Course Title	Duration	C	Cat.
1.	22EES101	Employability Enhancement Skills (Internship / Training)	2 Weeks	1	EES
2.	22EES102	Employability Enhancement Skills (Internship / Training)	2 Weeks	1	EES

MANDATORY COURSES (Non-credit)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	22MC101	Induction Programme	3 WEEKS		0	MC
2.	22MC102	Environmental Sciences	2/0/0	2	0	MC
3.	22MC103	Soft Skills	2/0/0	2	0	MC
4.	22MC104	Management Organizational Behavior	2/0/0	2	0	MC
5.	22MC105	General Aptitude	2/0/0	2	0	MC

VALUE ADDED COURSES (Additional credit courses)

SL. No.	Course Code	Course Title	Course Credits
1.	22VA130	Effective Communication Skills	2
2.	22VA101	Building Function Design using AutoCAD	1
3.	22VA102	Total Station and GPS Surveying	1
4.	22VA103	Arc GIS for Civil Engineers	1
5.	22VA104	Structural Analysis and Design Using STAAD.Pro	1
6.	22VA105	Project Management Using Primavera	1
7.	22VA106	3DBuilding Modeling Using Revit Architecture	1

Semester - 1

22CE101	INTRODUCTION TO CIVIL ENGINEERING	3/0/0/3

Nature of Course	Theory
Pre requisites	Nil

Course Objectives:

1	To give an understanding to the students of the vast breadth and numerous areas of engagement available in the overall field of Civil Engineering
2	To give the students an illustration of the use and properties of various building materials and explain the building construction aspects
3	To impart knowledge on structure of earth and engineering geology.
4	To impart knowledge about the impacts of human in environment

Course Outcomes:

Upon completion of the course, students shall have ability to

C101.1	Discuss the scope of civil engineering and importance of civil engineering structures.	[U]
C101.2	Apply the various building materials in appropriate requirements.	[AP]
C101.3	Discuss the various building components and Construction	[U]
C101.4	Understand the fundamentals concepts of green buildings, applications of IoT and impacts of human in environment	[U]
C101.5	Understand the geological structure and about seismology	[U]

Course Contents: Theory

Course Contents:

Module 1: Civil Engineering Structures and Materials **15 Hrs.**

Scope of Civil Engineering – Functions of a Civil Engineer – Civil Engineering in infrastructural development of the country – Types and classification of structures: buildings, bridges, dams, roads, railways, runways, tunnels, chimneys, retaining walls, water tanks, towers and silos –Types, applications and quality standards of building materials: Aggregate, M-sand, bricks, blocks, cement, concrete, structural steel, high tensile steel bar, construction chemicals, timber, plywood, aluminum, GI sheet, PVC, UPVC, CPVC.

Module 2: Building Components and Construction **15 Hrs.**

Classification of buildings – Selection of site – Components of a building: foundation, basement, stone masonry,brick masonry,column, RC members, pre-stress concrete members, beams,staircase, lintel, slab, flooring,roof, truss & damp proof course – Construction sequences of building- building bye laws –Fundamentals of Town Planning and Smart cities – Green Building- Applications of Software and IoT in Civil Engineering

Module 3: Geology and Environment **15 Hrs.**

Geology in civil engineering – Branches – Structure of earth –Tectonic plates – Continental drift - Seismic zones in India – atmosphere – weathering of rocks – Classification of rocks; Igneous(Granite, Basalt), Sedimentary (Sandstone, Limestone) and Metamorphic (Schist, Gneiss, marble) – strike, dip – folds, faults and joints: relevance to civil engineering – Human and Environment – Pollution: water, air, soil, noise.

Total Hours	**45 Hrs.**

Text Books:

1	BhavikattiS.S., “Basic Civil Engineering”, New Age International Publishers, 2018.
2	Punmia B.C., Ashok kumarjain and Arunkumarjain, “Building constructions” LaxmiPublications (P) LTD, 2016
Reference Books:	
1	P.P. Anil Kumar, “Introduction to Smart Cities” Pearson Education, 2019
2	Varghese, P.C., Engineering Geology for Civil Engineering Prentice Hall of India Learning Private Limited, New Delhi, 2012.
3	Purushothama Raj P “Building Construction Materials and Techniques” Pearson Education India, 2017
Web References:	
1	Construction Contracts, http://www.jnormanstark.com/contract.htm
2	Internet and Business Handbook, Chap 4, Contracts law, http://www.laderapress.com/laderapress/contractslaw1.html
3	Contract & Agreements , http://www.tco.ac.ir/law/English/agreements/General/Contract %20Law/C.htm
4	Contracts, http://206.127.69.152/jgretch/crj/211/ch7.ppt
5	Business & Personal Law. Chapter 7. “How Contracts Arise”, http://yucaipahigh.com/schristensen/lawweb/lawch7.ppt
6	Types of Contracts, http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt
7	IV. Types Of Contracts And Important Provisions, http://www.worldbank.org/html/opr/consult/guidetxt/types.html
8	Contract Types/Pricing Arrangements Guideline- 1.4.G (11/04/02), http://www.sandia.gov/policy/14g.pdf
9	www.ieindia.org
10	https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture-notes/
11	http://nptel.ac.in/courses/113106032/4%20-%20Crystal%20structure.pdf
12	https://www.kluniversity.in/physics/pdfs/crypdf.pdf

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C101.1	Understand	Quiz	20

C101.2	Apply	Assignment	20
C101.3	Analyze	Assignment	20
C101.4	Apply	Tutorial	20
C101.5	Apply		

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	-	-
Understand	60	60	60
Apply	40	40	40
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	-	-	1	-	2	2	2	-	-	-	2	2	-	1
2	3	-	-	1	-	2	2	2	-	-	-	2	2	-	1
3	3	-	-	1	-	2	2	2	-	-	-	2	2	-	1
4	3	-	-	1	-	2	2	2	-	-	-	2	2	-	1
5	3	-	-	1	-	-	-	-	-	-	-	2	2	-	1
Avg.	3	1	-	1	-	2	2	2	-	-	-	2	2	-	1

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22MA101	ENGINEERING MATHEMATICS I (CIVIL)	3/1/0/4

Nature of Course	B (100% Analytical)
Pre requisites	-

Course Objectives:

1	To develop the skill to use matrix algebra techniques that are needed by engineers for practical applications.
2	To find the solution of ordinary differential equations as most of the engineering problems are characterized in this form.
3	To gain knowledge in integrals which are needed in Engineering applications.
4	To develop logical thinking and analytical skills in evaluating vector integration.
5	To acquaint the concepts of vector calculus needed for problems in all engineering disciplines.

Course Outcomes:(Theory)

Upon completion of the course, students shall have ability to

C101.1	Recall the concepts of matrices, Ordinary Differential equations and basic integration in Engineering problems.	[R]
C101.2	Understanding the system of linear equations and ordinary differential equations to solve using numerical techniques.	[U]
C101.3	Compute the eigenvalues and eigenvectors of matrices both analytically and numerically.	[AP]
C101.4	Apply the differential techniques to solve ordinary differential equations	[AP]
C101.5	Apply the integral techniques and calculate grad, div, curl and use Gauss and Greens theorem to simplify the calculations of integrals.	[AP]

Course Contents:

MODULE I - MATRICES **20 Hrs.**

Definition –Types of matrices – Characteristic equation – Eigenvalues and Eigenvectors of a real symmetric matrix and their properties (Excluding Proof) – Cayley-Hamilton theorem (statement only) - Diagonalization of real symmetric matrix by Orthogonal transformation – Reduction of Quadratic form to Canonical form by Orthogonal transformation - Solution of system of linear equations by Gauss elimination and iterative methods of Gauss Jacobi and Gauss Seidel methods – Eigenvalues by Power method.

MODULE II - ORDINARY DIFFERENTIAL EQUATIONS **20 Hrs.**

Ordinary differential equations: Solving second and higher order linear differential equations with constant coefficients - Euler Cauchy's equation – Legendre's Linear equation - Method of variation of parameters – Numerical solution to ordinary differential equations: Single step methods: Taylor's method - Euler's method - Runge-Kutta method of fourth order - Multi step methods: Milne's method – Adam Bashforth Predictor Corrector method.

MODULE III - INTEGRAL CALCULUS **20 Hrs.**

Bernoulli's formula – Relation between Beta and Gamma function - Double integration in Cartesian coordinates – Area as double integral – Triple integration in Cartesian coordinates –Volume as triple integral **Vector integration**:Directional derivatives - Divergence and Curl of a vector point function - Solenoidal and Irrotational vectors - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (Excluding Proofs) – Applications involving Cubes and rectangular parallelepipeds.

Total Hours:	**60**

Text Books:

1	Erwin E., “Advanced Engineering Mathematics”,John Wiley and Sons (Asia) Limited, Hoboken,2020.
2	Jain M.K. Iyengar, K & Jain R.K., Numerical Methods for Scientific and Engineering Computation, New Age International (P) Ltd, Publishers,6th edition, 2016.
3	Grewal. B.S, “Higher Engineering Mathematics”, 43rd edition, Khanna Publications, Delhi, 2014.
Reference Books:	
1	Veerarajan. T, “Engineering Mathematics II”,Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018.
2	Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, 4th edition, 2012.
3	N.P.Bali and Dr.ManishGoyal,”A Textbook of Engineering Mathematics”, 9th edition, Laxmi publications ltd, 2014.
4	Gilbert Strang, “Linear Algebra and its Applications”, Third Edition, Harcourt College Publishers, 1988.
Web References:	
1	http://www.nptel.ac.in/courses/111105035
2	http://www.nptel.ac.in/courses/122104017
3	http://nptel.ac.in/courses/122102009
4	http://nptel.ac.in/courses/111107063
Online Resources:	
1	https://www.coursera.org/learn/linearalgebra2
2	https://www.coursera.org/learn/differentiation-calculus
3	https://www.coursera.org/learn/single-variable-calculus
4	https://alison.com/courses/Algebra-Functions-Expressions-and-Equations

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C101.1	Remember	Quiz	20
C101.2	Understand	Seminar	20
C101.3 – C101.5	Apply	Tutorial	20

C101.3 – C101.5	Apply	Assignment	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	20	20	20
Understand	30	30	30
Apply	50	50	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1: 100 Marks			**CA 2: 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	1	1	1										1		
2	1	2	1										2		
3	3	3	2										2		
4	1	1	2										1		
5	2	1	2										2		
Avg.	1.6	1.6	1.6										1.6		

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22EE113	FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING (Common to MECH and CIVIL)	2/1/0/3

Nature of Course	G (Theory analytical)
Course Pre-requisites	Nil

Course Objectives:

1	To import the students with a basic understanding of Electrical circuits.
2	To learn the working principle of static machine.
3	To understand the rotating Machines working principles and to have a knowledge on selection of machine for specific types of applications.
4	To give a comprehensive exposure to Electrical installations.

Course Outcomes:
Upon completion of the course, students shall have ability to

C113.1	Analyze the concepts in AC circuit and DC circuits.	[A]
C113.2	Examine the working principle of Static machines.	[A]
C113.3	Understand the working principle of Rotating machines.	[U]
C113.4	Utilize the basic components for Electrical installations.	[AP]
C113.5	Interpret the basic devices in Electronics and Instrumentation.	[A]

Course Contents:

Module I: DC Circuits and AC Circuits **15 Hrs.**

DC Circuits - Electrical circuit elements (R, L and C) - Voltage and Current Sources - Kirchoff's current and voltage law - analysis of simple circuits with DC excitation - Mesh and Nodal Analysis. **AC Circuits** - Representation of sinusoidal waveforms, Peak and RMS values, Phasor representation, Real power, Reactive power, Apparent power, Power factor. Analysis of single phase ac circuits consisting of R, L, C, RL and RC. Three phase balanced circuits - Voltage and Current relations in star and delta connections.

Module II: Electrical Machines and Installations **15 Hrs.**

Static machines: BH characteristics, construction & working principle of single-phase and three phase transformers. Rotating machines: Generation of rotating magnetic fields, construction and working principle of DC machines, three-phase induction motor and synchronous motor. Components of LT Switchgear - Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Domestic wiring, Types of Wires and Cables, Earthing.

Module III: Fundamentals of Semiconductor Devices and Instrumentation **15 Hrs.**

Semiconductor - PN junction diode - Zener diode - Bipolar Junction Transistor Introduction - Field Effect Transistor Introduction - Construction and characteristics of JFETs - MOSFET - Depletion type MOSFET, Enhancement type MOSFET, Transfer characteristics. Sensors, Solenoids, Pneumatic controls with electrical actuator, Mechatronics, types of valves and its applications, Electro-Pneumatic systems, Proximity sensors, Limit switches.

Total Hours	**45 Hrs.**

Text Books:

1	Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', Tata McGraw Hill, 7th edition, 2020.
2	Vincent. Del. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 2nd edition, 2015.

3	E. Hughes, “Electrical and Electronics Technology”, Pearson, 10th edition, 2011.
4	Donald .A. Neamen, Electronic Circuit Analysis and Design, 2nd Edition reprint, Tata Mc Graw Hill, 2013.
Reference Books:	
1	Charles A.Gross, Thaddeus A.Roppel, “Fundamentals of Electrical Engineering”, CRC press, 2012.
2	D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, Revised 1st edition 2017,
3	Theodore F. Bogart, Jeffery S. Beasley and Guilermo Rico, ‘Electronic Devices and Circuits’, Pearson Education, 6th edition, 2013.
Web References:	
1	http://nptel.ac.in/course.php?disciplineId=108
2	https://ocw.mit.edu/courses/find-by topic/#cat=engineering&subcat=electricalengineering&spec=electricpower
3	https://nptel.ac.in/video.php?subjectId=117103063
4	https://onionesquereality.wordpress.com/.../more-video- lectures-iit-open
5	https://nptel.iitg.ernet.in/Elec_Comm_Engg/.../Video-ECE.pdf
Online Resources:	
1	http://www.electrical-knowhow.com/
2	https://www.edx.org/course/electricity-magnetism-part-1-ricex-phys102-1x-1
3	https://www.mooc-list.com/course/fundamentals-electrical-engineering-coursera
4	https://nptel.ac.in/course.php

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C113.1	Analyze	Quiz	20
C113.2	Analyze	Tutorial	20
C113.3	Understand	Group Assignment	20
C113.4	Apply		
C113.5	Understand	Presentation	20

Assessment based on Summative and End Semester Examination			
Bloom’s Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	20	20	20

Understand	30	30	30
Apply	20	20	20
Analyse	30	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Programme Outcomes (PO)Programme Specific Outcomes (PSO)

Cos	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3												1		
2	3												1		
3	3		1										1		
4	3		1										1		
5	3		1										1		
Avg.	**3**		**1**										**1**		

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22PH104	APPLIED PHYSICS (Common to MECH. MCT and CIVIL)	3/0/2/4
Nature of Course	: E (Theory skill based)	
Prerequisites	: Nil	

Course Objectives:

1	To enable the students to understand the basics of harmonic oscillator and Laser.
2	To learn the basic concepts of Electromagnetic waves
3	To familiarize the principle of Quantum mechanics and crystallography.

Course Outcomes:
Upon completion of the course, students shall have the ability to

C104.1	Understand the physical characteristics of Simple harmonic oscillation	[U]
C104.2	Recall the basic concept and applications of laser.	[R]
C104.3	Describe the basic principles of Electromagnetic waves, sensors and transducers.	[U]
C104.4	Interpret the central concepts and principles in quantum mechanics, such as the Schrödinger equation and the wave function.	[AP]
C104.5	Estimate the Atomic packing, acquire the basic knowledge about Crystal Lattice and Unit cell.	[AP]

Course Contents:

Harmonic oscillations and Laser **15 Hrs.**

Harmonic oscillations: periodic motion – Simple harmonic motion: characteristics of simple harmonic motion – Simple spring-mass system – Resonance – Damped harmonic oscillator. Energy considerations, comparison with un-damped harmonic oscillator, logarithmic decrement, relaxation time, quality factor.

Laser: characteristics of laser – Principle of spontaneous emission and stimulated emission – Einstein's theory of matter radiation interaction and A and B coefficients (derivation) – Population inversion – Pumping – Different types of lasers: CO_2 laser - Semiconductor Laser (Homo-junction and Heterojunction), – Qualitative industrial applications of lasers: welding, drilling and cutting.

Electromagnetic waves: **15 Hrs.**

Concept of Del operator, gradient, divergence and curl operators and their physical significances - Gauss divergence theorem, Stokes theorem.

Laws of Electromagnetism: Gauss law of electricity, Gauss law of magnetism, Faraday' law of electromagnetic induction, Ampere's circuital law- (Derivation only) – Dielectrics: Concept of different charge and current densities - free charges, bound charges; Maxwell's equations in free space and dielectric medium (equations only). **Sensors and Transducers:** Introduction, Classification of Transducers - Transducers Actuating Mechanisms - Resistance Transducers - Piezoelectric Transducers, Thermoelectric Transducers - Photoelectric Transducers.

Quantum mechanics and Crystallography: **15 Hrs.**

Quantum mechanics: Planck's quantum theory (derivation) – Matter waves, de-Broglie wavelength – Heisenberg's uncertainty principle – Schrödinger's wave equation: time independent and time dependent – Physical significances of wave function – Particle in a one-dimensional potential box. **Crystallography:** crystal system – lattice – Bravais lattice, calculation of atomic packing factor for simple cubic, body centered cubic, face centered cubic and hexagonal close packed lattice – Miller indices – Problems - Crystal

imperfections: point & line - burger vector. Basic concepts of band theory and classification of materials into conductor, semiconductor and insulator.		
		Total - *45 Hrs.*
Lab Component		
S. No	**List of Experiments**	**BT**
1	Determination of frequency of transverse and longitudinal wave modes – Melde's experiment.	[E]
2	Determination of characteristics of Simple harmonic motion – Simulation lab.	[E]
3	Determination of laser parameter	[E]
4	Determination of optical fiber parameters.	[E]
5	Determination of characteristics of LCR circuits.	[E]
6	Determination of characteristics of RC circuit to find the time constant	[E]
7	Determination of Magnetic field along the axis of current carrying coil-Stewart and Gee method.	[E]
8	Determination of Planck's Constant.	[E]
9	Determination of Stefan's Constant.	[E]
10	Determination of lattice constant of cubic crystal structure.	[E]
	Life Skills Experiments	
11	Determination of pressure required to shut off the fuel pump nozzle.	[E]
12	Determination of capacitance required to shut off the circuit in a circuit breaker.	[E]
13	Determination of earth, neutral and phase line in a circuit.	[E]
	Total Hours	**30 Hrs.**
Text Books:		
1	David Halliday, Robert Resnick, Jearl Walker "Fundamentals of Physics" Wileyplus.2018	
2	Rajendran, V "Engineering Physics" Mc Graw Hill Publications ltd, New Delhi, 2016.	
Reference Books:		
1	Avadhanulu M.N., Kshirshagar P.G., Arun Murthy TVS "A Text Book of Engineering Physics"S. Chand& Co Ltd, 2018.	
2	Sawhney A.K., Puneet Sawhney "A Course In Mechanical Measurements And Instrumentation & Control" Dhanpat Rai & Co, 2013.	
3	**Richard P. Feynman. Robert B. Leighton, Matthew Sands**"The Feynman Lectures on Physics Vol. I": The New Millennium Edition.2015	
4	David J. Griffiths, "Introduction to Quantum Mechanics", 2nd edition, Cambridge university press, 2017.	
5	Chris Bernhardt, "Quantum Computing for Everyone" The MIT press, 2019	
Web References/ Online Resources:		
1	https://faraday.physics.utoronto.ca/IYearLab/Elastic-properties-of-solids-manual.pdf	
2	https://www.physik.uzh.ch/~matthias/espace-assistant/manuals/en/anleitung_102-tb_e.pdf	
3	https://ir.nctu.edu.tw/bitstream/11536/1680/1/A1995TF11100052.pdf	
4	http://www2.optics.rochester.edu/workgroups/cml/whole-enchilada-SPR05.pdf	
5	https://nptel.ac.in/courses/122/103/122103010/	

6	https://nptel.ac.in/courses/115/106/115106119/
7	https://www.eatm.in/upload/srit__unit_i_laser.pdf
8	https://nptel.ac.in/courses/115/101/115101107/
9	https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture-notes/
10	http://nptel.ac.in/courses/113106032/4%20-%20Crystal%20structure.pdf

Continuous Assessment									End Semester Examination	Total
Theory				Practical			Total (A+B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	**120**	**200**	**100**	**75**	**25**	**100**	**200**	**50**	**50**	**100**

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (10%) [80 Marks]**
C104.1	Understand	Online Quiz - I	**20**
C104.2	Remember	Assignment - I	**20**
C104.3	Understand	Online Quiz - II	**20**
C104.4	Apply	Assignment - II	**20**
C104.5	Apply		

Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	**Summative Assessment (15%) [120 Marks]**		**End Semester Examination (35%) [100 Marks]**
	CIA1: (60 Marks)	**CIA2: (60 Marks)**	
Remember	20	20	20
Understand	50	50	50
Apply	30	30	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination – Practical			
Bloom's Level	**Continuous Assessment (25%) [100 Marks]**		**End Semester Examination (15%) [100 Marks]**
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	-	-	-
Understand	20	20	20
Apply	30	30	30
Analyse	25	25	25
Evaluate	25	25	25
Create	-	-	-

Assessment based on Continuous and End Semester Examination									
Continuous Assessment (50%)									End Semester Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)			Theory Examination (35%) Practical Examination (15%)
SA 1 (60M)	FA 1		SA 2 (60M)	FA 2		FA (75M)	SA (25M)		
	Component-I (20 Marks)	Component-II (20 Marks)		Component-I (20 Marks)	Component-II (20 Marks)				

Mapping of Course Outcomes (CO) with Programme Outcomes (PO)Programme Specific Outcomes (PSO)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1		1								1			
2	3	2		1								1			
3	3	2		1								1			
4	2	1		1								1			
5	3	2	1	1								1			
Avg.	2.6	1.6	1	1								1			

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22EN101	TECHNICAL COMMUNICATION SKILLS (MCT/CIVIL/IT/EEE/ECE/AI&DS/CYBER/CSE/CSD) (SEMESTER I) (MECH- SEMESTER II)	2/0/2/3

Nature of Course	: Theory Skill Based
Pre requisites	Basics of English Language

Course Objectives:

1	To enhance learners' LSRW skills.
2	To develop students' ability to understand the process of communicating and interpreting ideas and human experiences.
3	To facilitate learners to acquire effective technical writing skills.
4	To prepare learners for placement and competitive exams.
5	To facilitate effective language skills for academic purposes and real-life situations.

Course Outcomes:

Upon completion of the course, students shall have ability to

C101.1	Remember language skills for technical communication.	[R]
C101.2	Apply communication skills in a corporate environment.	[AP]
C101.3	Understand and communicate effectively in personal and professional situations.	[AP]
C101.4	Understand and analyse a variety of reading strategies to foster comprehension and to construct meaningful and relevant connections to the text.	[U]
C101.5	Apply technical writing skills to write letters, emails and prepare technical documents.	[AP]

Course Contents:

Module I **10 Hrs.**

Introduction-Listening: - Listening to News in NDTV and Times Now Channels. **Speaking**: Introduction to Effective Communication - Barriers to Effective Communication- Tips to develop Communication Skills - Self Introduction - Overview of Business Communication-Short Talk on Business Topics -Impromptu Speaking (Public Speaking) - Non-Verbal Communication-SATORI-Sharing Personal Information-**Reading**: Reading Comprehension- Values and its Importance. **Writing**: SWOT Analysis -Book Review - Movie Review-Vocabulary Building.

Module II **10 Hrs.**

Listening: Listening to Specific Information. **Speaking**: Speaking on Specific Information. **Reading**: Skimming and Scanning-Reading Short Texts - Comparing Facts and Figures - Short Stories and Scientific Articles. **Writing**: Good and Bad Writing- Note Making - Writing Formal Letters (Inviting, Accepting and Declining Invitations)- Writing Business Letters (Calling for Quotations, Seeking Clarifications, Placing an Order and Complaint Letter)- Transcoding (Bar chart, Flowchart. Pie chart and Table)-Job Application Letter- Resume Writing.

Module III **10 Hrs.**

Listening: Listening to Narrations and Persuasive speech and identifying narrative and persuasive techniques. **Speaking**: 21st Century Skills- Narrative Skills- Leadership- Conflict Resolution-Persuasive Speaking-How to Tell a Story with Charts and Graphs **Reading:**Product Description and Product Review. **Writing**: Email Writing –Advantages and Disadvantages- Circular – Agenda and Minutes of the Meeting - Proofreading- Subject Verb Agreement-Tenses-Active Voice- Passive Voice- Impersonal Passive Voice-Report Phrases – Report Writing.

Total : 30 Hrs.

Lab Components

S. No	List of Experiments	BT
1	Listening Comprehension 1.News in NDTV and Times Now Channels 2.Listening to Specific Information	[AP]
2	Impromptu Speaking	[AP]
3	Reading Comprehension related to Competitive Exams	[U]
4	Immersion Activity and Presentation	[AP]
5	Group Discussion	[AP]
6	Group Assignment – Form an NGO	[AP]
	Total Hours	**30 Hrs.**

Text Books:

1	Basic Communication Skills for Technology, by Andrea J Rutherford, Pearson Publishers.2000
2	Remedial English Grammar. F.T. Wood. Macmillan.2007
3	Oxford Guide to Effective Writing & Speaking by John Seely, Oxford University Press.2005
4	Dr Sumanth S, English for Engineers, Vijay Nicole Imprints Private Limited 2015.

Reference Books:

1	Touchstone Student's Book 1 by Michael McCarthy, Jeanne McCarten, Helen Sandiford, Cambridge University Press.2005
2	Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
3	Touchstone Student's Book 2 by Michael McCarthy, Jeanne McCarten, Helen Sandiford, Cambridge University Press.2015

Web References:

1	http://www.academiccourses.com/Courses/English/Business-English
2	https://www.liveworksheets.com/worksheets/en/English_as_a_Second_Language_(ESL)/Technical_English

Online Resources:

1	https://www.coursera.org/specializations/business-english
2	https://www.businessenglishresources.com/learn-english-for-business/student-section/practice-exercises-new/

Continuous Assessment									End Semester Examination	Total
Theory				Practical			Total (A+B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory

Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)	FA (10%) [80 Marks]
C101.1 C101.2	Understand	Quiz	**20**
C101.3	Apply	Technical Presentation	**20**
C101.4	Understand	Reading Comprehension	**20**
C101.5	Apply	Group Assignment	**20**

Assessment based on Summative and End Semester Examination - Theory

Bloom's Level	Summative Assessment (15%) [120 Marks]		End Semester Examination (25%) [100 Marks]
	CIA1: (60 Marks)	CIA2: (60 Marks)	
Remember	20	20	20
Understand	40	40	40
Apply	40	40	40
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (25%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	20	20	20
Understand	30	30	30
Apply	50	50	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination															
Continuous Assessment (50%)															End Semester Examination (50%)
CA 1 (100 Marks)				CA 2 (100 Marks)				Practical Exam (100 Marks)							Theory Examination (25%) Practical Examination (25%)
SA 1 (60M)	FA 1			SA 2 (60M)	FA 2			FA (75M)	SA (25M)						
	Component -I (20 Marks)		Component -II (20 Marks)		Component -I (20 Marks)		Component -II (20 Marks)								

Mapping of Course Outcomes (CO) with Programme Outcomes (PO)Programme Specific Outcomes (PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1										3					
2								2		3					
3								2		3	2				
4										3					
5										3		3			
Avg								**2**		**3**	**2**	**3**			

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CS101	Problem Solving using C++	3/0/2/4
Nature of Course	C(Theory Concept), K (Problem Programming)	
Pre requisites	NIL	

Course Objectives:

1	To learn the fundamental programming concepts and methodologies which are essential to build good C++ programs.
2	To gain knowledge on control structures and functions in C++
3	To provide the basic object-oriented programming concepts and apply them in problem solving.
4	To introduce file streams and operations for storing data permanently.
5	To know generic programming paradigm

Course Outcomes:

Upon completion of the course, students shall have ability to

C101.1	Solve problems using operators and control Statements	[AP]
C101.2	Write C++ programs for processing strings and arrays	[AP]
C101.3	Apply the concepts of pointers and functions in programs.	[AP]
C101.4	Develop C++ programs using various object-oriented concepts to solve real world problems	[A]
C101.5	Implement the concepts on file streams and operations	[AP]

Course Contents: Theory

Module – I: C++ Programming Fundamentals **15 Hrs.**

C vs C++, Basic of OOPS, the main () function, Header files, Basic Input and Output (I/O) using c in and c out, Variable, Constant. **Operators:** Arithmetic Operators, Assignment Operators, Relational Operators, Logical Operators, Bitwise Operators, Other Operators, Operator Precedence Control Statements: if, if...else and Nested if...else, switch, case, break and continue, Loops – for loop, while loop, do while loop, goto. **Arrays and Strings**: 1D array, 2D array, Strings, String functions. **Function:** Basics, call by value, call by reference & return by reference, Inline function, overloading Functions, inline Functions, Recursive Functions. **Pointers:** Pointer, Dynamic Memory Allocation.

Module – II: Object Oriented Concepts **15 Hrs.**

Classes and Objects, public, private, protected. **Constructors and destructors**: Overloaded Constructor, Copy Constructor, Shallow Copying, Deep Copying. **Overloading:** this' Pointer, structs vs Classes, Friends of a class, Operator Overloading Inheritance, Overloading vs overriding, Polymorphism, Virtual Functions, Pure Virtual Functions and Abstract Classes.

Module – III: Files and Generic Programming **15 Hrs.**

Abstract Classes as Interfaces, Exception, Files, Streams and I/O, STL, Generic Programming, Lambda Expression.

Total Hours	**45 Hrs.**

Laboratory Course Content:	
S. No	**List of Experiments**
1	Practice of C Programming using Branching and Iterative constructs.
2	Programs using arrays and strings
3	Programs using Functions
4	Programs using Structures and Pointers.
5	Programs using classes and objects
6	Programs using constructor and destructor
7	Programs using method overloading, operator overloading and polymorphism concepts.
8	Programs using friend class
9	Programs using virtual functions and abstract class.
10	Programs using inheritance concepts
11	Programs using exception handling concept
12	Programs using Files.
13	Mini project
Total Hours	**30 Hrs.**

Text Books:	
1	Balagurusamy E,"Object Oriented Programming With C++", 4th Edition, Tata McGraw-Hill Education, 2008.
2	Yashavant P. Kanetkar, "Let us C++", BPB Publications, 2020
3	Sprankle M., "Problem Solving and Programming Concepts", 9th Edition, Pearson Education, New Delhi, 2011
Reference Book:	
1	Herbert Schildt, "The Complete Reference C++", 4th edition ,MH,2015
2	John Hubbard, "Schaum's Outline of Programming with C++", MH,2016
Web References:	
1	https://www.geeksforgeeks.org/c-plus-plus/
2	http://web.stanford.edu/class/cs106l/
Online Resources	
1	https://nptel.ac.in/courses/106101208
2	https://www.hackerrank.com/domains/cpp
3	https://codeforces.com/blog/entry/74684
4	https://www.hackerearth.com/practice/notes/tricky-and-fun-programming-in-c/

Continuous Assessment									End Semester Examination	Total
Theory				Practical			Total (A+B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (10%) [80 Marks]**
C101.1	Apply	Quiz	**20**
C101.2	Apply	Assignment Quiz	**20**
C101.3	Apply		
C101.4	Analyse	Group Assignment	**20**
C101.5	Apply	Case Study	**20**

Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	**Summative Assessment (15%) [120 Marks]**		**End Semester Examination (35%) [100 Marks]**
	CIA1: (60 Marks)	**CIA2: (60 Marks)**	
Remember	20	20	20
Understand	40	30	30
Apply	40	50	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical			
Bloom's Level	**Continuous Assessment (25%) [100 Marks]**		**End Semester Examination (15%) [100 Marks]**
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	10	20	20
Understand	30	20	20
Apply	50	60	60
Analyse	10	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination										
Continuous Assessment (50%)										End Semester Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)		Theory Examination (35%) Practical Examination (15%)		
SA 1 (60M)	FA 1		SA 2 (60M)	FA 2		FA (75M)	SA (25M)			
	Component -I (20 Marks)	Component -II (20 Marks)		Component -I (20 Marks)	Component -II (20 Marks)					

Mapping of Course Outcomes (CO) with Programme Outcomes (PO)Programme Specific Outcomes (PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3											3		
2	3	3	3	2	2				2	1		3	3	2	1
3	3	3	3	2	3				2	1		3	3	2	1
4	3	3	3	3	3				3	2		3	3	2	2
5	3	3	3	3	3				2	2		2	3	2	1
Avg	3	3	3	3	3				3	2		2	3	2	2

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE102	ENGINEERING PRACTICES LABORATORY	0/0/4/2
Nature of Course	Practical application	
Pre requisites	Nil	

Course Objectives:

1	To examine the quality of civil engineering building materials as per standard code recommendations.
2	To accomplish knowledge on building components, geology and environment
3	To gain hands on experience in carpentry, sheet metal, plumbing and welding.

Course Outcomes:
Upon completion of the course, students shall have ability to

C102.1	Examine the quality and properties of building materials and construction methods	[AP]
C102.2	Calculate the area of given plots and mark the boundaries of building using setting out process.	[AP]
C102.3	Assess the preliminary quality of polluted water and analyze suitable cost-effective remedial measures.	[AP]
C102.4	Prepare the basic connections involved in plumbing and make simple metal joints using welding equipment and wooden joints using carpentry tools	[AP]
C102.5	Develop the surfaces and make simple components like tray and funnel	[AN]

Course Contents:

GROUP A (CIVIL)

Laboratory Component:

S. No	List of Experiments	CO Mapping	BT
1	Examine the quality of bricks based on: (i) structure – standard shape, size, colour; (ii) hardness, (iii) sound test (iv) water absorption and (v) presence of chemicals and report.	C102.1	[AP]
2	Construct the front elevation of English bond and Flemish bond in bricks. Demonstrate the plan for 1 brick thick and 1½ brick thick wall.	C102.1	[AP]
3	Identify coarse and fine aggregates. Classify the particle size of coarse aggregates using sieve analysis.	C102.1	[AP]
4	Collect different soil samples and name them. Analyse and report the origin of the soil samples.	C102.1	[U]
5	Report the density of the soil sample and water.	C102.1	[AP]
6	Determine the specific gravity of cement.	C102.1	[AP]
7	Determine the Initial and final setting time of cement.	C102.1	[AP]

8	Identification of various steel and aluminium bars and sections.	C102.1	[AP]
9	Collect any three different types of stones. Analyse the texture and report the origin of formation of the stones.	C102.1	[U]
10	Setting out work of a building using linear methods.	C102.2	[AP]
11	Find the area of the given plot using linear and angular methods.	C102.2	[AP]
12	Examine the quality of polluted water based on: (i) color (ii) odour (iii) temperature (iv) turbidity. Report the source of pollution. Report any one of the cost-effective methods to remove colour/odour/turbidity.	C102.3	[AP]
GROUP B (MECHANICAL)			
Laboratory Component:			
1	Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.	C102.4	[AP]
2	Connections of pipelines and joints involved in water tank to wash basin, water heater and washing machine	C102.4	[AP]
3	Preparation of plumbing line sketches for water supply and sewage works.	C102.4	[AP]
4	Planning of sample wood pieces and the study of the joints in roofs, doors, windows and furniture	C102.4	[AP]
5	Preparation of dove-tail joint from the given wood piece to the required shape	C102.4	[AP]
6	Preparation of cross-half lap joint from the given wood piece to the required shape	C102.4	[AP]
7	Preparation of square butt joint from the given metal piece to the required shape	C102.4	[AP]
8	Preparation of lap joint from the given metal piece to the required shape	C102.4	[AP]
9	Preparation of tee fillet joint from the given metal piece to the required shape	C102.4	[AP]
10	Making rectangular tray from the given sheet metal to the required shape	C102.5	[AN]
11	Making cone and funnel from the given sheet metal to the required shape	C102.5	[AN]
12	Making cylinder from the given sheet metal to the required shape	C102.5	[AN]
		Total Hours:	**60 Hrs.**
Reference Books:			
1	H.S Moondra, Rajiv Gupta, “Laboratory manual for civil engineering”, Vol. II, CBS publications., 2019.		

2	M.K. Pant, “Laboratory manual for civil engineering students”, S.K. Kataria Publishers., 2016.
3	Hajra Choudhury, “Elements of Workshop Technology”, Vol. I & II, Media PromotorsPvt Ltd., 2014.
4	Balasubramanyam N, Prasanthi G.” A Text Manual of Engineering Workshop Technology”, Hamburg, Anchor Academic Publishing 2016.
Web References:	
1	www.nptel.ac.in
2	www.sme.org
3	http://www.allaboutcircuits.com/education/

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
75	**25**	**100**	**60**	**40**	**100**

Assessment based on Continuous and End Semester Examination			
Bloom’s Level	**Continuous Assessment (60%) [100 Marks]**		**End Semester Practical Examination (40%) [100 Marks]**
	FA (75 Marks)	**SA (25 Marks)**	
Remember	10	10	10
Understand	10	10	10
Apply	40	40	40
Analyse	20	20	20
Evaluate	10	10	10
Create	10	10	10

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

Cos	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
2	3	3	2	2	1	-	-	2	-	-	-	2	3	-	2
3	3	3	2	2	2	-	-	2	-	-	-	2	3	-	2
4	3	3	3	2	1	-	-	2	-	-	-	2	3	-	2
5	3	3	3	-	-	-	-	2	-	-	-	2	3	-	2
Avg.	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**1**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22EE115	FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY (Common to MECH and CIVIL)	0/0/2/1

Nature of Course	: M (Practical application)
Pre-requisites	: Nil

Course Objectives:

1	To learn the safety precautions and troubleshooting in using Electricity.
2	To estimate the current flow and voltage across the circuit elements under different loading conditions.
3	To understand the basic components for electrical installations.

Course Outcomes:
Upon completion of the course, students shall have ability to

C115.1	Illustrate Electrical and Electronic components and its specifications.	[U]
C115.2	Verify the current flow and voltage across the circuit elements using different analysis method.	[A]
C115.3	Measure power and power factor of single and three phase AC circuits.	[AP]
C115.4	Comprehend the cut-out sections of DC Motor and Induction Motor.	[U]
C115.5	Utilize the basic components for electrical installations.	[AP]

Course Contents:

S.No	List of Experiments	CO Mapping	RBT
1	Demonstration of meters, electrical and electronic components with specification.	C115.1	[U]
2	Safety precautions with electrical components.	C115.1	[U]
3	Troubleshooting of electrical equipment.	C115.1	[A]
4	Testing of CRO and Electronic components using Multimeter.	C115.2	[A]
5	Determination of mesh current by Mesh Analysis.	C115.2	[A]
6	Estimation of Voltage and Current in star and delta connections.	C115.2	[A]
7	Measurement of power and energy.	C115.3	[A]
8	Soldering practice - Components devices and Circuits using general purpose PCB.	C115.5	[A]
9	Residential house wiring.	C115.4	[A]
10	Demonstration of cut-out sections of DC Motor and Induction Motor.	C115.3	[U]
11	Demonstration of components of LT Switch Gears.	C115.5	[U]
12	Familiarization of digital basic gate ICs.	C115.5	[U]
	Total Hours	**30 Hrs.**	

Text Books:

1	Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', Tata McGraw Hill, 7th edition, 2020.

2	Vincent. Del. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 2nd edition, 2015.
3	E. Hughes, “Electrical and Electronics Technology”, Pearson, 10th edition, 2011.
4	Donald .A. Neamen, Electronic Circuit Analysis and Design, 2nd Edition reprint, Tata Mc Graw Hill, 2013.
Reference Books:	
1	Charles A.Gross, Thaddeus A.Roppel, “Fundamentals of Electrical Engineering”, CRC press, 2012.
2	D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, Revised 1st edition 2017,
3	Theodore F. Bogart, Jeffery S. Beasley and Guilermo Rico, ‘Electronic Devices and Circuits’, Pearson Education, 6th edition, 2013.
Web References:	
1	http://nptel.ac.in/course.php?disciplineId=108
2	https://ocw.mit.edu/courses/find-by topic/#cat=engineering&subcat=electricalengineering&spec=electricpower
3	https://nptel.ac.in/video.php?subjectId=117103063

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
75	**25**	**100**	**60**	**40**	**100**

Assessment based on Continuous and End Semester Examination			
Bloom’s Level	**Continuous Assessment (60%) [100 Marks]**		**End Semester Practical Examination (40%) [100 Marks]**
	FA (75 Marks)	**SA (25 Marks)**	
Remember	-	-	-
Understand	30	30	30
Apply	30	30	30
Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

Mapping of Course Outcomes (CO) with Programme Outcomes (PO)Programme Specific Outcomes (PSO)

Cos	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	1											3		
2	3	1													
3	3	1													

4	3	2													
5	3	1													
Avg.	**3**	**1.2**											**3**		

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

Semester - 2

22GE201	UNIVERSAL HUMAN VALUES (Common to all branches)	3/0/0/3

Nature of Course	Descriptive
Pre-Requisites	Interpersonal Communication and Value Sciences

Course Objectives:

1	Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2	Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence.
3	Strengthening of self-reflection.
4	Development of commitment and courage to act.
5	Helping the students to appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.
6	Highlighting plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Course Outcomes:
Upon completion of the course, students shall have ability to

C201.1	Understand and take responsibilities in life and handle problems to attain sustainable solutions while keeping human relationships and human nature in mind.	[U]
C201.2	Apply responsibilities towards their commitments (human values, human relationship and human society).	[AP]
C201.3	Apply what they have learnt to their own self indifferent day-to-day settings in real life, atleast a beginning would be made in this direction.	[AP]
C201.4	Analyze ethical and unethical practices, and formulate strategies to actualize a harmonious environment wherever they work.	[AN]
C201.5	Understand the harmony in nature and existence, and work out mutually on fulfilling participation in nature.	[U]

Course Contents:

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education, Understanding Harmony in the Human Being-Harmony in Myself! 15 Hrs.

Self-evaluation of the students- Pre-test of UHV**-** Purpose and motivation for the course. Self-Exploration–Its content and process- A look at basic Human Aspirations. Understanding Happiness and Prosperity correctly-Understanding the needs of Self('I') and 'Body'-Understanding the Body as an instrument of 'I'(being the doer, seer and enjoyer)-Understanding the characteristics and activities of 'I' and harmony in 'I' - Understanding the harmony of 'I' with the Body- Social activities – Waste Management - Water Conservation-Soil Pollution - Physical Health and related activities - Lectures by eminent persons- Literary activities.

Module 2: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship, Understanding Harmony in the Nature and Existence- Whole existence as Coexistence 15 Hrs.

Understanding values in human relationship - Understanding the harmony in the society (society being an extension of family): - Visualizing a universal harmonious order in society-Understanding the harmony in Nature.-Understanding Existence as Coexistence of mutually Interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence-Buddy program- Relationships-Homesickness-Managing peer pressure-Projects-Socially responsible engineers-Visit to local areas (orphanages, special children)- Physical activities (games).

Module 3: Implications of the above Holistic Understanding of Harmony on Professional Ethics 15 Hrs.

Natural acceptance of human values- Definitiveness of Ethical Human Conduct-Basis for Humanistic Education-Humanistic Constitution and Humanistic Universal Order-Competence in professional ethics-Case studies of typical holistic technologies, management models and eco-friendly production systems - Strategy for transition from the present state to Universal Human Order-Sum up: Self-evaluation of the students-Post test of UHV.

Total Hours:	**45 Hrs.**
Text Books:	
1	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2	Rajni Setia, Priyanka Sharma, “Human Values”, Genius Publication”, Jaipur, 2019.
Reference Books:	
1	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
2	The Story of My Experiments with Truth –by Mohandas Karam chand Gandhi
3	India Wins Freedom-Maulana Abdul Kalam Azad.
Web References:	
1	https://examupdates.in/professional-ethics-and-human-values/
2	http://hvpe1.blogspot.com/2016/06/notes-human-values-and-professional.html
3	https://www.yourmorals.org/schwartz.2006.basic%20human%20values.pdf
Online Resources:	
1	https://nptel.ac.in/courses/109/104/109104068/
2	https://medium.com/the-mission/the-12-important-life-skills-i-wish-id-learned-in-school-f4593b49445b
3	https://www.thebalancecareers.com/life-skills-list-and-examples-4147222

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C201.1	Understand & Apply	Online Quiz	20
C201.2	Understand & Apply	Group Assignment	20
C201.3	Understand	Presentation	20
C201.4	Apply		
C201.5	Apply	Seminar	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	10	20	20
Apply	40	40	40
Analyse	40	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1						3									

2						3			3						
3						3		3							
4						3	3	3			2				
5						3	3								
Avg.						**3**	**3**	**3**	**3**		**2**				

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22ME101	ENGINEERING MECHANICS	3/0/0/3
Nature of Course	Concepts and Analytical	
Pre-Requisites	Fundamentals of basic mathematics and physics	

Course Objectives:

1	To make the students understand the vector and scalar representation of forces and moments and the static equilibrium of particles and rigid bodies.
2	To understand the effect of friction on equilibrium, laws of motion, kinematics of motion and their interrelationship.
3	To make the students understand the properties of surfaces and solids, prediction of behaviour of particles and rigid bodies under motion.

Course Outcomes:
Upon completion of the course, students shall have ability to

C101.1	Define and illustrate the basic concepts of force system	[U]
C101.2	Calculate the resultant force, moment and geometrical properties of 2D, objects	[Ap]
C101.3	Analyse the resistance force of objects for Impending Motion	[A]
C101.4	Determine the displacement, velocity and acceleration of particles and objects.	[Ap]
C101.5	Determine the Dynamic forces exerted in various mechanisms of planar motion	[Ap]

Course Contents:

Module 1: Equilibrium of Particles and Rigid Bodies **15 Hrs.**

Force Systems – Basic concepts, Laws of Mechanics, Principle of Transmissibility, System of Forces, Coplanar Concurrent Forces, Resolution and resultant of several concurrent forces, Equilibrium of particles in 2D. Statics of Rigid bodies in two dimensions- Varignon's theorem; Couples and Resultant of Force System, Equations of equilibrium of rigid bodies in 2D. Beams - types of supports, loads and reactions.

Module 2: Centre of Gravity, Moment of Inertia and Friction **15 Hrs.**

Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Parallel Axis theorem and perpendicular axis theorem, Moment of inertia of standard sections and composite sections (problems only); Introduction to Mass moment of inertia.

Friction: Types of friction, Limiting friction, Laws of friction – Static Friction-simple contact friction in blocks only.

Module 3: Dynamics of Particles **15 Hrs.**

Kinematics of Particles: Displacements, Velocity and acceleration, their relationship in linear motion (Horizontal only), projectile motion.

Kinetics of Particles: D'Alembert's principle and its applications; Work-kinetic energy, Impulse-momentum.

Total Hours:	**45 Hrs.**

Text Books:

1	Beer F.P, and Johnston ER, Vector Mechanics for Engineers – Statics and Dynamics, McGraw Hill Education, New Delhi, 2017.
2	Dhiman A.K, Dhiman P, Kulshreshtha D.C, Engineering Mechanics-Statics and Dynamics, McGraw Hill Education, 2017.

Reference Books:

1	Kottiswaran N, Engineering Mechanics - Statics and Dynamics, Sri Balaji Publications- 2017.
2	R.S.Khurmi , A Textbook Of Engineering Mechanics, S Chand publications ,2018.
3	Meriam JL and Craige, “Engineering Mechanics statics and dynamics”, John Willey and Son’s publication, 9th edition.2021
4	Sanju Unadkat, “Engineering Mechanics”, Tech-Neo Publications-2020.
5	Irving H. Shames, Engineering Mechanics - Statics and Dynamics, Pearson Education Asia Pvt. Ltd., 2016.
6	Timoshenko.S, “Engineering Mechanics”, McGraw Hill Education, 2017.
Web References:	
1	http://nptel.ac.in/courses/122104015/
2	http://nptel.ac.in/courses/112103109/
Online Resources:	
1	https://ocw.mit.edu/courses

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C101.1	Understand	Online Quiz	20
C101.2	Apply	Assignment	20
C101.3	Analyse	Assignment	20
C101.4	Apply		
C101.5	Apply	Tutorial	20

Assessment based on Summative and End Semester Examination			
Bloom’s Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	10	20	20
Apply	40	40	40
Analyse	40	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3		1										2		
2	3	2	2										3	1	
3	3	3	3										3		
4	3	2	3										3	1	
5	3	2	2										3	1	
Avg.	3	2.2	2.2										2.8	1	

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22MA201	ENGINEERING MATHEMATICS II (CIVIL)	3/1/0/4

Nature of Course	B (100% Analytical)
Pre requisites	-

Course Objectives:

1	To understand the different possible forms of Fourier series, partial differential equations and the Laplace transform techniques.
2	To Apply analytical methods to solve the partial differential equations, Laplace Transform and the Signals
3	To study the concept of mathematical formulation of certain practical problems in terms of partial differential equations
4	To acquaint the student with transform techniques which are used in a variety of engineering fields.
5	To impart the knowledge of Laplace transform, to find solutions of initial value problems for linear ordinary differential equations.

Course Outcomes:

Upon completion of the course, students shall have ability to

C201.1	Represent discontinuous function which occurs in circuits and signals processing by using Fourier series, functions of several variables and Laplace transform techniques.	[R]
C201.2	Understand the use of discrete and continuous transform techniques to connect the time domain and frequency domain and to solve equations involving more than one variable.	[U]
C201.3	Apply analytical methods to find the Fourier series of various signals in Engineering problems.	[AP]
C201.4	Understand the techniques in solving Partial differential equations that model engineering problems.	[AP]
C201.5	Describe homogeneous and higher order partial differential equations using analytical and numerical techniques.	[AP]

Course Contents:

MODULE I - FOURIER ANALYSIS **20 Hrs.**

Fourier series: Periodic functions - Dirichlet's conditions -General Fourier Series: Problems under (0,2l)-Problems under (0,2π) - Odd and Even Functions: Problems under (-π,π) - Problems under (-l,l)- Half range sine and cosine series – Root mean square value- Parseval's Identity- Harmonic analysis - **Fourier Transform:** Complex form of Fourier Transforms – Properties of Fourier Transform-Fourier sine and cosine transforms — Transforms of simple functions – Convolution theorem and Parseval's Identity (Excluding Proofs) – Evaluation of integrals using Parseval's Identity.

MODULE II - PARTIAL DIFFERENTIAL EQUATIONS **20 Hrs.**

Introduction to PDE- Formation of PDE by eliminating arbitrary constants- Formation of PDE by eliminating arbitrary functions- Lagrange's linear equations-Linear homogeneous partial differential equations of second and higher order with constant coefficients - Classifications of partial differential equation- Numerical Solution to Partial differential Equation - Elliptic equations: Liebmann's Iteration Process - Parabolic equations: Bender Schmidt's Difference scheme – Crank-Nicholson's Difference Scheme - Hyperbolic equations: One dimensional Wave equation.

MODULE III - LAPLACE TRANSFORMS **20 Hrs.**

Sufficient condition for existence- Convergence of Laplace transform – Transform of some standard functions -– Unit step function – Unit Impulse function – Properties - Transforms of derivatives and integrals– Transforms of Periodic functions- Initial and Final value theorem – Inverse Laplace transform – Partial fraction method – Convolution theorem – Solving second order ordinary differential equations using Laplace transform Techniques.	
Total Hours:	**60 Hrs.**
Text Books:	
1	Erwin E., “Advanced Engineering Mathematics”, John Wiley and Sons (Asia) Limited, Hoboken, 2020.
2	Jain M.K. Iyengar, K & Jain R.K., Numerical Methods for Scientific and Engineering Computation, New Age International (P) Ltd, Publishers,6th edition, 2016.
3	Grewal. B.S, “Higher Engineering Mathematics”, 43rd edition, Khanna Publications, Delhi, 2014.
Reference Books:	
1	Veerarajan. T, “Engineering Mathematics II”,Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018.
2	Glyn James, “Advanced Modern Engineering Mathematics”, Pearson Education, 4th edition, 2012.
3	N.P. Bali and Dr. Manish Goyal, ”A Textbook of Engineering Mathematics”, 9th edition, Laxmi publications ltd, 2014.
4	Gilbert Strang, “Linear Algebra and its Applications”, Third Edition, Harcourt College Publishers, 1988.
5	Veerarajan. T, “Engineering Mathematics II”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018.
Web References:	
1	https://www.youtube.com/watch?v=jNC0jxb0OxE
2	https://www.youtube.com/watch?v=iRXXmtcocAQ
3	https://www.youtube.com/watch?v=OGT59INHz3Y
Online Resources:	
1	https://nptel.ac.in/courses/111/106/111106111/
2	https://nptel.ac.in/courses/111/107/111107111/
3	https://nptel.ac.in/courses/111/107/111107107/

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	t**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list -**	**FA (16%) [80 Marks]**

		Quiz, Assignment, Case study, Seminar, Group Assignment)	
C201.1	Remember	Quiz	20
C201.2	Understand	Seminar	20
C201.3–C201.5	Apply	Tutorial	20
C201.3 – C201.5	Apply	Assignment	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	20	20	20
Understand	30	30	30
Apply	50	50	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1: 100 Marks			**CA 2: 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	1	1	1										1		
2	1	2	1										2		
3	3	3	2										2		
4	1	1	2										1		
5	2	1	2										2		
Avg.	**1.8**	**1.6**	**1.6**										**1.6**		

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CH101	ENGINEERING CHEMISTRY Common for all B.E/ B.Tech Engineering Courses (Except CSBS &M.Tech CSE)	3 /0 /2 /4

Nature of Course	: E (Theory Skill based)
Pre requisites	: NIL

Course Objectives:

1	To understand the principles and applications of electrochemistry and to learn electro analytical methods.
2	To learn the effect of corrosion in materials and the methods for prevention of corrosion.
3	To understand the basic concepts, synthesis, and applications of nano materials.
4	To explore the synthesis and properties of important engineering plastics and energy sources.
5	To understand the concepts of photophysical and photochemical processes in spectroscopy.

Course Outcomes:
Upon completion of the course, students shall have ability to

C101.1	Recall the principle and working of reference electrodes and conductivity meters as an analyzer.	[R]
C101.2	Apply the various corrosion control techniques in real time industrial environments.	[AP]
C101.3	Interpret the basic concepts and applications of Nano chemistry.	[U]
C101.4	Use the knowledge of various energy sources in storage devices and polymeric products in engineering field.	[AP]
C101.5	Interpret the principle and working of certain analytical techniques.	[U]

Course Contents

Electrochemistry and Corrosion: Electrochemistry-Introduction-single electrode potential-Electrochemical cells-EMF series. Reference electrodes-standard hydrogen electrode, saturated calomel electrode, glass electrode-pH measurement. Corrosion-types–mechanism of dry and wet corrosion-galvanic corrosion-differential aeration corrosion. Corrosion protection-electroplating of Chromium-electroless plating of Nickel.

Case Study: Electrochemical oxidation of effluents from sewage water treatment.

15 hours

Nano-Chemistry and Energy sources:Nano Chemistry-Basics-Comparison of molecules, nanomaterials and bulk materials. Preparation of nanomaterials-Electrochemical deposition and electro spinning. Applications of nanomaterials in medicine. Energy Sources-Fuel Cells-H_2-O_2 fuel cell. Storage Devices-Batteries- Alkaline-Lead acid, Nickel cadmium and Lithium-ion batteries.

Case Study: Hydrogen fuel cell in agricultural-opportunities and challenges.

15 hours

Polymer Chemistry and Analytical Techniques

Introduction-monomers and polymers-classification of polymers-Degree of Polymerization Mechanism of addition polymerization (free radical mechanism). Plastics-classification-Thermoplastic-thermosetting plastics. Conducting polymers-Types-Mechanism-applications.Spectroscopy-Beer Lambert's law, principle, instrumentation, and applications of Electronic spectroscopy (UV-visible)-Vibrational and rotational spectroscopy (IR)-Flame emission spectroscopy (FES).

Case Study: To design new drug molecules using molecular docking software.

15 hours

Theory:		**45 hours**
Lab Components:		**30 hours**
1	Determination of total, temporary, calcium and magnesium hardness of water sample by EDTA method.	[E]
2	Estimation of alkalinity of water sample.	[E]
3	Estimation of dissolved oxygen in water.	[E]
4	Potentiometry- determination of redox potentials and emf's.	[E]
5	Conductometric titration-mixture of acids vs NaOH..	[E]
6	Determination of strength of strong acid by pH-metry.	[E]
7	Determination of corrosion rate of mild steel in acid medium.	[E]
8	Electroplating of nickel over copper.	[E]
9	Spectrophotometry-Estimation of iron in water.	[E]
10	Determination of single electrode potential of Zinc and Copper by given solution.	[E]
	Total Hours:	**75**
Understanding the concepts by simple Demonstrations/Experiments:		
11	To detect the chlorine content in tap water using simple chemical method.	
12	To know the presence of dissolved oxygen in given water sample using glucose by redox principle.	
13	To illustrate the rate of corrosion in steel nails using acid medium.	
Text Books:		
1	Dara S.S, Umare S.S, "Engineering Chemistry", First revised Edition by S. Chand & Company Ltd., New Delhi 2015.	
2	Jain P. C. & Monica Jain., "Engineering Chemistry", 16th Edition, DhanpatRai Publishing Company (P) Ltd, New Delhi, 2015.	
3	Fundamentals of Molecular Spectroscopy, 4th Edition by C. N. Banwell Publishing McGraw-Hill Book Company (P) Ltd, England, 1994.	
4	Nanochemistry, 2nd Edition by K. Klabunde, G. Sergeev Springer Publisher, 2013.	
Reference Books:		
1	Shikha Agarwal., "Engineering Chemistry and Applications", Cambridge University press, 2016.	
2	Liliya., Bazylak.I., Gennady.E.,Zaikov.,Haghvi.A.K.,"Polymers and Polymeric Composites" CRC Press,2014.	
3	Lefrou., Christine., Fabry.,Pierre.,Poignet.,Jean-claude.,"Electrochemistry - The Basics, with examples" 2012 ., Springer.	
4	Zaki Ahmad, Digby Macdonald, "Principles of Corrosion Engineering and Corrosion Control", Elsevier Science, 2nd Edition 2012.	
5	Introduction to Nano: basics to Nanoscience and Nanotechnology, by Sengupta, Amretashis, Sarkar, Chandan Kumar, Springer Publisher, 2015.	
Web References:		
1	http://www.analyticalinstruments.in/home/index.html	
2	www.springer.com › Home › Chemistry › Electrochemistry	
3	https://www.kth.se/.../electrochem/welcome-to-the-division-of-applied-electrochemistry	
4	www.edx.org/	
5	https://www.ntnu.edu/studies/courses	
6	www.corrosionsource.com/	
Online Resources:		
1 2 3 4 5	https://ocw.mit.edu/courses/chemistry nptel.ac.in/courses/105106112/1_introduction/5_corrosion.pdf https://alison.com - Spectroscopic technique, Colorimetry https://ocw.mit.edu/courses/chemistry nptel.ac.in/courses/113108051	

Continuous Assessment									End Semester Examination	Total
Theory				Practical			Total (A+B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	Bloom's Level	Assessment Component(Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)	FA (10%) [80 Marks]
C101.1	Remember	Online Quiz-I	20
C101.2	Apply	Assignment-I	20
C101.3	Understand	Online Quiz-II	20
C101.4	Apply	Assignment-II	20
C101.5	Understand		

Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	Summative Assessment (15%) [120 Marks]		End Semester Examination (35%) [100 Marks]
	CIA 1: [60 Marks]	CIA 2: [60 Marks]	
Remember	20	20	20
Understand	35	35	35
Apply	45	45	45
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical			
Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (15%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	-	-	-
Understand	20	20	20
Apply	30	30	30
Analyze	25	25	25
Evaluate	25	25	25
Create	-	-	-

Assessment based on Continuous and End Semester Examination									
Continuous Assessment (50%)									End Semester Examination (50%)
CIA 1 (100 Marks)			CIA 2 (100 Marks)			Practical Exam (100 Marks)			Theory Examination (35%) Practical Examination (15%)
SA 1 (60M)	FA 1		SA 2 (60M)	FA 2		FA (75M)	SA (25M)		
	Component-I (20 Marks)	Component-II (20 Marks)		Component-I (20 Marks)	Component-II (20 Marks)				

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**K**	**l**	**1**	**2**	**3**
C101.1	3	2	2		1							1			
C101.2	3	2	2	1	1							1			
C101.3	3	3	2		1							1			
C101.4	3	2	2		1							1			
C101.5	3	2	2	1	1							1			
		3	Strongly agreed		2	Moderately agreed						1	Reasonably agreed		

22CS201	Data Structures and Algorithms	3/0/2/4

Nature of Course:	F (Theory Programming)
Pre requisites:	Problem Solving using C++

Course Objectives:

1.	To introduce list data structure and its applications.
2.	To impart the importance of stacks and queues in problem solving.
3.	To provide knowledge on Tree and Graph data structures.
4.	To discuss the role of hashing in information storage and retrieval.

Course Outcomes:
Upon completion of the course, students shall have ability to:

C201.1	Demonstrate the knowledge of basic data structures such as array and Linked List.	[AP]
C201.2	Solve real world problems efficiently by applying stack and queue data structures.	[AP]
C201.3	Illustrate the applications of tree and trie data structures.	[AP]
C201.4	Discuss the importance of heap and hashing techniques in information storage	[AP]
C201.5	Employ graph algorithms for solving real time computing problems and analyze them.	[A]

Course Contents:

Module 1: Linear data structures **15 Hrs.**

Linked List: Array vs Linked list - Types of linked list - Singly, Doubly and Circular Linked list - Applications of linked list. **Stack:** Array and Linked list implementation of Stack – Applications of Stack - Infix, Prefix and Postfix expressions - Expression Evaluation. **Queue:** Array and Linked list implementation of Queue - Priority Queue - Applications of Queue. **Searching & Sorting:** Linear search, Binary search, Bubble sort, Insertion sort, Selection sort, Quick sort, Merge sort.

Module 2: Trees and hashing **15 Hrs.**

Trees: Binary Tree - Binary Search Tree - Insertion, Deletion, Traversal - Inorder, Preorder, Postorder, Level order traversal. **Tries:** Introduction to Tries, making a trie node, Insert, Search and Remove operation in Tries. **Heaps & Hashing:** Implementation of Heaps, Binary Heap, Heap sort, Direct Address Table, Collision handling.

Module 3: Graph data structures **15 Hrs.**

Graphs: Weighted and Directed graphs - Adjacency matrix and list implementation - Traversal – Breadth First Search & Depth First Search. **Graph Algorithms:** Minimum spanning Tree – Prim's and Kruskal's algorithms, Dijkstra's Shortest path algorithm.

Total Hours (Theory):	**45 Hrs.**

S. No.	Lab Exercises
1	Implementation of Singly, Doubly and Circular Linked List.
2	Implementation of Stack using Arrays and Linked List.
3	Implementation of Stack applications

4	Implementation of Queue using Arrays and Linked List.
5	Implementation of Priority Queue.
6	Implementation of Queue applications.
7	Implementation of sorting algorithms
8	Implementation of Hashing techniques
9	Implementation of Heap
10	Implementation of Binary Search Tree.
11	Implementation of Graph Traversal algorithms
12	Implementation of Minimum spanning tree algorithms
13	Implementation of Dijkstra's Shortest path Algorithms.
14	Implementation of Trie data structure
	Total Hours **30 Hrs.**

Text Books:	
1	Sartaj Sahni, "Data Structures, Algorithms and Applications in C++", Silicon pape publications, 2004.
2	Anany Levitin, Introduction to the design & analysis of algorithms ,3rd Edition,Pearso Education, 2021.
3	Michael T. Goodrich, "Data Structures and Algorithms in C++", 2nd Edition, Wile Publication, 2011.
Reference Books:	
1	Seymour Lipschutz, "Data Structures by Schaum Series", 2nd edition, Tata McGraw Hill, 2013.
2	Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures andAlgorithmic Puzzles", 5th Edition, CareerMonk,2016.
3	Debasis Samanta, "Classic data structures", Prentice Hall of India, 2nd edition, 2014.
Web References:	
1	https://www.codingninjas.com/courses/c-plus-plus-data-structures-and-algorithms
2	https://www.edx.org/course/data-structures-algorithms-using-c
Online Resources:	
1	https://www.programiz.com/dsa l
2	https://freevideolectures.com/course/2519/c-programming-and-data-structures
3	https://www.cprogramming.com/algorithms-and-data-structures.html

Continuous Assessment									**End Semester Examination**	**Total**
Theory				**Practical**			**Total (A+B)**	**Total Continuous Assessment**		
Formative Assessment	**Summative Assessment**	**Total**	**Total (A)**	**Formative Assessment**	**Summative Assessment**	**Total (B)**				
80	**120**	**200**	**100**	**75**	**25**	**100**	**200**	**50**	**50**	**100**

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (10%) [80 Marks]**
C201.1	Understand	Quiz	20
C201.2	Apply	Case Study	20
C201.3	Apply	Group Assignment	20
C201.4	Analyze	Assignment	20
C201.5	Apply		

Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	**Summative Assessment (15%) [120 Marks]**		**End Semester Examination (35%) [100 Marks]**
	CIA 1: [60 Marks]	**CIA 2: [60 Marks]**	
Remember	20	20	20
Understand	40	30	30
Apply	40	40	40
Analyze	-	10	10
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical			
Bloom's Level	**Continuous Assessment (25%) [100 Marks]**		**End Semester Examination (15%) [100 Marks]**
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	**-**	**-**	**-**
Understand	20	20	20
Apply	30	30	30
Analyze	25	25	25
Evaluate	25	25	25
Create	**-**	**-**	**-**

Assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)								**End Semester Examination (50%)**
CIA 1 (100 Marks)			**CIA 2 (100 Marks)**			**Practical Exam (100 Marks)**		**Theory Examination (35%) Practical Examination (15%)**
SA 1 (60M)	**FA 1**		**SA 2 (60M)**	**FA 2**		**FA (75 M)**	**SA (25 M)**	
	Component-I (20 Marks)	**Component-II (20 Marks)**		**Component-I (20 Marks)**	**Component-II (20 Marks)**			

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	2									1	3	1	1
2	3	3	3	3	3				2	1		2	3	2	2
3	3	3	3	3	3				2	1		2	3	2	2
4	3	3	3	3	3				2	1		2	3	2	2
5	3	3	3	3	3				2	1		2	3	2	2
Avg.	**3**	**3**	**3**	**3**	**3**				**2**	**1**		**2**	**3**	**2**	**2**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22TA101	HERITAGE OF TAMILS	1/0/0/1

Nature of Course:	C (Theory Concept)
Pre requisites:	NIL

Course Objectives:

1	To know various concepts of Tamil Language families.
2	To know about the essentialities of Heritage.
3	To understand the Aram concepts of Tamils and the cultural influence.

Course Outcomes:

Upon completion of the course, students shall have ability to

C101.1	Know about the language families in India, impact of religions and the contribution of Bharathiyar and Bharathidhasan.	[U]
C101.2	Observe the growth of sculpture, making of musical instruments and the role of temples in socio and economic lives.	[U]
C101.3	Understand the significance of folklore and martial arts.	[U]
C101.4	Learn the sangam literature, sangam age and overseas conquest of Cholas.	[U]
C101.5	Understand the contribution of Tamils to Indian Freedom Struggle, role of Siddha medicine and print history of Tamil Books.	[U]

Course Contents:

Language and Literature: 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.

Heritage - Rock Art Paintings to Modern Art – Sculpture: 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. **Folk And Martial Arts:** Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

Thinai Concept Of Tamils - 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. Contribution of Tamils to Indian national movement and indianculture: 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 Hours: 15

Text-cum-Reference Books:

1	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித் தமிழ் – முனைவர் இல. சுந்தரம் . (விகடன் பிரசுரம்).

3	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4	பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
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 Civilization 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).
12	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C101.1	Understand	Quiz	20
C101.2	Understand	Seminar	20
C101.3	Understand	Seminar	20
C101.4	Understand	Quiz	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	40	40	40
Understand	60	60	60
Apply	-	-	-
Analyse	-	-	-
Evaluate	-	-	-

Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-
2	-	-	-	-	-	-	-	1	1	-	-	1	-	-	-
3	-	-	-	-	-	-	-	1	1	-	-	1	-	-	-
4	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
5	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
Avg.	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE201	ENGINEERING GRAPHICS LABORATORY	0/0/4/2
Nature of Course	Practical application	
Pre requisites	Nil	

Course Objectives:

1	To learn the construction of conic curves used in engineering applications.
2	To develop an understanding of Isometric to orthographic projections.
3	To learn the projection of lines, planes and solids objects.
4	To know development of lateral surfaces and building drawings.

Course Outcomes:
Upon completion of the course, students shall have ability to

C201.1	Understand the construction of conic curves and its applications.	[U]
C201.2	Apply the knowledge of drafting skills in the orthographic projections.	[AP]
C201.3	Construct the projection of lines, plane surfaces and solids using the drafting package.	[AP]
C201.4	Develop the lateral surface of the solids and perspective projections.	[AP]
C201.5	Develop the plan, section and elevation of the simple building using drafting package.	[AP]

Course Contents:

Laboratory Component:

S. No	List of Experiments	CO Mapping	BT
1	Construction of conic curves (Ellipse, Parabola and Hyperbola)	C201.1	[AP]
2	Hands on experience of the drafting package.	C201.2	[AP]
3	Drawing the orthographic projections from isometric projections manually and using drafting package.	C201.2	[AP]
4	Projection of lines inclined to anyone of the principal planes using drafting package.	C201.3	[AP]
5	Projection of plane surfaces inclined to anyone of the principal planes.	C201.3	[AP]
6	Projection of solids (Prism and Pyramid) inclined to HP using drafting package.	C201.3	[AP]
7	Projection of solids (Cone and Cylinder) inclined to VP using drafting package.	C201.3	[AP]
8	Development of lateral surfaces (Prism and Pyramid) using drafting package.	C201.4	[AP]
9	Development of lateral surfaces (Cone and Cylinder) using drafting package.	C201.4	[AP]

10	Hands on overview to Perspective Projections.	C201.4	[AP]
11	Drafting the plan, section and elevation of a single room building using drafting package.	C201.5	[AP]
12	Drafting the plan and section of a simple residential building using drafting package.	C201.5	[AP]
		TOTAL HOURS	**60 Hrs.**
Reference Books:			
1	Bhatt, N.D., and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2014.		
2	Natarajan K. V., "A text Book of Engineering Graphics", Dhanalakshmi Publishers, 2018.		
3	Gopalakrishna K. R., "Engineering Drawing" Vol. I & II, Subhas Stores, Bangalore, 2011.		
4	VenugopalK., and Prabhu Raja V., "Engineering Graphics", New Age International Pvt. Ltd., 2013.		
Web References:			
1	https://onlinecourses.nptel.ac.in/noc21_me128/preview		
2	https://www.autodesk.com/training		

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
75	**25**	**100**	**60**	**40**	**100**

Assessment based on Continuous and End Semester Examination			
Bloom's Level	**Continuous Assessment (60%) [100 Marks]**		**End Semester Practical Examination (40%) [100 Marks]**
	FA (75 Marks)	**SA (25 Marks)**	
Remember	10	10	10
Understand	10	10	10
Apply	40	40	40
Analyse	20	20	20
Evaluate	10	10	10
Create	10	10	10

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
Cos	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	2	3	-	-	1	1	1	-	2	2	-	2

2	3	2	2	2	3	-	-	1	1	1	-	2	2	-	2
3	3	2	2	2	3	-	-	1	1	1	-	2	2	-	2
4	3	2	2	2	3	-	-	1	1	1	-	2	2	-	2
5	3	2	2	2	3	-	-	1	1	1	-	2	2	-	2
Avg.	**3.0**	**2.0**	**2.0**	**2.0**	**3.0**	**-**	**-**	**1.0**	**1.0**	**1.0**	**-**	**2.0**	**2.0**	**-**	**2.0**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

Semester - 3

22MA301	PROBABILITY AND NUMERICAL METHODS (CIVIL)	3/1/0/4

Nature of Course	B (100% Analytical)
Pre requisites	-

Course Objectives:

1.	To define the concept of probability and its features.
2.	To have a well – founded knowledge of standard distributions which can be used to describe real life phenomena.
3.	To learn the concept of testing hypothesis using statistical analysis.
4.	To study the concept of fitting a curve of best fit to the given numerical data and to calculate the deviation of the expected value from the observed value.
5	To study the various numerical methods to fit the polynomial by interpolation formulae and to evaluate single and double integration.

Course Outcomes:
Upon completion of the course, students shall have ability to

C301.1	Recall the concept of probability and statistics.	[R]
C301.2	Understand to handle situations involving random variables and standard distributions.	[U]
C301.3	Apply measures of central tendency to analyze statistical data and to find the correlation and regression between the given data.	[AP]
C301.4	Develop the inferences for engineering problems using testing of hypothesis.	[AP]
C301.5	Apply numerical methods to fit the polynomial by interpolation formulae and to evaluate single and double integration.	[AP]

Course Contents

MODULE I - PROBABILITY **20 Hrs.**

Sample space – Axioms of Probability – Events – Conditional probability – Total Probability – Baye's Theorem (Statement only). One dimensional Random Variable – Discrete random variable – Probability mass function – Discrete distribution: Binomial distribution – Poisson distribution – Continuous Random Variable – Probability density function – Continuous distribution: Uniform distribution – Normal distribution.

MODULE II - STATISTICS **20 Hrs.**

Measures of central tendency: Mean, Median and Mode. Correlation (Karl Pearson's) – Rank correlation (Spearman's) – Linear regression. Testing of Hypothesis – Small Samples – Student's t-Test for single mean, difference of means – F test – Chi square test for goodness of fit and independence of attributes – Analysis of Variance – One way classification.

MODULE III - NUMERICAL METHODS **20 Hrs.**

Solution of Algebraic and transcendental equations – Newton Raphson method – Fixed point iteration method. Interpolation – Interpolation with equal intervals – Newton's Forward and Backward difference formula – Interpolation with unequal intervals – Newton's Divided difference formula – Lagrange's interpolation formula. Numerical Integration – Trapezoidal rule – Simpson's 1/3 rd rule and Simpson's $3/8^{th}$ rule – Double integration using Trapezoidal and Simpson rule.

Total Hours	**60 Hrs.**

Text Books:

1.	Peebles Jr. P.Z., – Probability Random Variables and Random Signal Principles, Tata McGraw-Hill Publishers, Fourth Edition, New Delhi, 2016
2.	Gupta, S.C., & Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan Chand & sons, 12th edition , 2020
3.	Grewal B.S., Numerical methods in Engineering and Science. 12th edition, Stylus Publishing, 2018.

Reference Books:

1.	Ross, S,"A First Course in Probability, Ninth edition", Pearson Education, Delhi, 2018.
2.	Richard A. Johnson, Irwin Miller, John Freund, Miller & Freund's,"Probability and Statistics for Engineers",Ninth edition, 2016.
Web References:	
1.	http://nptel.ac.in/courses/111104079/
2.	http://www.nptelvideos.in/2012/12/probability-random-variables.html
3.	http://freevideolectures.com/Course/2311/Digital-Communication/4
Online Resources:	
1.	https://www.coursera.org/learn/probability-intro
2.	https://www.coursera.org/lecture/wharton-introduction-spreadsheets-models/3-1-random-variables-and-probability-distributions-Y3bCF
3.	https://www.codewithc.com/newtons-interpolation-in-matlab/

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (16%) [80 Marks]**
C301.1	Remember	Quiz	20
C301.2	Understand	Seminar	20
C301.3 – C301.5	Apply	Tutorial	20
C301.3 – C301.5	Apply	Assignment	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	20	20	20
Understand	30	30	30
Apply	50	50	50
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1: 100 Marks			CA 2: 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	1	-	-	-	-	-	-	-	-	-	1	-	-
2	2	2	2	-	-	-	-	-	-	-	-	-	1	-	-
3	3	3	3	-	-	-	-	-	-	-	-	-	2	-	-
4	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
5	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
Avg.	2.4	2.4	2.4	-	-	-	-	-	-	-	-	-	2	-	-

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE301	SURVEYING AND GEOMATICS	3/1/0/4
Nature of Course	Practical Application	
Pre requisites	Nil	

Course Objectives:

1	To introduce the principles of various surveying methods and applications to Civil Engineering Projects
2	To deals with geodetic measurements and control survey methodology and its Adjustments.
3	To introduce the working principles of modern surveying instruments
4	To expose the modern surveying methods and its applications in recent surveying techniques

Course Outcomes:

Upon completion of the course, students shall have ability to

C301.1	Measure the area of the plot and volume of earthwork using various techniques	[AP]
C301.2	Choose the surveying equipment to prepare LS & CS, Contour maps and carryout surveying works related to civil engineering projects	[AP]
C301.3	Distinguish the advantages of electronic surveying over conventional surveying methods	[AP]
C301.4	Analyze the working principle of Total station & GPS, its components, signal structure of GPS and error sources	[AN]
C301.5	Classify the concepts of photogrammetry and remote sensing techniques used in modern surveying methods	[AP]

Course Contents: Theory

Module 1: Conventional surveying and Levelling **20 Hrs.**

Definitions, Classifications – basic principles – field and office work - Scales - methods of ranging – Errors in linear measurements and their corrections – Conventional signs - Compass – types – bearing systems and conversions – errors and local attraction – leveling and applications – Booking – Levels and staves - Reduction Methods – Fly, Check and Reciprocal leveling – curvature and refraction– Sources of errors in leveling - Contouring – characteristics & Interpolating methods – Computations of cross-sectional areas and volumes – Earthwork calculations – Mass haul diagrams.

Module 2: Triangulation & Modern surveying methods **20 Hrs.**

Theodolite – surveying adjustments – Heights and Distances – Triangulation – instrument and accessories – satellite station – reduction to center – Signals and towers - true and most probable values - weighed observations - method of equal shifts - principle of least squares - normal equation - correlates - Total Station Surveying– Electro optical system: Measuring and working principles, sources of errors. Electro optical micro wave system – COGO functions – Field procedure and applications - Comparison between Electrooptical and Microwave system - Care and maintenance of Total Station instruments.

Module 3: Hydrographic and GPS surveying **20 Hrs.**

Hydrographic surveying – Tides – MSL – Sounding methods – Determination of depth and position using multi-beam sounder - Fundamentals of underwater acoustic positioning - sediments and seabed topography - SURFER 8.0 – Applications – GPS Surveying - segments of GPS – Satellite configuration and signal structure – Hand held and Geodetic

receivers – Photogrammetry and remote sensing techniques – Flying height - Geodetic satellite – Doppler effect – Positioning concept – GNSS – IRNSS and GAGAN – Anti spoofing and selective availability – DGPS – Fundamentals and working principles.	
Total Hours	**60 Hrs.**
Text Books:	
1	Punmia B.C., "Surveying" – "Vols. – I, II & III", Laxmi publications, New Delhi 2016.
2	Kanetkar T.P, Kulkarni S.V., "Surveying and Levelling", Vols. I and II, Standard publishers Distributors, New Delhi 2015.
3	Anji Reddy M., Remote Sensing and Geographical Information System, B.S. Publications, 2012
Reference Books:	
1	Purushothamaraj.P, "Surveying –I & II" Laxmi Publications, 2012.
2	James M. Anderson and Edward M. Mikhali, "Surveying, Theory and Practice", 7th Edition, McGraw Hill, 2017
3	Satheesh Gopi, R. Sathish kumar, N. Madhu, "Advanced Surveying, Total Station GPS and Remote sensing" Pearson education, 2017.
4	Arora K.R., "Surveying Vol I & II", Standard book house, 2015
Web References:	
1	http://nptel.ac.in/course.php?disciplineId=108
2	https://onlinecourses.nptel.ac.in/noc20_ce18/preview
3	https://nptel.ac.in/video.php?subjectId=117103063
Online Resources:	
1	http://ecoursesonline.iasri.res.in/course/view.php?id=523
2	https://www.udemy.com/course/surveying/
3	https://freevideolectures.com/course/98/surveying
4	https://www.surveyofindia.gov.in/pages/courses-offered

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C301.1	Understand	Quiz	20
C301.2	Apply	Tutorial	20

C301.3	Understand	Group Assignment	20
C301.4	Apply		
C301.5	Understand	Presentation	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	20	20	20
Apply	40	40	30
Analyse	30	30	40
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2						1				2	1		1
2	3	3	3	3				2				3	3		2
3	2							1				1			1
4	3	3	2	2				2				3	3		2
5	3	3	3	3				2				3	3		2
Avg.	**3**	**3**	**2.5**	**2.5**				**1.6**				**2.4**	**3**		**1.6**
1	Reasonably agreed				2	Moderately agreed			3	Strongly agreed					

22CE302	ARCHITECTURAL PLANNING AND BUILDING DRAWING	3/0/3/4.5
Nature of Course	Theory Application	
Pre requisites	Nil	

Course Objectives:

1	To introduce the various facets of architecture and planning for a holistic understanding of the disciplines.
2	To understand the elements and principles of architecture.
3	To understand the design approach of various building types with specific reference to site and climate.
4.	To understand the building rules, Bye laws and Building Information Modelling (BIM).

Course Outcomes:

Upon completion of the course, students shall have ability to

C302.1	Apply the components and elements of an architectural design.	[AP]
C302.2	Relate spatial relationship and spatial organization principles.	[AP]
C302.3	Incorporate principles of architecture and circulation in the design.	[AP]
C302.4	Perform climate responsive designs and its various components – passive design strategy.	[AP]
C302.5	Design in accordance with building Bye laws, National Building Code and discuss Building Information Modelling.	[AP]

Course Contents: Theory

Module 1: Introduction and Elements of Architecture **15 Hrs.**

Definitions of Architecture – architecture as a discipline – context for architecture as satisfying human needs: functional, aesthetic and psychological- outline of components and aspects of architectural form. Building typologies: Residential, institutional, commercial and Industrial types – Anthropometry and space standards- Functional relationships - Understanding fundamental elements such as point, line, plane, form and space, shape, pattern, light, color, surface and texture. Understanding perceptual effects of geometric forms such as sphere, cube, pyramid, cylinder and cone. Understanding perceptual effects of configuration of architectural spaces – Spatial relationship and its types, Spatial organization and its types – built form and open space relationships.

Module 2: Principles of Architecture and Climate responsive design **15 Hrs.**

Understanding fundamental principles such as proportion, scale, balance, symmetry/asymmetry, rhythm, axis, hierarchy, datum, unity, harmony, dominance, and climax. Movement with reference to the architectural form and space – relationship between architectural form and circulation – Types of circulation. Site analysis and climate responsive design **-** Site Surveys - Site analysis of natural, cultural and aesthetic factors – topography, hydrology, soils, vegetation, macro/micro climate, surface drainage, accessibility, size and shape, infrastructures available - Site level planning and organization of open, semi-open and built spaces. Man, Climate and Shelter - Factors that determine climate – Characteristics of climate types – Design for various climate types – Passive and active energy controls - Simple passive design considerations.

Module 3: Building Bye laws & Building Information Modelling **15 Hrs.**

Building Rules and Bye-laws - Overview to National Building Code (NBC) -Overview to Development Control Regulation (DCR) - Guidelines -Floor Space Index (FSI)- Floor Area Ratio (FAR)- Setbacks-Open space reservation (OSR) - Industries - Fire safety regulations- Building services-Building Approval Process -Plan Requirements- Real estate regulatory authority (RERA)- Building Information Modelling –Concepts -Advantages - Drawing based process vs BIM process- 3D Simulations- 4D Scheduling- 5D Costing- 6D Sustainability- 7D Facility and Asset Management- Design Coordination - BIM softwares -Case studies.		
Total Hours		**45 Hrs.**
Course Outcomes: Lab Component **Upon completion of the course, students shall have ability to**		
C302.1	Design a single storied residential space for a given client set and draft its sectional and elevation views.	[AN]
C302.2	Design a hospital building with all amenities and draft its sectional and elevational views.	[AN]
C302.3	Design a school building with all amenities and draft its sectional and elevational views.	[AN]
C302.4	Design a factory building with North Light roof truss & G+1 commercial building and draft its sectional and elevational views.	[AN]
C302.5	Render a 3D model of residential building, school, hospital building using Revit software Package and understand the Scheduling, costing, Clash detection and Automation in BIM.	[AP]

Laboratory Course Content:

S. No.	List of Experiments	CO Mapping	BT
1.	Planning and drafting the plan, section & elevation of a single storied residential building.	C302.1	[AN]
2.	Planning and drafting the section, elevation of a G+1 hospital building	C302.2	[AN]
3.	Planning, drafting the section and elevation of a school building	C302.3	[AN]
4.	Planning and drafting the section, elevation of a factory building with north Light Roof truss	C302.4	[AN]
5.	Planning and drafting the section elevation of a G+1 commercial complex building.	C302.4	[AN]
6	Hands on Overview to Building Information Modelling (BIM)	C302.6	[AP]
7.	Hands-on 3D Modeling of a single storied residential building. (Autodesk Revit Architecture).	C302.5	[AP]
8.	Hands-on 3D Modeling of a factory building with north Light Roof truss (Autodesk Revit Architecture).	C302.5	[AP]
9.	Hands-on 3D Modeling of a school building (Autodesk Revit Architecture)	C302.5	[AP]

10.	Hands-on Overview to 4D (BIM)- Simulation of a residential building.	C302.5	[AP]
11.	Hands-on Overview to 5D (BIM) - cost estimating of a residential building.	C302.5	[AP]
12.	Hands-on Overview to Clash detection (Navisworks) and Visual Programming environment for automation (Dynamo Studio)	C302.5	[AP]
		Total Hours	**45 Hrs.**

Text Books:	
1.	Simon Unwin, “Analyzing Architecture”, Routledge; 4th edition, 3024
2.	Koenigsberger O.H. et.al, “Manual of Tropical Housing and Building” – Part I - Climate design, Orient Longman, Madras, India, 3020.
3.	Kale C.M, Patki S.Y. “Building Drawing with an Integrated to Built Environment” Mc-Graw Hill Education, fifth reprint edition 3023.
Reference Books:	
1.	Julius Panero, Martin Zelnik, “Human Dimension and Interior Space: A Source Book of Design Reference Standards”, 3022.
2.	Arvind Krishnan, Nick Baker, Simos Yannas and Szokolay.S.V., “Climate Responsive Architecture”., A Design Hand Book for Energy Efficient Building, Tata McGraw Hill Publishing Company Ltd., New Delhi, 3027
3.	Ricard Hyde, “Climate Responsive Design: A Study of Buildings in Moderate and Hot Humid Climates” Taylor & Francis; 1 edition, 3025
Web References/ Online Resources:	
1.	http://www.civilengineeringx.com/building-design-and-construction-handbook
2.	https://www.thebalancesmb.com/designing-climate-responsive-architecture-3157812
3.	http://char.txa.cornell.edu/language/principl/principl.htm
4.	https://www.open.edu.au/sitecore/content/Alchemy/Home/degrees/master-of-urban-and-regional-planning-curtin-university-cur-urp-mas

Continuous Assessment									**End Semester Examination**	**Total**
Theory				**Practical**			**Total (A+B)**	**Total Continuous Assessment**		
Formative Assessment	**Summative Assessment**	**Total**	**Total (A)**	**Formative Assessment**	**Summative Assessment**	**Total (B)**				
80	**120**	**200**	**100**	**75**	**25**	**100**	**200**	**50**	**50**	**100**

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (10%) [80 Marks]**
C302.1	Understand	Quiz	**20**

C302.2	Apply	Assignment	**20**
C302.3	Apply	Seminar	**20**
C302.4	Apply		
C302.5	Apply	Case study	**20**

Assessment based on Summative and End Semester Examination - Theory

Bloom's Level	**Summative Assessment (15%) [120 Marks]**		**End Semester Examination (25%) [100 Marks]**
	CIA1: (60 Marks)	**CIA2: (60 Marks)**	
Remember	30	30	20
Understand	50	40	50
Apply	20	30	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	**Continuous Assessment (25%) [100 Marks]**		**End Semester Examination (25%) [100 Marks]**
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	10	10	**-**
Understand	10	10	**10**
Apply	50	50	**50**
Analyse	30	30	40
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

Continuous Assessment (50%)							**End Semester Examination (50%)**
CA 1 (100 Marks)			**CA 2 (100 Marks)**			**Practical Exam (100 Marks)**	
SA 1 (60M)	**FA 1**		**SA 2 (60M)**	**FA 2**		**FA (75M)**	**SA (25M)**	**Theory Examination (25%) Practical Examination (25%)**
	Component -I (20 Marks)	**Component -II (20 Marks)**		**Component -I (20 Marks)**	**Component -II (20 Marks)**			

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO) - (Theory)

COs	**POs**	**PSOs**

	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1							1		1	2	2	1
2	3	2	1							1		1	2	2	1
3	3	2	1							1		1	2	2	1
4	3	2	1							1		1	2	2	1
5	3	2	1							1		1	2	2	1
Avg	3	2	1							1		1	2	2	1

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO) - (Laboratory)

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1		3		2	3	3	2		1	2	2	1
2	3	2	1		3		2	3	3	2		1	2	2	1
3	3	2	1		3		2	3	3	2		1	2	2	1
4	3	2	1		3		2	3	3	2		1	2	2	1
5	3	2	1		3		2	3	3	2		1	2	2	1
Avg	3	2	1		3		2	3	3	2		1	2	2	1

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE303	STRENGTH OF MATERIALS	3/0/3/4.5
Nature of Course	Problem Analytical	
Pre requisites	Engineering Mechanics	

Course Objectives:

1	To apply the basic principles to analyse the stress strain behavior materials
2	To apply torsion theory to analyse the torsional behavior of shafts and springs
3	To impart the basic principles to compute and sketch the shear force, bending moment, slope and deformations of beams.
4	To analyse the indeterminate structures and trusses.

Course Outcomes:
Upon completion of the course, students shall have ability to

C303.1	To apply the fundamental concepts of stress, strain and deformation of solids	[AP]
C303.2	Compute the bending and torsional deformation on shafts and springs.	[AN]
C303.3	Analyze the determinate beams and compute the shear forces, bending moments, slope and deformations.	[AN]
C303.4	Analyze the indeterminate beams and compute the shear forces and bending moments.	[AN]
C303.5	Apply the equilibrium concepts to analyse the trusses and beams.	[AN]

Course Contents: Theory

Module 1: Simple Stresses and Strains & Bending **15 Hrs.**

Stresses in the Members of a Structure - types of stresses and strain - Hooke's Law – Stress–Strain relationship - Strain Behavior of Ductile and Brittle Materials - Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli - Relation between Elastic Constants - Bars of varying section – composite bars – Temperature stresses - Theory of simple bending - Determination of bending stresses - Section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections –

Module 2: Shear, Bending, Slope and Deflection of beams & Torsion **15 Hrs.**

Determinate structures – internal forces and moment in beams – Shear force and bending moment diagrams – cantilever and simply supported beams (with and without overhangs) - Slope and deflection for determinate beams - Integration Method - Moment-Area Method - Torsion - Bending and Torsional Deformation of a Circular Shaft – power transmitted by shafts – Springs - stresses in helical springs - deflection of springs.

Module 3: Indeterminate beam analysis and Truss analysis **15 Hrs.**

Indeterminate Beams – fixed, propped and continuous beams – Theorem of three moments (Limited to two span) - shear force and bending moment diagrams for concentrated load, uniformly distributed load and combined load cases - Analysis of plane truss - stability and equilibrium of plane frames - analysis of forces in truss members - method of joints - method of sections

Total Hours	**45 Hrs.**

Course Outcomes : Laboratory
Upon completion of the Laboratory, students shall have ability to

C303.1	Analyze and compute the shear force, bending moment and deflection of beams and frames using analysis package.	[AN]
C303.2	Analyze and compute the member forces and deflection of roof truss using analysis package.	[AN]
C303.3	Compute the stress distribution of a homogeneous concrete beam with FEM package	[AN]
C303.4	Analyze and compute the tension, shear, torsion, hardness and impact strength of metal specimen.	[AN]
C303.5	Analyze and compute the spring stiffness, modulus of rigidity of the spring wire and maximum strain energy stored.	[AN]

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Computation of shear force, bending moment and deflection of beams using analysis package.	C303.1	[AN]
2	Computation of shear force, bending moment and deflection of portal frames using analysis package.	C303.1	[AN]
3	Computation of member forces and deflection for a roof truss using analysis package.	C303.2	[AN]
4	Computation of stress distribution of a homogeneous concrete beam with FEM package	C303.3	[AN]
5	Determination of tensile strength of steel rod	C303.4	[AN]
6	Determine the modulus of elasticity of mild steel by beam deflection method.	C303.1	[AN]
7	Determination of double shear strength of steel rod	C303.4	[AN]
8	Estimate the torsion strength of steel rod	C303.4	[AP]
9	Determine the impact strength of steel bar (Charpy / Izod)	C303.4	[AN]
10	Determine the hardness of metal specimens (Brinell / Rockwell)	C303.4	[AN]
11	Determination of Elastic properties of open coiled helical springs.	C303.5	[AN]
12	Determination of Elastic properties of closed coiled helical springs.	C303.5	[AN]
		Total Hours	**45 Hrs.**

Text Books:

1	Gere J.M. and Goodno, B.J., “Mechanics of Materials”, CENGAGE Learning Custom Publishing; 9th edition edition, 2017.
2	Bansal R.K, “Strength of Materials”, Lakshmi Publications Ltd, New Delhi, 2022.
3	Punmia B.C and Jain A.K., “Mechanics of Materials”, Laxmi Publications Ltd, New Delhi, 2018.

Reference Books:

1	William A. Nash, Strength of Materials, Tata McGraw-Hill Publishing Co. Ltd, New Delhi, 2013

2	Gambhir M.L. “Fundamentals of Solid Mechanics”, PHI Learning Private Ltd., New Delhi, 2009.
3	Kazimi S.M.A., “Solid Mechanics ", Tata McGraw-Hill Publishing Company, New Delhi, 2017
4	Shames I.H.., Introduction to Solid Mechanics, Prentice-Hall of India Pvt. Ltd, 2009
Web Reference:	
1	http://nptel.iitk.ac.in/courses/Webcourse-contents/IIT-Delhi/Mechanics%20Of%20Solids/index.htm
2	http://textofvideo.nptel.iitm.ac.in/1053/lec1.pdf
3	http://www.nesoacademy.org/civil-engineering/mechanics of solids
Online Resources:	
1	http://nptel.ac.in/video.php?subjectId=105106116
2	http://nptel.ac.in/video.php?subjectId=112107147

Continuous Assessment									End Semester Examination	Total
Theory				Practical			Total (A+B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (10%) [80 Marks]**
C303.1	Apply	Quiz	**20**
C303.2	Analyse	Assignment	**20**
C303.3	Analyse	Quiz	**20**
C303.4	Analyse		
C303.5	Analyse	Tutorial	**20**

Assessment based on Summative and End Semester Examination - Theory			
Bloom’s Level	**Summative Assessment (15%) [120 Marks]**		**End Semester Examination (25%) [100 Marks]**
	CIA1: (60 Marks)	**CIA2: (60 Marks)**	
Remember	-	-	-
Understand	30	30	20
Apply	30	30	30
Analyse	40	40	50
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (25%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	10	10	10
Understand	20	20	20
Apply	40	40	40
Analyse	30	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)								End Semester Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)		Theory Examination (25%) Practical Examination (25%)
SA 1 (60M)	FA 1		SA 2 (60M)	FA 2		FA (75M)	SA (25M)	
	Component-I (20 Marks)	Component-II (20 Marks)		Component-I (20 Marks)	Component-II (20 Marks)			

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO) - (Theory)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	2						2		3	3		2
2	3	3	3	2						2		3	3		2
3	3	3	3	2						2		3	3		2
4	3	3	3	2						2		3	3		2
5	3	3	3	2						2		3	3		2
Avg	3	3	3	2						2		3	3		2

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO) - (Laboratory)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3				2	2		3	3		2
2	3	3	3	3	3				2	2		3	3		2

3	3	3	3	3	3				2	2		3	3		2
4	3	3	3	3	3				2	2		3	3		2
5	3	3	3	3	3				2	2		3	3		2
Avg	**3**	**3**	**3**	**3**	**3**				**2**	**2**		**3**	**3**		**2**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22IT311	INTRODUCTION TO PYTHON PROGRAMMING	1/0/4/3
Nature of Course	F(Theory Programming)	
Prerequisites	Nil	

Course Objectives:

1.	To understand and execute Python script using types and expressions.
2.	To understand the difference between expressions & statements and to understand the concept of assignment semantics.
3.	To utilize high level data types such as lists and dictionaries.
4.	To import and utilize a module and to perform read & write operations on files.

Course Outcomes

Upon completion of the course, students shall have ability to

C311.1	Demonstrate programs using simple python statements and expressions.	[U]
C311.2	Build control flow and string concept in python for solving problems.	[AP]
C311.3	Develop python programs using functions.	[AP]
C311.4	Analyze compound data using python lists, tuples and dictionaries.	[A]
C311.5	Apply python programs using files, exception, modules and packages.	[AP]

COURSE CONTENTS:

DATA,EXPRESSIONS,STATEMENTS: 15 Hours

Data Types, Variables and Identifiers, Operators and Expression, Conditional Branching Statements, Iterative statements Nested Loops, Break, Continue, Pass statements, Function - definition and function call, arguments, return statements, Lambda Function and Recursive Function.

STRING, LISTS, FUNCTIONS: 15 Hours

Strings – Concatenation, Append, Comparing Strings, Iterating Strings, Strings Modules and Functions, Modules – NumPy, Math, List: Operations, Nested list, Cloning, Methods, Looping, Tuple: Operations, Nested Tuple, Tuple assignments, Checking the index, Dictionary: Operations, looping over and Nested Dictionary, Built in functions and Methods.

FILES, INHERITANCE: 15 Hours

Classes and Objects, Inheritance, Polymorphism, File Handling and Exception Handling.

Total Hours	**45**

Laboratory Component:

S. No	List of Experiments
1.	Compute the GCD of two numbers.
2.	Find the square root of a number (Newton's method).
3.	Exponentiation (power of a number).
4.	Find the maximum of a list of numbers.
5.	Linear search and Binary search.
6.	Selection sort, Insertion sort.
7.	Merge sort.
8.	First n prime numbers.
9.	Multiply matrices.
10.	Programs that take command line arguments (word count).
11.	Plotting datasets.
12.	File handling and plotting.
Total Hours	**30**

Text Books:	
1.	Allen B. Downey, “Think Python: How to Think Like a Computer Scientist’’, 2nd Edition, Updated for Python 3, Shroff / O’Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/).
2.	Tony Gaddis, “Starting out with Python’’, 4th Edition, Addison Wesley, Pearson 2017.
Reference Books:	
1.	Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition,2021.
2.	G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”,1st Edition, Notion Press, 2021.
3.	John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data”, 3rd Edition, MIT Press, 2021.
Web References:	
1.	http://nptel.ac.in/courses/106106145/
2.	https://www.codecademy.com/learn/learn-python
3.	https://www.coursera.org/learn/python-data-analysis#syllabus
Online Resources:	
1.	https://www.programiz.com/python-programming
2.	https://www.fullstackpython.com/best-python-resources
3.	https://www.udemy.com/course/easy-way-to-learn-python-for-beginners-2021/
4.	https://stackify.com/learn-python-tutorials/

Continuous Assessment									End Semester Practical Examination	Total
Theory				Practical			Total (A+B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (10%) [80 Marks]**
C311.1	Understand	Assignment - 1	20
C311.2	Apply	Quiz	20
C311.3	Apply	Assignment - 2	20
C311.4	Analyze	Case Study	20
C311.5	Apply		

Assessment based on Summative Assessment - Theory		
Bloom’s Level	**Summative Assessment (15%) [120 Marks]**	
	CIA1: (60 Marks)	**CIA 2: (60 Marks)**
Remember	10	10
Understand	40	40
Apply	40	40
Analyse	10	10

Evaluate	-	-
Create	-	-

Assessment based on Continuous and End Semester Examination – Practical			
Bloom's Level	**Continuous Assessment (25%) [100 Marks]**		**End Semester Examination (50%) [100 Marks]**
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	10	10	10
Understand	30	30	30
Apply	40	40	40
Analyse	20	20	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)								**End Semester Practical Examination (50%)**
CA 1 (100 Marks)			**CA 2 (100 Marks)**			**Practical Exam (100 Marks)**		
SA 1 (60M)	**FA 1**		**SA 2 (60M)**	**FA 2**		**FA (75M)**	**SA (25M)**	
	Component -I (20 Marks)	**Component-II (20 Marks)**		**Component -I (20 Marks)**	**Component-II (20 Marks)**			

Course Outcomes (CO)	**Programme Outcomes (PO)**												**Programme Specific Outcomes (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C311.1	1	2	1	1								2	1	2	1
C311.2	3	3	3	3	2							2	3	3	2
C311.3	3	3	3	3								2	3	3	2
C311.4	3	3	3	3	3							2	3	3	2
C311.5	3	2	3	3	3							1	3	3	2

22TA201	TAMILS AND TECHNOLOGY	1/0/0/1

Nature of Course:	C (Theory Concept)
Pre requisites:	NIL

Course Objectives:

1	To know about weaving, ceramic, design and construction technologies in sangam age.
2	To know the significance of technologies such as manufacturing, agriculture and irrigation.
3	To understand the development of Scientific Tamils and Tamil Computing.

Course Outcomes:
Upon completion of the course, students shall have ability to

C201.1	Describe about the weaving industry in sangam age and ceramic technology.	[U]
C201.2	Observe the design of houses, sculptures and construction of temples.	[U]
C201.3	Relate the various manufacturing materials and stone types in Silappathikaram.	[U]
C201.4	Understand the significance of agriculture and irrigation technology in ancient period.	[U]
C201.5	Explain the growth of scientific Tamil, Tamil computing and digitization of Tamil books.	[U]

Course Contents:

Weaving and Ceramic Technology: Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries. **Design and Construction Technology:** 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) - Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

Manufacturing Technology: 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. **Agriculture and Irrigation Technology:** Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu 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.

Scientific Tamil & Tamil Computing: 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 Hours:	**15**

Text-cum-Reference Books:

1	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித் தமிழ் – முனைவர் இல. சுந்தரம் . (விகடன் பிரசுரம்).

3	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4	பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
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 Civilization 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).
12	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C201.1	Understand	Seminar	20
C201.2	Understand	Quiz	20
C201.3, C201.4	Understand	Quiz	20
C201.5	Understand	Seminar	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	40	40	40
Understand	60	60	60
Apply	-	-	-
Analyse	-	-	-
Evaluate	-	-	-

Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1
2	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1
3	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1
4	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1
5	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1
Avg.	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE304	SURVEYING AND GEOMATICS LABORATORY		0/0/3/1.5
Nature of Course	Practical application		
Pre requisites	Nil		
Course Objectives:			
1	To introduce the principles of various surveying methods and applications to Civil Engineering Projects		
2	To deals with geodetic measurements and control survey methodology and its Adjustments.		
3	To introduce the working principles of modern surveying instruments		
4	To expose the modern surveying methods and its applications in recent surveying techniques		
Course Outcomes: **Upon completion of the course, students shall have ability to**			
C304.1	Measure the Horizontal & Vertical angles and calculate the area of the given plot		[AP]
C304.2	Measure the difference in elevation between two inaccessible points and plot the LS & CS view of the road surface using software tools		[AP]
C304.3	Measure the distance and elevation of an object using theodolite		[AP]
C304.4	Prepare the contour map of the area using modern tools and measure the elevation differences		[AP]
C304.5	Measure the area and distance of two points Find out the Latitude & Longitude of the point using GPS		[AP]
Course Contents:			
Laboratory Component:			
S. No	**List of Experiments**	**CO Mapping**	**BT**
1	Computation of bearings and area by Compass Traversing	C304.1	[AP]
2	Measurement of Horizontal angles by Repetition, Reiteration and Vertical angles.	C304.1	[AP]
3	Determination of Elevation of an object single plane method. (Base accessible and in- accessible)	C305.2	[AP]
4	Determination of difference in elevation using Dumpy/Auto Level	C304.3	[AP]
5	Profile leveling – Longitudinal & Cross-sectional plotting using TERRA MODEL/EXCEL	C304.2	[AP]
6	Measurement of height and distance by tangential tachometry.	C304.3	[AP]
7	Preparation of Contour map by grid contouring method using software tools	C304.4	[AP]
8	Preparation of Radial contour map of the given plot using software tools	C304.4	[AP]
9	Study of total station, measuring horizontal and vertical angles	C304.5	[AP]

10	Determination of distances and elevation between two inaccessible points using total station.	C304.5	[AP]
11	Traversing and area measurement using total station and its latitude and longitude observation using GPS.	C304.5	[AP]
12	Determination of Remote height and staking out process of the given points using total station	C304.5	[AP]
		Total Hours:	**45 Hrs.**

Text Books:	
1	Punmia B.C., "Surveying" – "Vols. – I, II & III", Laxmi publications, New Delhi 2016.
2	Kanetkar T.P, Kulkarni S.V., "Surveying and Levelling", Vols. I and II, Standard publishers Distributors, New Delhi 2015.
3	Anji Reddy M., Remote Sensing and Geographical Information System, B.S. Publications, 2012
Reference Books:	
1	Purushothamaraj. P, "Surveying –I & II" Laxmi Publications, 2012.
2	James M. Anderson and Edward M. Mikhali, "Surveying, Theory and Practice", 7th Edition, McGraw Hill, 2017
3	Satheesh Gopi, R. Sathish kumar, N. Madhu, "Advanced Surveying, Total Station GPS and Remote sensing" Pearson education, 2017.
4	Arora K.R., "Surveying Vol I & II", Standard book house, 2015
Web References:	
1	http://nptel.ac.in/course.php?disciplineId=108
2	https://onlinecourses.nptel.ac.in/noc20_ce18/preview
3	https://nptel.ac.in/video.php?subjectId=117103063

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
75	**25**	**100**	**60**	**40**	**100**

Assessment based on Continuous and End Semester Examination			
Bloom's Level	**Continuous Assessment (60%) [100 Marks]**		**End Semester Practical Examination (40%) [100 Marks]**
	FA (75 Marks)	**SA (25 Marks)**	
Remember	-	-	-
Understand	20	20	20
Apply	40	40	40
Analyse	40	40	40
Evaluate	-	-	-

Create	-	-	-

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

Cos	Pos												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	2		2			2	2			3	3		2
2	3	3	2		2			2	2			3	3		2
3	3	3	2	1	3			2	2			3	3		2
4	3	3	2	1	3			2	2			3	3		2
5	3	3	2	1	3			2	2			3	3		2
Avg.	**3**	**3**	**2**	**1**	**2.5**			**2**	**2**			**3**	**3**		**2**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

Semester - 4

22CE401	ENVIRONMENTAL ENGINEERING	3/0/0/3
Nature of Course	Theory analytical	
Pre requisites	Environmental Science	

Course Objectives:

1	To study the principles and concepts of unit operations and processes involved in water and wastewater treatment.
2	To enable the students in designing water and waste water treatment plants for a community.
3	To study the various techniques for sludge disposal and disposal into land or water bodies.
4	To understand about air pollution sources and control methods

Course Outcomes:

Upon completion of the course, students shall have ability to

C401.1	Cognize and assimilate the physical, chemical and biological characteristics of different sources of water	[AP]
C401.2	Estimate the water demand and design a good water distribution system for a town/city	[AP]
C401.3	Design an appropriate treatment system for the water and wastewater available at the source	[AP]
C401.4	Identify the suitable mode of disposal for the treated wastewater without endangering the environment	[AN]
C401.5	Analyze the amount of Particulate Matter present in the Air and its control measures	[AN]

Course Contents: Theory

Module 1: Water quality characteristics and water supply system **15 Hrs.**

Physical, Chemical and Biological quality parameters. – Water quality requirements and standards – Planning – objectives – design period – population forecasting – water demand – Water distribution system- Methods of distribution – Analysis of network (Hardy cross method- Theory only). Water Treatment – objectives – unit operations and process – Clarifiers – Flocculators – Sedimentation tanks and sand filters – Disinfection – Aeration – Iron and manganese removal – defluoridation and demineralization – Membrane systems – Desalination – Recent advances

Module 2: Primary and Secondary treatment of sewage **15 Hrs.**

Sources of waste – Characteristics and composition of sewage – Factors – Primary treatment – Principles, Functions – Screens – Grit chambers – Primary sedimentation tanks – Secondary treatment – ASP – Attached culture process - UASB – Septic tanks -Trickling filters – oxidation ditches and aerated lagoons – waste stabilization ponds – Reclamation and reuse of sewage – Recent advances in sewage - Wastewater modelling by STEADY software.

Module 3: Sludge Disposal and Environmental Pollution **15 Hrs.**

Sludge Characteristics – Sludge Thickening – Sludge Digestion and Biogas Generation – Sludge Drying beds – Conditioning and dewatering – Incineration – Deep well Injection – Sludge Disposal – Self-purification of natural water bodies – Land disposal and sewage farming – Disposal to lakes and sea – Sanitary practices in rural areas – Eutrophication - Impact on sea - Oxygen sag curve (Theory only) –Water less Urinals – Bio toilets – Air Pollution – Sources – Control measures – Monitoring methods.	
Total Hours	**45 Hrs.**
Text Books:	
1	Garg S.K, “Water Supply Engineering”, Khanna publishers, 2017
2	Metcalf and Eddy, “Wastewater Engineering Treatment and Reuse”, Tata McGraw Hill Publishers, New Delhi, 2010.
3	Punmia B.C, Ashok Jain, “Wastewater Engineering”, Laxmi publications Pvt. Ltd., 2016
4	Rao M.N., and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, New Delhi, 2017
Reference Books:	
1	Birdie G.S., Water supply Engineering, Dhanpat rai publishing company, 2014
2	Venugopal Rao P., “Textbook of Environmental Engineering”, Prentice Hall of India Pvt.Ltd, 2013
3	Peavy, Rowe, Tchobanoglous, “Environmental Engineering”, McGraw Hill Publishers, NewDelhi, 2013.
4	Basak N.N, “Environmental Engineering”, McGraw Hill Education., 2017
Web References:	
1	http://mohua.gov.in/cms/Latest-Manual-part-a-Engineering.php
2	http://164.100.161.188/cms/Latest-Manual-Part-B-Operation-and-Maintenance-2013.php
3	http://mohua.gov.in/cms/Latest-Manual-Part-C-Management-2013.php
4	http://cpheeo.gov.in/cms/manual-on-municipal-solid-waste-management-2016.php
Online Resources:	
1	https://www.mooc-list.com/course/water-and-wastewater-treatment-engineering-physicochemical-technology-edx
2	http://nptel.ac.in/courses/105106119/
IS Codes	
1	IS 10500:2012 Water Quality Standards, New Delhi, 2012
2	IS SP 26 – Handbook on Water supply and Drainage.

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C401.1	Apply	Assignment	20
C401.2	Analyze		
C401.3	Apply	Quiz	20
C401.4	Analyze	Seminar	20
C401.5	Analyze	Presentation – OCLE Report	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	20	20	20
Apply	50	50	50
Analyse	20	20	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO) - (Theory)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	2	2	-	2	2	2	2	-	-	3	1	3	2
2	3	2	2	2	1	1	2	2	2	-	-	2	2	2	2
3	2	2	2	2	1	1	-	2	1	-	-	2	1	2	2
4	3	3	2	1	-	1	1	-	1	-	-	3	1	3	2
5	3	3	3	-	1	2	2	1	1	-	-	3	2	3	2
Avg	**2.8**	**2.6**	**2.2**	**1.8**	**1**	**1.8**	**1.8**	**1.8**	**1.5**			**2.6**	**1.5**	**2.6**	**2**
1	Reasonably agreed					2	Moderately agreed				3	Strongly agreed			

22CE402	CONSTRUCTION MATERIALS AND TECHNOLOGY	3/0/3/4.5
Nature of Course	Theory and Practical Application	
Pre requisites	Engineering Chemistry and Applied Physics.	

Course Objectives:

1	To have a clear knowledge of construction materials and their properties.
2	To know the market forms of special and alternate building materials.
3	To learn various testing methods for assessing the strength and quality of materials.
4	To be familiar with the several advanced construction techniques and practices.

Course Outcomes: Theory
Upon completion of the course, students shall have ability to

C402.1	Explain the properties and applications of various building materials and their appropriate suitability for a given scenario.	[AP]
C402.2	Demonstrate the manufacturing process of buildings materials and role of admixtures in the concrete mixture.	[AP]
C402.3	Apply mix proportion principles to design a concrete mix by using IS code for construction works.	[AP]
C402.4	Predict the properties of fresh and hardened concrete.	[AP]
C402.5	Interpret and select suitable modern machineries and technologies for construction activities.	[AP]

Course Contents: Theory

Module 1: Construction materials and Admixtures **15 Hrs.**

Bricks and Blocks: Classifications, Manufacturing, Tests – Steel: Composition, Types, Manufacturing, Properties and Applications – Aggregates: Natural and Artificial aggregates, Recycled aggregates, Grading, Bulking of fine aggregate – Cement: Ingredients, Manufacturing, Types, Grades, Properties, Cement mortar, Hydration of cement – Admixtures: Accelerators, Retarders, Plasticizers, Super plasticizer, Air entraining admixtures.

Module 2: Mix design and Concrete properties **15 Hrs.**

Mix design: Introduction, concept of mix design – mix design methods – IS method - Manufacture of concrete; batching, mixing, transporting, placing, compaction, curing - Fresh concrete - Properties: workability - factors affecting workability, segregation, bleeding - Test on fresh Concrete - Hardened concrete – Properties: strength, stress and strain characters, maturity, shrinkage – Test on Hardened Concrete - Durability of Concrete; Permeability, creep, sulphate attack, alkali aggregate reaction, chloride attack, carbonation - Special materials: wood, paint and glass materials.

Module 3: Construction Machineries and Techniques **15 Hrs.**

Machineries for: Earthmoving, Dewatering, Plastering, Prestressing jacks and grouting equipment, Pile driving, Lifting (Cranes, Hoists and other equipment) - Equipment Productivities - Use of Drones for spread out sites - Use of robots for repetitive activities and for modern construction material use and manufacturing of materials, 3D printing.

Innovative modern construction tools, accessories and equipment's. Special construction methods: Scaffolding, Shoring, Underpinning, Piling. Conventional construction methods Vs Mechanized methods and advantages of latter.		
	Total Hours	**45 Hrs.**
Course Outcomes: Laboratory **Upon completion of the course, students shall have ability to**		
C402.1	Determine the properties of aggregate and cement.	[AP]
C402.2	Determine the workability of concrete.	[AP]
C402.3	Determine the fresh concrete properties.	[AP]
C402.4	Determine the hardened concrete properties.	[AP]
C402.5	Examine the concrete qualities by applying NDT.	[AN]

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Determination of specific gravity and water absorption of aggregates	C402.1	[AN]
2	Assess the fineness and soundness properties of cement	C402.1	[AN]
3	Determination of compression strength of cement	C402.1	[AN]
4	Determine the workability by slump cone test	C402.2	[AN]
5	Determine the workability by compaction factor test	C402.2	[AN]
6	Determine the workability by Vee Bee Consistometer test	C402.2	[AN]
7	Determine the fresh concrete property by flow table test	C402.3	[AN]
8	Determine the compressive and tensile strength of concrete	C402.3	[AN]
9	Determine the flexural strength of concrete	C402.4	[AN]
10	Determine the modulus of elasticity of concrete	C402.4	[AN]
11	Determine the surface hardness of concrete structures by rebound hammer test	C402.5	[AN]
12	Determine the quality of concrete structures by ultrasonic pulse velocity test	C402.5	[AN]
	Total Hours		**45 Hrs.**

Text Books:	
1	Varghese.P.C, "Building Materials", PHI Learning Pvt. Ltd, New Delhi, 2016.
2	Sahu G.C, Jayagopal Jena, "Building Materials and Construction", McGraw Hill Education Pvt. Ltd, New Delhi, 2017.
3	Shetty, M.S., Jain, A.K., Concrete Technology, Theory and Practice, S. Chand and Company Ltd, New Delhi, 2018.
4	Carlos Balaguer, "Robotics and automation in construction", Springer ed., 2008.
Reference Books:	
1	Aggarwal & Arora, "Construction materials & building materials", New India's,

	2020.
2	Gambhir, M.L, Concrete Technology, McGraw Hill Publishing Company Ltd, New Delhi, 2017.
3	Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", 9th Edition, McGraw Hill, Singapore, 2018.
4	Arora S.P and Bindra S.P “Building Construction, Planning Techniques and Method of Construction”, Dhanpat rai and Sons, 2013
Code Books :	
1	IS 3495 – 2016 (Part I – IV), “Methods of tests on burnt clay building bricks”.
2	IS 4031 – 2019 (Part 1 – 15), “Methods of physical tests for cement”
3	IS 4032 – 2019, “Method of chemical analysis of hydraulic cement”
4	IS 2386 – 1963 (Part 1 – 8), “Methods of Test for Aggregates for Concrete”
5	IS 1608 – 2018 (Part 1 – 3), “Metallic Materials — Tensile Testing”
6	IS10262 – 2009, Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 2009.
7	IS 456 – 2000 Plain and Reinforced Concrete- Code of Practice, Bureau of Indian Standards, New Delhi, 2000.
8	SP: 23 – 1982, Handbook on concrete.
Web References:	
1	https://aquicore.com/blog/10-new-materials-changing-commercial-construction/
2	https://www.nbmcw.com/tech-articles/concrete/3725-new-construction-materials-for-modern-projects.html
3	https://www.indianconcreteinstitute.org/
4	http://www.iaacblog.com/programs/robot-assisted-interior/
5	https://www.sciencedirect.com/science/article/pii/S2352710219300889
6	https://construction-robotics.eu/journal/
7	https://wingtra.com/drone-mapping-applications/drones-in-construction-and-infrastructure/
8	https://www.thenbs.com/knowledge/drones-in-construction
Online Resources:	
1	https://nptel.ac.in/courses/105/106/105106053/
2	https://onlinecourses.nptel.ac.in/noc20_ar04/preview
3	https://alison.com/course/diploma-in-characterization-of-construction-materials
4	https://www.futurelearn.com/courses/modern-building-design
5	https://www.youtube.com/watch?v=ZTvNm4QamX8
6	https://www.youtube.com/watch?v=fyGW_7eGVfo
7	https://onlinecourses.swayam2.ac.in/nou20_cs14/

Continuous Assessment									End Semester Examination	Total
Theory				Practical			Total (A+B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (10%) [80 Marks]**
C402.1	Apply	Quiz , Assignment	**20**
C402.2	Apply	Quiz , Assignment	**20**
C402.3	Apply	Quiz , Assignment	**20**
C402.4	Apply	Seminar, Assignment	**20**
C402.5	Apply		

Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	**Summative Assessment (15%) [120 Marks]**		**End Semester Examination (25%) [100 Marks]**
	CIA1: (60 Marks)	**CIA2: (60 Marks)**	
Remember	10	10	10
Understand	40	30	35
Apply	40	50	50
Analyse	10	20	15
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical			
Bloom's Level	**Continuous Assessment (25%) [100 Marks]**		**End Semester Examination (25%) [100 Marks]**
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	-	-	-
Understand	-	-	-
Apply	50	50	50
Analyse	50	50	50
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination									
Continuous Assessment (50%)									End Semester Examination (50%)
CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)			Theory Examination (25%) Practical Examination (25%)
SA 1 (60M)	FA 1		SA 2 (60M)	FA 2		FA (75M)	SA (25M)		
	Component-I (20 Marks)	Component-II (20 Marks)		Component-I (20 Marks)	Component-II (20 Marks)				

Mapping of Course Outcomes (CO) with Programme Outcomes (PO)Programme Specific Outcomes (PSO) (Theory)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	3	-	-	-	1	-	-	-	1	3	-	1
2	3	2	3	1	-	-	-	1	-	-	-	1	2	1	-
3	2	3	2	2	-	1	1	1	-	-	1	1	3	2	1
4	2	3	1	-	-	1	1	1	-	-	-	1	3	2	-
5	2	2	1	1	1	-	1	1	-	-	1	1	2	2	1
Avg	2.4	2.4	1.6	1.8	1.0	1.0	1.0	1.0	-	-	1.0	1.0	2.6	1.8	1.0

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

Mapping of Course Outcomes (CO) with Programme Outcomes (PO)Programme Specific Outcomes (PSO) (Laboratory)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	2	2	-	1	1	2	2	-	2	2	1	2
2	3	2	2	2	1	-	1	1	2	2	-	2	2	1	2
3	3	3	2	1	1	-	1	1	2	2	-	2	2	1	2
4	3	3	2	2	1	-	1	1	2	2	-	2	2	1	2
5	3	2	2	2	2	-	1	1	2	2	-	2	2	1	2
Avg	3.0	2.6	2.0	1.8	1.4	-	1.0	1.0	2.0	2.0	-	2.0	2.0	1.0	2.0

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE403	FLUID MECHANICS AND HYDRAULIC MACHINERY	3/0/3/4.5
Nature of Course	Problem Analytical	
Pre requisites	Engineering Physics and Engineering Mathematics	

Course Objectives:

1	To understand the statics, kinematics and dynamics behavior of fluid and apply Pascal's law, continuity equation, and Bernoulli's equation
2	To determine pressure in closed pipes, major and minor energy loss in flow through pipes, and design most economical section for open channel flow
3	To analyze fluid flow through pipes in series, parallel, branched pipes and understand the fluid discharge in pipe networks
4	To apply dimensional and prototype-model analysis of hydraulic structures, and understand the work done by hydraulic machines (turbines and pumps), applications of computational fluid dynamics, hydro informatics in Civil Engineering

Course Outcomes:
Upon completion of the course, students shall have ability to

C403.1	Understand fluid properties, the broad principles of fluid statics, kinematics, dynamics and apply Pascal's law, continuity equation and Bernoulli's equation	[U]
C403.2	Determine pressure in closed pipes, major and minor energy loss in flow through pipes and design most economical section for open channel flow	[AN]
C403.3	Analyze the fluid flow through pipes in series, parallel, branched pipes and understand the concept of fluid discharge in pipe networks	[AN]
C403.4	Apply dimensional analysis and perform prototype-model analysis for any hydraulic structures	[AP]
C403.5	Analyze the performance of hydraulic machines (turbines and pumps) and apply the concept of computational fluid dynamics, hydro informatics in Civil Engineering problems	[AN]

Course Contents: Theory

Module I: Fluid Statics, Kinematics and Dynamics **15 Hrs.**

Properties of fluids: density, specific weight, specific volume, specific gravity – viscosity, compressibility, bulk modulus, surface tension, capillarity, vapour pressure and cavitation - Pascal's law - Pressure measurement in simple and differential manometers - Hydrostatic forces – Buoyancy – Types of fluid flow, rate of flow, continuity equation, stream and equipotential lines, flow net – Euler's equation of motion -Bernoulli's equation – Practical applications (Venturimeter, Orifice meter, pitot-tube)

Module II: Flow through Pipes and Open Channel **15 Hrs.**

Closed conduit: laminar and turbulent flow – major and minor energy losses – hydraulic gradient and total energy line – Flow through pipes in series and parallel, Equivalent pipe, Flow through branched pipes, Flow through nozzles, syphon – Water hammer in pipes, Pipe network – Hardy Cross Method - Flow through orifice, hydraulic co-efficient - Open Channel: laminar and turbulent flow, notches and weirs: classification and discharge – most economical section, hydraulic jump and energy dissipation

Module III: Dimensional Analysis and Hydraulic Machines **15 Hrs.**

Dimensional analysis – Rayleigh's method and Buckingham's pi theorem - Hydraulic models – Geometric, kinematic and dynamic similarities - dimensionless numbers – model and prototype relations – Impulse and Reaction Turbines (Pelton, Francis and Kaplan Turbine) - Centrifugal and Reciprocating Pumps - working principle, work done and efficiency - Computational Fluid Dynamics: Basic equations, numerical model, grid generation – Introduction to Bentley Water Gems, Hammer softwares - Hydro informatics: concept, significance and applications

	Total Hours	**45 Hrs.**

Course Outcomes : Laboratory

Upon completion of the Laboratory, students shall have ability to

C403.1	Measure the flow in pipe section using orificemeter and venturimeter	[AP]
C403.2	Measure the discharge in channels using notches and impact of jet	[AP]
C403.3	Determine the major and minor losses in pipes	[AP]
C403.4	Study the performance of different types of pumps and turbines	[AP]
C403.5	Model a hydraulic structure numerically using CFD software	[AP]

Laboratory Course Content:

S. No	**List of Experiments**	**CO Mapping**	**BT**
1	Flow Measurement in pipe using Venturimeter	C403.1	[AP]
2	Flow Measurement in pipe using Orificemeter	C403.1	[AP]
3	Flow measurement in open channel using notches.	C403.2	[AP]
4	Study of impact of jet on vanes	C403.2	[AP]
5	Determination of frictional loss in pipes	C403.3	[AP]
6	Determination of minor losses in pipes	C403.3	[AP]
7	Performance test on reciprocating pump	C403.4	[AP]
8	Performance test on centrifugal & submersible pump	C403.4	[AP]
9	Performance test on impulse turbine (Pelton Turbine)	C403.5	[AP]
10	Performance test on reaction turbine (Francis Turbine)	C403.5	[AP]
11	Performance test on reaction turbine (Kaplan Turbine)	C403.5	[AP]

12	Numerical Modeling of a Dam Breakage using CFD software	C403.5	[AP]
		Total Hours	**45 Hrs.**

Text Books:	
1	Bansal R K, “Fluid Mechanics and Hydraulic Machines”, Laxmi Publications, New Delhi, 10th Edition 2018.
2	Modi P N and Seth S.M, “Hydraulics & Fluid Mechanics”, Standard book house, New Delhi, 2017.
3	Versteeg, H. K.; Malalasekera, W.,” An Introduction to Computational Fluid Dynamics”, Pearson Publishers,2007
Reference Books:	
1	Subramanya K, “Flow in open channels”, Tata McGraw Hill publishing company 4th Edition, 2015.
2	Som S K, “Introduction to Fluid Mechanics and Fluid Machines", McGraw Hill Education; 3rd edition, 2017
3	Yunus Cengel, “Fluid Mechanics in SI Units”, McGraw Hill Education; 3rd edition, 2017
4	Madan Mohan Das, Mimi Das Saikia, Bhargab Mohan Das , “Hydraulics andhydraulic machines”, PHI Leaning Pvt Ltd, New Delhi,2013
Web References:	
1	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-01-unified-engineering-i-ii-iii-iv-fall-2005-spring-2006/fluid-mechanics/
2	https://nptel.ac.in/courses/105/105/105105203/
3	https://cfdflowengineering.com/basics-of-cfd-modeling-for-beginners/
4	https://www.simscale.com/blog/2016/03/what-everybody-ought-to-know-about-cfd/
Online Resources:	
1	https://nptel.ac.in/courses/112/104/112104118/
2	https://www.coursera.org/learn/lectures-on-selected-topics-in-classical-and-fluid-mechanics
3	https://www.learncax.com/courses/by-software/fundamentals-of-cfd-detail
4	https://onlinecourses.nptel.ac.in/noc20_ae11/preview

Continuous Assessment				**End**	**Total**
Theory	**Practical**	**Total**			

Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)	(A+B)	Total Continuous Assessment	Semester Examination	
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (10%) [80 Marks]**
C403.1	Understand	Quiz & Surprise Test	**20**
C403.2	Analyse		
C403.3	Analyse	Assignment	**20**
C403.4	Apply	Surprise Test	**20**
C403.5	Analyse	Tutorial	**20**

Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	**Summative Assessment (15%) [120 Marks]**		**End Semester Examination (25%) [100 Marks]**
	CIA1: (60 Marks)	**CIA2: (60 Marks)**	
Remember	10	10	10
Understand	10	10	10
Apply	40	40	40
Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical			
Bloom's Level	**Continuous Assessment (25%) [100 Marks]**		**End Semester Examination (25%) [100 Marks]**
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	10	10	10
Understand	10	10	10
Apply	40	40	40
Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination	
Continuous Assessment (50%)	**End Semester Examination (50%)**

CA 1 (100 Marks)			CA 2 (100 Marks)			Practical Exam (100 Marks)		Theory Examination (25%) Practical Examination (25%)
SA 1 (60M)	FA 1		SA 2 (60M)	FA 2		FA (75M)	SA (25M)	
	Component -I (20 Marks)	Component -II (20 Marks)		Component -I (20 Marks)	Component -II (20 Marks)			

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO) - (Theory)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	2	2	-	-	-	2	2	-	3	3	1	2
2	3	3	3	2	2	-	-	-	2	2	-	3	3	1	2
3	3	3	3	2	2	-	-	-	2	2	-	3	3	1	2
4	3	3	3	2	2	-	-	-	2	2	-	3	3	1	2
5	3	3	3	2	2	-	-	-	2	2	-	3	3	1	2
Avg	**3**	**3**	**3**	**2**	**2**	-	-	-	**2**	**2**	**-**	**3**	**3**	**1**	**2**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO) - (Laboratory)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3	-	-	-	2	3	2	3	3	1	2
2	3	3	3	3	3	-	-	-	2	3	2	3	3	1	2
3	3	3	3	3	3	-	-	-	2	3	2	3	3	1	2
4	3	3	3	3	3	-	-	-	2	3	2	3	3	1	2
5	3	3	3	3	3	-	-	-	2	3	2	3	3	1	2
Avg	**3**	**3**	**3**	**3**	**3**	-	-	-	**2**	**3**	**2**	**3**	**3**	**1**	**2**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE404	STRUCTURAL ANALYSIS	3/0/3/4.5
Nature of Course	Problem Analytical	
Pre requisites	Strength of Materials	

Course Objectives:

1	To apply the Influence line concepts on beam analysis
2	To understand the arch behaviour and compute the reaction on arches
3	To analyse the indeterminate beams and frames using various methods
4	To analyse the beams, trusses and frames using matrix methods

Course Outcomes:

Upon completion of the course, students shall have ability to

C404.1	Apply the ILD concepts to beams to analyze and compute the forces and moments.	[AN]
C404.2	Analyze the various types of arches, cables and suspension bridges	[AN]
C404.3	Analyze the indeterminate beams and frames using various methods and compute the reactions, slope deflection and moments.	[AN]
C404.4	Analyze the beams and frames using flexibility matrix method.	[AN]
C404.5	Analyze the beams and frames using stiffness matrix method.	[AN]

Course Contents: Theory

Module 1: Influence lines, Arches and cables **15 Hrs.**

Influence lines for statically determinate beams – Reactions, shear force and bending moment and Elastic curve. Calculations of shear force and bending for UDL and series of concentrated loads – Absolute Maximum Bending Moment – Equivalent UDL. Arches **-** Analysis of three hinged and two hinged arches - Analysis of cables, suspension bridges with three and two hinged stiffening girder

Module 2: Slope deflection Method and Moment Distribution method **15 Hrs.**

Slope Deflection Method - Continuous beams and rigid frames (with and without sway) - Symmetry and antisymmetry - Simplification for hinged end - Support displacements. Moment Distribution Method - Continuous beams and frames – Limited to two bays and two stories - Plane rigid frames with and without sway.

Module 3: Matrix Methods **15 Hrs.**

Static and Kinematic indeterminacy - Degrees of freedom 2D and 3D - Matrix methods - Introduction to flexibility and stiffness approach - formation of flexibility and stiffness matrix for bar, truss and beam - analysis of determinate and indeterminate structures using flexibility matrix method - problems in simple, continuous beams, trusses and frames - Limited to two by two matrix.

Total Hours	**45 Hrs.**

Course Outcomes : Laboratory

Upon completion of the Laboratory, students shall have ability to

C404.1	Analyze an indeterminate beams using analysis package	[AN]
C404.2	Analyze a multi storied RCC structure using analysis package	[AN]
C404.3	Analyze an arch structure using analysis package	[AN]
C404.4	Analyse a steel structure using analysis package	[AN]
C404.5	Analyse a cooling tower and deck slab using analysis package	[AN]

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Analysis of an fixed and propped beam under gravity and lateral loads using analysis package	C404.1	[AN]
2	Analysis of an continuous beam under gravity and lateral loads using analysis package	C404.1	[AN]
3	Analysis of an curved beam in plan under gravity and lateral loads using analysis package	C404.1	[AN]
4	Analysis a multi storied RCC framed structure under gravity load using analysis package	C404.1	[AN]
5	Analysis a multi storied RCC framed structure under gravity and lateral loads using analysis package	C404.2	[AN]
6	Analysis of an 2 hinged and 3 hinged arch using analysis package	C404.3	[AN]
7	Analysis of roof assembly of a steel structure under gravity loads using analysis package	C404.4	[AN]
8	Analysis of roof assembly of a steel structure under gravity and lateral loads using analysis package	C404.4	[AN]
9	Analyse a workshop shed using analysis package considering gravity loads.	C404.4	[AN]
10	Analyse a workshop shed using analysis package considering gravity loads and lateral load.	C404.2	[AN]
11	Analysis of a cooling tower under gravity and lateral loads using analysis package	C404.5	[AN]
12	Analysis of a bridge deck under gravity and lateral loads using analysis package	C404.5	[AN]
		Total Hours	**45 Hrs.**

Text Books:

1	Bhavikatti S S,Structural Analysis Vol-1and 2, Vikas publishing House, PVT, LTD., 2021

2	Vaidyanathan,R and Perumal,P, “Structural Analysis” Vol.1 & 2 Laxmi Publications, New Delhi, 2022.
3	Devdas Menon, Structural Analysis, Narosa Publishing House, 2018
Reference Books:	
1	Norris, C.H., Wilbur, J.B., and Utku, S., Elementary Structural Analysis, TMH, 2003
2	Hibbeler, R.C., Structural Analysis, 8th Edition, Prentice Hall, 2012
3	Ghali.A, Nebille,A.M. and Brown, T.G. “Structural Analysis” A unified classical and Matrix approach” 6 th edition. SponPress, London and New York, 2013.
4	Reddy .C.S , “Basic Structural Analysis”, Tata McGraw Hill Publishing Company, 2011
Web Reference:	
1	https://freevideolectures.com/course/3015/advanced-structural-analysis
2	https://www.studocu.com/en/document/university-of-sheffield/advanced-structural-analysis/lecture-notes/lecture-notes-lectures-11-20/674048/view
Online Resources:	
1	https://nptel.ac.in/downloads/105101085/
2	https://nptel.ac.in/courses/105105109/
3	https://nptel.ac.in/courses/105106050/

Continuous Assessment									**End Semester Examination**	**Total**
Theory				**Practical**			**Total (A+B)**	**Total Continuous Assessment**		
Formative Assessment	**Summative Assessment**	**Total**	**Total (A)**	**Formative Assessment**	**Summative Assessment**	**Total (B)**				
80	**120**	**200**	**100**	**75**	**25**	**100**	**200**	**50**	**50**	**100**

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (10%) [80 Marks]**
C404.1	Analyse	Quiz	**20**
C404.2	Analyse	Assignment	**20**
C404.3	Analyse	Quiz	**20**
C404.4	Analyse		
C404.5	Analyse	Tutorial	**20**

Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	**Summative Assessment (15%) [120 Marks]**		**End Semester Examination (25%) [100 Marks]**
	CIA1: (60 Marks)	**CIA2: (60 Marks)**	
Remember	10	-	-
Understand	20	20	20
Apply	20	30	30
Analyse	50	50	50
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination - Practical			
Bloom's Level	**Continuous Assessment (25%) [100 Marks]**		**End Semester Examination (25%) [100 Marks]**
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	10	10	10
Understand	20	20	20
Apply	40	40	40
Analyse	30	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination								
Continuous Assessment (50%)								**End Semester Examination (50%)**
CA 1 (100 Marks)			**CA 2 (100 Marks)**			**Practical Exam (100 Marks)**		**Theory Examination (25%) Practical Examination (25%)**
SA 1 (60M)	**FA 1**		**SA 2 (60M)**	**FA 2**		**FA (75M)**	**SA (25M)**	
	Component -I (20 Marks)	**Component -II (20 Marks)**		**Component -I (20 Marks)**	**Component -II (20 Marks)**			

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO) - (Theory)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	2						2		3	3		2
2	3	3	3	2						2		3	3		2
3	3	3	3	2						2		3	3		2
4	3	3	3	2						2		3	3		2
5	3	3	3	2						2		3	3		2
Avg	**3**	**3**	**3**	2						**2**		**3**	**3**		**2**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO) - (Laboratory)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	3	3				2	2		3	3		2
2	3	3	3	3	3				2	2		3	3		2
3	3	3	3	3	3				2	2		3	3		2
4	3	3	3	3	3				2	2		3	3		2
5	3	3	3	3	3				2	2		3	3		2
Avg	**3**	**3**	**3**	**3**	**3**				**2**	**2**		**3**	**3**		**2**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE405	Environmental Engineering Laboratory		0/0/3/1.5
Nature of Course	Practical application		
Pre requisites	Engineering Chemistry Laboratory		
Course Objectives:			
1	To understand the Physico chemical analysis of water and wastewater.		
2	To interpret the results and draw conclusions about the quality of water for intended usage.		
3	To enable the students in designing water and wastewater treatment plants for a community.		
4	To learn the principles of analysis of common air pollutant.		
Course Outcomes: **Upon completion of the course, students shall have ability to**			
C405.1	Determine the quality of water based on its physical characteristic using the suitable experimental procedures		[AP]
C405.2	Calculate the type and quantum of chemical required for the removal of dissolved solid substances in water		[AP]
C405.3	Investigate the oxygen content in various forms in water		[AN]
C405.4	Determine the ionic and elemental concentration in water using sophisticated analytical methods		[AP]
C405.5	Investigate the ambient air quality characteristics and calculate the air quality index		[AN]
Course Contents: Laboratory Component			
S. No	**List of Experiments**	**CO Mapping**	**BT**
1.	Determination of Hardness present in the given water sample	C405.1	[AP]
2.	Determination of Dissolved Oxygen presents in the water sample	C405.1	[AP]
3.	Determination of Chlorides present in the given sample	C405.2	[AN]
4.	Determination of Bio-chemical Oxygen Demand	C405.2	[AN]
5.	Determination of Chemical Oxygen Demand	C405.3	[AN]
6.	Determination of Fluorides presents in the given waste water sample	C405.3	[AP]
7.	Determination of Sulphates presents in the given waste water sample	C405.3	[AP]
8.	Determination of Ammonia presents in given wastewater sample	C405.4	[AP]
9.	Determination of Sodium presents in the wastewater sample	C405.4	[AP]
10.	Determination of Nitrates in the given wastewater sample	C405.4	[AP]
11.	Determination of Air pollutant – Particulate Matter and Gaseous pollutant analysis	C405.5	[AN]
12.	Modeling of Wastewater treatment plant using STEADY software	C405.5	[AP]
		Total Hours:	**45 Hrs.**

Text Books:	
1	Metcalf and Eddy, “Wastewater Engineering Treatment and Reuse”, Tata McGraw Hill Publishers, New Delhi, 2010.
2	Punmia B.C, Ashok Jain, “Wastewater Engineering”, Laxmi publications Pvt. Ltd., 2016
3	Birdie G.S., Water supply Engineering, Dhanpat rai publishing company, 2014
4	Rao M.N., and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, New Delhi, 2017
Reference Books:	
1	Venugopal Rao P., “Textbook of Environmental Engineering”, Prentice Hall of India Pvt.Ltd, 2013
2	Peavy, Rowe, Tchobanoglous, “Environmental Engineering”, McGraw Hill Publishers, NewDelhi, 2013.
3	Basak N.N, “Environmental Engineering”, McGraw Hill Education., 2017
Web References:	
1	http://mohua.gov.in/cms/Latest-Manual-part-a-Engineering.php
2	http://164.100.161.188/cms/Latest-Manual-Part-B-Operation-and-Maintenance-2013.php
3	http://mohua.gov.in/cms/Latest-Manual-Part-C-Management-2013.php
4	http://cpheeo.gov.in/cms/manual-on-municipal-solid-waste-management-2016.php
IS Code References:	
1	IS 10500:2012 Water Quality Standards, New Delhi, 2012
2	IS SP 26 – Handbook on Water supply and Drainage.
Online Resources:	
1	https://www.mooc-list.com/course/water-and-wastewater-treatment-engineering-physicochemical-technology-edx
2	http://nptel.ac.in/courses/105106119/

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
75	25	100	60	40	100

Assessment based on Continuous and End Semester Examination			
Bloom’s Level	Continuous Assessment (60%) [100 Marks]		End Semester Practical Examination (40%) [100 Marks]
	FA (75 Marks)	SA (25 Marks)	

Remember	-	-	-
Understand	30	20	20
Apply	40	40	40
Analyse	30	40	40
Evaluate	-	-	-
Create	-	-	-

Mapping of Course Outcomes (CO) with Programme Outcomes (PO)Programme Specific Outcomes (PSO)

Cos	Pos												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	2	2	1	2	1	1	-	1	1	2	3	2
2	2	2	2	2	2	2	2	1	1	-	2	2	1	2	2
3	2	2	2	2	2	2	2	1	1	-	1	2	1	2	2
4	3	2	2	2	2	2	2	1	1	-	2	1	2	3	2
5	3	3	2	2	2	1	2	1	1	-	2	2	2	3	2
Avg.	**2.6**	**2.2**	**2**	**2**	**2**	**1.6**	**2**	**1**	**1**	**-**	**1.6**	**1.6**	**1.6**	**2.6**	**2**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

SEMESTER 5

22CE501	GEOTECHNICAL ENGINEERING	3/1/0/4
Nature of Course	Problem Analytical	
Pre requisites	-	

Course Objectives:

1	To study the fundamentals of soil mechanics and IS soil classification system
2	To analyse the soil characteristics such as permeability, total stress, effective stress, consolidation and shear strength
3	To study the various techniques for subsurface soil exploration
4	To design the shallow and deep foundations, and determine lateral earth pressure in retaining wall

Course Outcomes:
Upon completion of the course, students shall have ability to

C501.1	Examine the basic properties of soil and classify the soil according to IS soil classification system	[AN]
C501.2	Determine permeability, total stress, effective stress, consolidation and shear strength of soils.	[AN]
C501.3	Examine the soil exploration program for determining the geotechnical parameters required for the design of foundations.	[AP]
C501.4	Estimate the bearing capacity of soils and settlement of foundations.	[AP]
C501.5	Determine pile carrying capacity, pile group efficiency, and compute lateral earth pressure in retaining wall	[AN]

Course Contents:

Module 1: Permeability, Stresses in soils and Consolidation **15 Hrs.**

Soil formation and types – Civil Engineering problems related to soils - Basic definitions - Phase relationships - Indian Standard Soil Classification – Permeability: Darcy's law – Laboratory Methods – Permeability in stratified layers - Flow nets – Total and effective stress concepts in soils – Porewater pressure - Boussinesq's and Westergard's Analysis - Terzaghi's one dimensional consolidation theory – Time rate of consolidation and settlement

Module 2: Shear Strength, Slope Stability and Site Investigation **15 Hrs.**

Mechanism of shear resistance - Mohr–Coulomb failure criterion - Direct shear test- Triaxial shear test - Unconfined compressive strength test - Vane shear test – Types of slope – Slope failure mechanism - Stability of Infinite Slopes – Method of slices - Use of Taylor's stability number – Subsurface Investigation – exploration methods - samplers - Field test - SPT, CPT, DCPT - Geophysical Investigation – Borehole log and subsurface profile

Module 3: Bearing Capacity, Earth Pressure and Pile Foundation **15 Hrs.**

Bearing capacity failures - Terzaghi's analysis and IS code method - effect of water table - Proportioning of combined footing and strap foundation (no structural design) – Mat/Raft Foundation - Rankine's earth pressure theory for cohesive and cohesionless soils - Design of pile groups – Pile group efficiency – negative skin friction - under reamed piles – Well foundation - types and different shapes of wells - sinking of wells - tilts and shifts

Total Hours	**45 Hrs.**

Text Books:	
1	Arora, K. R. “Soil Mechanics and Foundation Engineering”, Standard Publishers Distributors, New Delhi, 7th Edition Reprint, 2019.
2	Gopal Ranjan and Rao A S R, “Basic and Applied Soil Mechanics”, New Age International Pvt. Ltd., New Delhi, 2020.
3	Punmia B. C., Ashok K Jain and Arun K Jain, “Soil Mechanics and Foundation”, Laxmi Publications, New Delhi, Sixteenth Edition, 2019.
Suggested Readings:	
1	Murthy V N S, “Textbook of Soil Mechanics and Foundation Engineering”, CBS Publication, New Delhi, 2017.
2	Muni Budhu, “Soil Mechanics and Foundation Engineering”, Wiley India Publication, New Delhi, 2016.
3	Purushothama Raj P, “Soil Mechanics and Foundation Engineering” Pearson Education India, 2014.
4	Alam Singh, “Modern Geotechnical Engineering”, IBS Publications, New Delhi, 2010.
IS Codes	
1	IS 2720 (Reaffirmed 2006) Part 2 to 7, 10,13, 15, 28, 36, Method of test for soil – Code of Practice, Bureau of Indian Standards, New Delhi.
2	IS 1080 (1985), Design and construction of Shallow foundations in soils, Bureau of Indian Standards, New Delhi.
3	IS 1888 (1982), Method of load test on Soils – Code of Practice, Bureau of Indian Standards, New Delhi.
4	IS 1892 (1979), Code of practice for Subsurface Investigation for foundation, Bureau of Indian Standards, New Delhi.
5	IS 1904 (1986), Design and Construction of Foundations in Soils, General Requirements, Bureau of Indian Standards, New Delhi.
6	IS 2131 (1981), Method for Standard Penetration Test for Soils, Bureau of Indian Standards, New Delhi.
7	IS 6403 (1981), Code of Practice for determination of Bearing Capacity of Shallow Foundations, Bureau of Indian Standards, New Delhi.
8	IS 2911 Part 1 to 4, Design and Construction of Pile Foundations – Code of Practice, Bureau of Indian Standards, New Delhi.
9	IS 8000 Part 1 (1976), Code of Practice for calculation of settlements of foundations – Shallow foundations subjected to symmetrical static vertical loads, Bureau of Indian Standards, New Delhi.
Web References:	

1	https://freevideolectures.com/course/95/soil-mechanics
2	https://freevideolectures.com/course/2674/foundation-engineering
3	https://lecturenotes.in/subject/534/geotechnical-engineering-2
4	https://www.youtube.com/playlist?list=PLbRMhDVUMngeiZjKPTPEFl1CByXmYX3Kv
Online Resources:	
1	https://nptel.ac.in/courses/105/105/105105168/
2	https://nptel.ac.in/courses/105/103/105103097/
3	https://nptel.ac.in/courses/105/107/105107120/
4	https://onlinecourses.nptel.ac.in/noc20_ce36/preview

Summative assessment based on Continuous and End Semester Examination

Continuous Assessment				End Semester Examination	Total
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy) - Theory

Formative assessment based on Capstone Model (10 Marks)

Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C501.1&C501.2	Analyze	Surprise Test	20
C501.3	Apply	Assignment	20
C501.4	Apply	Tutorial Problems	20
C501.5 & C501.6	Analyze	Case Study	20

Assessment based on Summative and End Semester Examination

Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	-	-	-
Understand	10	10	10
Apply	50	50	50
Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination															
Continuous Assessment (40%) [200 Marks]													End Semester Examination (60%) [100 Marks]		
CA 1 : 100 Marks						CA 2 : 100 Marks									
SA 1 (60 Marks)	FA 1 (40 Marks)					SA 2 (60 Marks)	FA 2 (40 Marks)								
	Component - I (20 Marks)		Component - II (20 Marks)				Component - I (20 Marks)		Component - II (20 Marks)						
Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	-	1	-	-	-	-	-	-	-	1	2	-	-
2	2	3	-	2	-	1	-	-	-	-	-	-	3	-	-
3	2	3	-	2	-	1	-	-	-	-	-	-	3	1	1
4	3	2	-	2	2	2	1	2	1	2	-	1	2	2	-
5	3	3	-	2	2	1	-	1	-	-	-	1	2	2	-
6	3	2	-	2	2	1	-	1	-	-	-	-	2	1	-
Avg.	**2.7**	**2.5**	**-**	**1.8**	**2**	**1.2**	**1**	**1.3**	**1**	**2**	**-**	**1**	**2.3**	**1.5**	**1**
1	Reason2ably agreed					2	Moderately agreed				3	Strongly agreed			

22CE502	Design of Reinforced Concrete Structures	3/0/3/4.5

Nature of Course	Problem Analytical
Pre-requisites	

Course Objectives:

1.	To introduce the concepts for the analysis and design of reinforced concrete elements as per Limit State Design.
2.	To impart knowledge on the latest Indian Standard codes of practice for the design of reinforced concrete elements
3.	To understand the limit state of serviceability requirements, deflection and crack width
4.	To draw the reinforcement detailing for various reinforced concrete elements.

Course Outcomes:
Upon completion of the course, students shall have ability to

C502.1	Understand the philosophy of different methods of design of reinforced concrete elements.	U
C502.2	Design of RC slab with different boundary conditions and RC Staircases.	AP
C502.3	Design the reinforced concrete beam element subjected to bending and shear.	AP
C502.4	Design of short and long columns for axial, uniaxial and biaxial loading.	AP
C502.5	Design of footings for axial load; design principle of combined and raft foundation.	AN

Course Contents:

Module 1: Design philosophy and Limit state design of slab **15 Hrs.**

Reinforced Concrete design method - Working stress and Limit State - Philosophy and principles - Limit state design: Stress block parameters, concept of balanced section, under reinforced and over reinforced section – Design of one way and two-way rectangular slabs subjected to uniformly distributed load for various boundary conditions and corner effects - Design of staircase - waist slab (dog legged).

Module 2: Design of beam for flexure and shear **13 Hrs.**

Limit State design of singly reinforced rectangular RC beam – Design of doubly reinforced concrete beams for flexure – Design of flanged beam for bending - Design of beams for shear: vertical stirrups and bent up bars - Development length - reinforcement detailing.

Module 3: Design of Columns and Footings **17 Hrs.**

Types of RC column - Design concepts of the column - Limit state design of short and long columns for axially, uniaxial and biaxial load using interaction charts - Design of axial load rectangular and square column footing - reinforcement detailing. Design of rectangular combined footing.

Total Hours:	**45 Hrs.**

Course Outcomes: (laboratory) Upon completion of the course, students shall have ability to		
C502.1	Design and Detailing of a RC beam.	[AP]
C502.2	Design and Detailing of a RC slab	[AP]
C502.3	Design and Detailing of a RC retaining wall	[AP]
C502.4	Design and Detailing of a RC water tank	[AP]
C502.5	Design and Detailing of a RC column	[AP]

Laboratory Component:

S. No.	List of Experiments	CO Mapping	RBT
1.	Design and Detailing of a singly reinforced beam	C502.1	[AN]
2.	Design and Detailing of a doubly reinforced beam.	C502.2	[AP]
3.	Design and Detailing of a flanged beam.	C502.2	[AP]
4.	Design and Detailing of a RC one way slab	C502.3	[AP]
5.	Design and Detailing of a RC Two way slab	C502.3	[AP]
6.	Design and Detailing of a Cantilever Retaining Wall	C502.4	[AP]
7.	Design and Detailing of a Counterfort Retaining Wall	C502.4	[AP]
8.	Design and Detailing of an Underground Rectangular Water Tank	C502.4	[AP]
9.	Design and Detailing of a Dome.	C502.3	[AP]
10	Design and Detailing of a short column	C502.5	[AP]
11.	Design and Detailing of a long column	C502.6	[AN]
12.	Design and Detailing of Isolated footing.	C502.6	[AN]

Text Books :

1.	Punmia B.C. and Jain A.K, Limit State Design of Reinforced Concrete, Laxmi Publications Pvt.Ltd, New Delhi, 2016.
2.	Unnikrishna Pillai and Devdass Menon, Reinforced Concrete Design, Tata McGraw Hill Publishing Company Ltd. New Delhi, 2021.
3.	Krishna Raju.N, Reinforced Concrete Design: IS:456-2000, Principles and Practice, New Age International Publishers, New Delhi, 2019.

Suggested Readings:

1.	Subramanian N., Design of Reinforced Concrete Structures, Oxford University Press,New Delhi, 2014.
2.	Varghese,P.C.,Limit State Design of Reinforced Concrete, Prentice Hall of India, Pvt. Ltd., New Delhi, 2020.
3.	Sinha,S.N.Reinforced Concrete Design–Tata McGrawHill Publishing Company Ltd. New Delhi, 2019.
4.	Shah V L and Karve S R., Limit State Theory and Design of Reinforced Concrete, Structures Publications, Pune, 2021.

IS Code Books :	
1.	IS 456:2000 Plain and Reinforced Concrete - Code of Practice, Bureau of Indian Standards, New Delhi.
2.	IS 875:1987 Code of Practice for Design Loads (other than earthquake) for buildings and structures, Bureau of Indian Standards, New Delhi
3.	National Building Code 2016, BIS, New Delhi.
4.	SP16:1980 Design Aids for Reinforced Concrete to IS456 : 1978, BIS, New Delhi.
5.	SP34:1987 Handbook on Concrete Reinforcement and Detailing, BIS, New Delhi.
Web References:	
1.	https://geology.com/
2.	https://www.indianconcreteinstitute.org/
Online Resources:	
1.	https://nptel.ac.in/courses/105/102/105102012/
2.	https://onlinecourses.swayam2.ac.in/nou20_cs14/

Continuous Assessment									End Semester Examination	Total
Theory				Practical			Total (A+B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (10%) [80 Marks]**
C501.1 – C502.2	Apply	Online Quiz-1	**20**
C502.3	Apply	Assignment-1	**20**
C502.4 – C502.5	Apply	Online Quiz-2	**20**
C502.5	Apply	Assignment-2	**20**

Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	**Summative Assessment (15%) [120 Marks]**		**End Semester Examination (35%) [100 Marks]**
	CIA1: (60 Marks)	**CIA2: (60 Marks)**	
Remember	10	-	-
Understand	20	10	10
Apply	30	50	50

Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination – Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (15%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	-	-	-
Understand	20	20	20
Apply	30	30	30
Analyse	50	55	50
Evaluate	-	-	-
Create	-	-	-

Mapping of Course Outcomes (CO) with Programme Outcomes (PO)Programme Specific Outcomes (PSO) - Theory

Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	3	1	-	-	-	-	-	1	-	1	2	-	3
2	3	2	3	1	-	-	-	-	-	1	-	1	2	-	3
3	3	2	3	1	-	-	-	-	-	1	-	1	2	-	3
4	3	2	3	1	-	-	-	-	-	1	-	1	2	-	3
5	3	2	3	1	-	-	-	-	-	1	-	1	2	-	3
Avg.	3	2	3	1	-	-	-	-	-	1	-	1	2	-	3

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

Mapping of Course Outcomes (CO) with Programme Outcomes (PO)Programme Specific Outcomes (PSO) - Laboratory

Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	3	1	3	-	-	-	2	2	-	1	1	-	3
2	3	2	3	1	3	-	-	-	2	2	-	1	1	-	3
3	3	2	3	1	3	-	-	-	2	2	-	1	1	-	3
4	3	2	3	1	3	-	-	-	2	2	-	1	1	-	3
5	3	2	3	1	3	-	-	-	2	2	-	1	1	-	3
Avg.	3	2	3	1	3	-	-	-	2	2	-	1	1	-	3

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE503	TRANSPORTATION ENGINEERING	3/0/3/4.5
Nature of Course	Theory Application	
Pre requisites	Nil	

Course Objectives:

1	To know about highway planning and geometric design of roads.
2	To learn about pavement design and maintenance.
3	To know about the construction principles and maintenance of railway tracks.
4	To understand the processes involved in railway engineering.

Course Outcomes:
Upon completion of the course, students shall have ability to

C503.1	Apply the basic concepts of highway planning.	[AP]
C503.2	Plan the various geometric elements for highway construction.	[AN]
C503.3	Illustrate the construction processes and alignment of railways.	[AN]
C503.4	Examine the working procedures in railways.	[AP]
C503.5	Outline the airport components and services	[AP]

Course Contents: Theory

Module 1: Highway planning, design and construction **15 Hrs.**

Significance of highway planning – History of road development in India – factors influencing highway alignment - Engineering surveys for alignment, Classification of highways. Highway components - Sight distances – Horizontal curves, Super elevation, transition curves, widening at curves – Vertical curves – Use of software for alignment process - Gradients, Testing of highway materials - Construction practice- WBM road – Bituminous road – Concrete road.

Module 2: Railway planning, design, construction and maintenance **15 Hrs.**

Role of Indian Railways in National Development – Railway cross sectional elements - Functions - Geometric Design of railway tracks, super elevation, cant deficiency and excess, negative superelevation. Points and Crossings – Working Principle - Signaling, Interlocking and Track Circuiting, Track Drainage, Railway Stations and Yards, Level Crossings – LRT & MRTS – Calculation of capacity of traffic.

Module 3: Airport planning and design **15 Hrs.**

Airports – Components of airports - Airport obstructions - Airport drainage - Airport lighting - Air traffic control -Runway and taxiway markings - Visual aids - Air traffic control network - Passenger facilities and services - Runway orientation - Cross wind component - Wind rose diagram (Problem) - Layout of taxiway and terminal area - Systems of aircraft parking - Circular Runways – Future terminal buildings.

Total Hours	**45 Hrs**

Course Outcomes : Laboratory **Upon completion of the Laboratory, students shall have ability to**		
C503.1	Investigate the applicability of aggregates based on shape and density.	[AP]
C503.2	Determine and evaluate the strength parameters of aggregates.	[AN]
C503.3	Plan the vertical and horizontal alignment of pavements and rail tracks	[AN]
C503.4	Examine the wind direction and orientation of airports	[AN]
C503.5	Examine the suitability of bitumen for usage in field	[AP]

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Determination of flakiness and elongation index of aggregates	C503.1	[AN]
2	Determination of resistance offered by aggregate against gradual loading	C503.2	[AN]
3	Determination of resistance offered by aggregates against impact loading	C503.2	[AP]
4	Determination of resistance of aggregate against abrasion	C503.2	[AP]
5	Design of alignment of pavements using software package	C503.3	[AP]
6	Geometric design of railway tracks using software package	C503.4	[AN]
7	Design of airport runway orientation using wind rose diagram	C503.4	[AN]
8	Determination of resistance of cylindrical bituminous mix specimens to loading	C503.5	[AN]
9	Determination of Viscosity of bituminous binder	C503.5	[AP]
10	Determination of Ductility of bituminous binder	C503.5	[AP]
11	Determination of Softening point of bitumen	C503.5	[AP]

12	Determination of Penetration of bitumen (Penetration Test)	C503.5	[AP]
Text Books:			
1	Rangwala, “Airport Engineering”, Charotar Publishing House, 2016.		
2	Veeraragavan. A, Khanna S.K and Justo C E G, “Highway Engineering “, Nem Chand & Bros, 10th edition, 2015.		
3	Arora .S.P and Saxena .S.C, “A Textbook of Railway Engineering”, CBS Publishers, 2017.		
Suggested Readings:			
1	Sharma S.K, “Principles Practices & Design of Highway Engineering” S.Chand & Co, 2014.		
2	Satish Chandra and Agarwal.M.M, “Railway engineering” Prabha & Co, Delhi, 2012.		
3	Partha Chraborthy and Animesh Das, “Principles of Transportation Engineering”, Tata McGraw Hill Co Ltd, New Delhi, 2012.		
4	Norman J. Ashford, Saleh Mumayiz, Paul H. Wright, “Airport Engineering: Planning, Design, and Development of 21st Century Airports” Wiley; 4th edition, 2011		
IS Codes			
1	IS: 2386 – Part I to IV – 1963, “Methods of test for aggregates for concrete” .		
2	IS 1203 to 1208 – 1978, “Methods for testing for tar and bituminous materials”		
Web References:			
1	https://www.designingbuildings.co.uk/wiki/Railway_engineering		
2	https://www.brighthubengineering.com/building-construction-design/125227-highway-construction-and-engineering/		
Online Resources:			
1	https://www.edx.org/course/railway-engineering-an-integral-approach-2		
2	https://www.mooc-list.com/tags/highway-engineering		

Continuous Assessment									End Semester Examination	Total
Theory				Practical			Total (A+B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (10%) [80 Marks]**
C501.1 – C502.2	Apply	Online Quiz-1	**20**
C502.3	Apply	Assignment-1	**20**
C502.4 – C502.5	Apply	Online Quiz-2	**20**
C502.5	Apply	Assignment-2	**20**

Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	**Summative Assessment (15%) [120 Marks]**		**End Semester Examination (35%) [100 Marks]**
	CIA1: (60 Marks)	**CIA2: (60 Marks)**	
Remember	10	-	-
Understand	20	10	10
Apply	30	50	50
Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination – Practical			
Bloom's Level	**Continuous Assessment (25%) [100 Marks]**		**End Semester Examination (15%) [100 Marks]**
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	-	-	-
Understand	20	20	20
Apply	30	30	30
Analyse	50	50	50
Evaluate	-	-	-
Create	-	-	-

Mapping of Course Outcomes (CO) with Programme Outcomes (PO)Programme Specific Outcomes (PSO) - Theory															
Cos	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	**3**	**2**	**1**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**	**1**
2	**3**	**2**	**1**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**	**1**
3	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**	**1**
4	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**	**1**
5	**3**	**2**	**1**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**	**1**

Avg.	3	2	1	1	-	1	-	-	-	-	-	1	2	-	1
1	Reasonably agreed					2	Moderately agreed					3	Strongly agreed		

Mapping of Course Outcomes (CO) with Programme Outcomes (PO)Programme Specific Outcomes (PSO) - Laboratory

Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	3	-	1	1	2	2	-	1	1	-	2
2	3	2	1	1	3	-	1	1	2	2	-	1	1	-	2
3	3	2	1	1	3	-	1	1	2	2	-	1	1	-	2
4	3	2	1	1	3	-	1	1	2	2	-	1	1	-	2
5	3	2	1	1	3	-	1	1	2	2	-	1	1	-	2
Avg.	3	2	1	1	3	-	1	1	2	2	-	1	1	-	2
1	Reasonably agreed					2	Moderately agreed					3	Strongly agreed		

22CE504	Soil Mechanics Laboratory		0/0/3/1.5
Nature of Course	Practical application		
Pre requisites	Nil		
Course Objectives:			
1	To analyze the soil sample and examine the index, engineering properties of soils		
2	To classify the soil based on particle size and determine the permeability of soil samples		
3	To determine the shear parameters, and co-efficient of consolidation of soils		
4	To determine the bearing capacity and penetration resistance of soils in the field.		
Course Outcomes: **Upon completion of the course, students shall have ability to**			
C504.1	Examine the soil and report index, engineering properties of soils		[AP]
C504.2	Classify the soil based on particle size and determine soil permeability		[AP]
C504.3	Relate compaction and consolidation behavior of soils		[AP]
C504.4	Determine the shear strength parameters of soils		[AP]
C504.5	Demonstrate the field test SPT and DCPT		[AP]
Course Contents:			
Laboratory Component:			
S. No	**List of Experiments**	**CO Mapping**	**BT**
1	Determination of water content and specific gravity of soils	C504.1	[AP]
2	Determination of relative density of cohesionless soils	C504.1	[AP]
3	Determination of field density of soil by core cutter method and sand replacement method	C504.1	[AP]
4	Determination of liquid limit, plastic limit and shrinkage limit	C504.1	[AP]
5	Determination of particle size distribution of soils using sieve analysis method	C504.2	[AP]
6	Determination of permeability of soil using constant and falling head method	C504.2	[AP]
7	Determination of maximum dry density of soil using standard proctor's compaction test	C504.3	[AP]
8	Determination of co-efficient of consolidation of soils	C504.3	[AP]
9	Determination of shear strength parameters of soil using direct shear method	C504.4	[AP]
10	Determination of unconfined compressive strength and shear strength of clay using laboratory vane shear test	C504.4	[AP]

11	Determination of angle of shearing resistance and bearing capacity of soil by standard penetration test	C504.5	[AP]
12	Determination of penetration resistance of soil using dynamic cone penetration test	C504.5	[AP]

Text Books:	
1	Arora, K. R. "Soil Mechanics and Foundation Engineering", Standard Publishers Distributors, New Delhi, 7th Edition Reprint, 2019.
2	Gopal Ranjan and Rao A S R, "Basic and Applied Soil Mechanics", New Age International Pvt. Ltd., New Delhi, 2020.
3	Punmia B. C., Ashok K Jain and Arun K Jain, "Soil Mechanics and Foundation", Laxmi Publications, New Delhi, Sixteenth Edition, 2019.
Suggested Readings:	
1	Murthy V N S, "Textbook of Soil Mechanics and Foundation Engineering", CBS Publication, New Delhi, 2017.
2	Muni Budhu, "Soil Mechanics and Foundation Engineering", Wiley India Publication, New Delhi, 2016.
3	Purushothama Raj P, "Soil Mechanics and Foundation Engineering" Pearson Education India, 2014.
4	Alam Singh, "Modern Geotechnical Engineering", IBS Publications, New Delhi, 2010.
Web References:	
1	https://freevideolectures.com/course/95/soil-mechanics
2	https://freevideolectures.com/course/2674/foundation-engineering
3	https://lecturenotes.in/subject/534/geotechnical-engineering-2

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
75	**25**	**100**	**60**	**40**	**100**

Assessment based on Continuous and End Semester Examination

Bloom's Level	**Continuous Assessment (60%) [100 Marks]**		**End Semester Practical Examination (40%) [100 Marks]**
	FA (75 Marks)	**SA (25 Marks)**	
Remember	-	-	-
Understand	20	20	20
Apply	40	40	40
Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	3	3	1	-	2	1	1	-	1	2	1	1
2	2	2	-	3	2	1	-	2	1	1	-	1	2	1	1
3	2	2	-	3	2	2	-	2	1	1	-	1	2	-	1
4	2	2	-	3	2	2	-	2	1	1	-	1	2	1	1
5	2	2	-	3	2	2	-	2	1	1	-	1	2	1	1
Avg.	**2.2**	**2**	**2**	**3**	**2.2**	**1.6**	**-**	**2**	**1**	**1**	**-**	**1**	**2**	**1**	**1**
1	Reasonably agreed					2	Moderately agreed				3	Strongly agreed			

SEMESTER 6

22CE601	Construction Planning and Management	2/1/0/3
Nature of Course	Theory analytical	
Pre requisites	Nil	

Course Objectives:

1	To learn the basic concepts of Construction planning and management.
2	To understand project scheduling and use Cost control tools and use of project information
3	To know the assessment systems of quality control.
4	To study principles of safety and Health management systems.

Course Outcomes:

Upon completion of the course, students shall have ability to

C601.1	Apply the elementary concepts in construction management and planning	[AP]
C601.2	Model and plan construction problems using various network methods	[AN]
C601.3	Apply the principles of scheduling for construction projects	[AP]
C601.4	Examine the cost analysis using crashing in construction management	[AN]
C601.5	Illustrate the ideas of quality control and understand the concept of gathering and using project information and learn the different database that can be maintained in a construction industry	[AN]

Course Contents: Theory

Module 1: Planning and Management **15 Hrs.**

Construction project planning - Stages of project planning: pre-tender planning, pre-construction planning, Framework, Importance of Planning - Types of organizations, role and responsibilities of project Manager, Resource planning - Project life cycle, Project feasibility reports based on socio- techno-economic, Process of development of plans and schedules, work break-down structure, Classification of Construction projects, Stages of construction, Resources, Contract Types of contracts Formation of contract

Module 2: Schedule Management **15 Hrs.**

Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedencerelationships, preparation of CPM networks - Work Breakdown structure – PERT –Activity float and schedules -Resource oriented scheduling –Scheduling with resource constrains and precedence's-Scheduling with uncertain durations-Crashing and time/cost trade-offs -Resource smoothing and Leveling, Critical Chain method, Concepts of earned value management .

Module 3: Project Information and Quality Control **15 Hrs.**

Types of Project Information –Accuracy and Use of Information –Computerized Organization and Use of Information-Organizing Information in Database –Relation Model of Database –Other Conceptual model of database- Centralized Database Management System – Database and Application Programs -Quality control, Quality Assurance, Cost of Quality-Quality Assessment system-Continuous process improvement - PDCA cycle, 5S, Kaizen - checklists for quality control, role of inspection, Principles of Safety -Safety and Health Management system.	
Total Hours	**45 Hrs.**
Text Books:	
1	Neeraj Kumar Jha ,"Construction Project Management –Theory and Practice" Pearson Education India; 2nd edition 2015
2	Chitkara, K.K.Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi ,Third Edition ,2014.
3	Steven Mccabe ,"Quality Improvement Techniques in Construction :Principles and Methods", Routledge ,2016
4	Steve Rowlinson,"Construction Safety Management System ",Routledge ,2019.
Reference Books:	
1	Charles Patrick ,Construction Project Planning & Scheduling ,Pearson ,2012
2	Lock, Gower,"Project Management Handbook "2013.
3	Jimmie W.Hinze,"Construction Planning and Scheduling",Prentice Hall Publication ,4th edition ,2011.
4	Brain Thorpe and Peter Summer ,"Quality Assurance in Construction ",Routledge 2016
Web References:	
1	https://lecturenotes.in/subject/547/construction-management-cm
2	https://www.transit.dot.gov/sites/fta.dot.gov/files/FTA_Report_No._0015.pdf
3	https://www.pmi.org/
4	https://www.projectmanager.com/
Online Resources:	
1	https://nptel.ac.in/courses/105104161/
2	https://nptel.ac.in/courses/105103093/
3	https://www.edx.org/course/project-management-of-engineering-projects-prepari

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C601.1	Apply	Online Quiz-1	20
C601.2& C601.3	Analyze	Assignment-1	20
C601.3& C601.4	Analyze	Assignment-2	20
C601.5	Analyze	Online Quiz-2	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	-	10
Understand	20	20	10
Apply	30	30	30
Analyse	40	50	50
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	3	2	1	2	-	-	-	2	-	2	3	2	2	2	-
1	3	2	1	2	-	-	-	2	-	2	3	2	2	2	-
2	3	3	2	2	-	-	-	2	-	2	3	1	2	2	-
3	3	2	1	2	-	-	-	2	-	2	3	2	2	2	-
4	3	2	1	2	-	-	-	2	-	2	3	1	2	2	-
5	3	2	1	2	-	-	-	2	-	2	3	2	2	2	-
Avg.	3	2	1	2	-	-	-	2	-	2	3	1.8	2	2	-
1	Reasonably agreed					2	Moderately agreed					3	Strongly agreed		

22CE602	CONSTRUCTION COST ESTIMATION AND VALUATION	3/0/3/4.5
Nature of Course	Theory Application	
Pre requisites	Nil	

Course Objectives:

1	To obtain the knowledge of various types of estimates.
2	To apply the various estimation methods for buildings.
3	To prepare an estimate for the special structures such as sanitary structures, roads and retaining walls.
4	To acquire knowledge on tender, contract, valuation and report preparation.

Course Outcomes:
Upon completion of the course, students shall have ability to

C602.1	Apply the various types and methods of estimation.	[AP]
C602.2	Prepare the estimation of load bearing, framed RCC and special structures.	[AN]
C602.3	Prepare a tender and contract documents for various types of construction works.	[AN]
C602.4	Analyze the rates for different items of works and evaluate the valuation of an RCC building.	[AN]
C602.5	Prepare reports for various building typologies and evaluate the rent for various buildings.	[AN]

Course Contents: Theory

Module 1: Estimation of Buildings and Special Structures **15 Hrs.**

General - Units of measurements - Types of Estimation - Methods of estimates and its advantages - Simple problems - Estimation of different foundations, steps, and boundary walls – Load bearing structures - Calculation of quantities of brickwork, RCC, PCC, Plastering, whitewashing color washing, and painting/varnishing for rooms, residential buildings with flat roofs - Estimation of framed structures - Estimating of the septic tank and soak pit - Estimate of bituminous and cement concrete roads - Estimate of retaining walls.

Module 2: Specification, Tenders and Rate Analysis **15 Hrs.**

Specifications - General and Detailed specifications for various items of work – Tenders - TTT Act - e-tender - preparation of tender Notice and Document – Contracts - Types of Contracts - Drafting of contract documents - Arbitration and legal requirements - Schedule of rates and Databook – the procedure of rate analysis - Requirement of labor and materials for different works - Obtaining rate for different works namely: cement mortar - cement concrete - RCC - RR masonry - Brick masonry - Damp Proof Course - Plastering - flooring - painting.

Module 3: Valuation and Report Preparation **15 Hrs.**

Valuation - definition of various terms such as free and leasehold property - Market value -

Book value - Assessed value - Mortgage Value - Replacement Value - Gross and Net Income - Capital cost - Cost Escalation - Depreciation - sinking fund method - Fixation of Rent - Calculation of Standard Rent of Government Building - Principles of Report preparation.		
	Total Hours	**45 Hrs**
Course Outcomes : Laboratory **Upon completion of the Laboratory, students shall have ability to**		
C602.1	Prepare the detailed estimate of the residential building.	[AN]
C602.2	Prepare the detailed estimate of septic tank, soak pit, flexible and rigid pavements for highways.	[AN]
C602.3	Prepare the tender and contract documents for the given infrastructure.	[AN]
C602.4	Analyze the rates for different items of works and evaluate the valuation of given buildings.	[AN]
C602.5	Prepare reports for various building typologies and evaluate the rent for various buildings.	[AN]

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Estimation of a Single Room Building: Load bearing structure using spreadsheets.	C602.1	[AN]
2	Estimation of 1 BHK Residential Building: Load bearing structure using spreadsheets.	C602.1	[AN]
3	Estimation of 1 BHK Residential Building: RC framed structure using spreadsheets.	C602.1	[AN]
4	Estimation of septic Tank with Soak Pit for 2-BHK House using spreadsheets.	C602.2	[AN]
5	Estimation of Flexible and Rigid Pavement for State Highway using spreadsheets.	C602.2	[AN]
6	Preparation of tender Notice and document for proposed real time project.	C602.3	[AN]
7	Drafting of contract documents for a proposed real time project.	C602.3	[AN]
8	Rate Analysis for different items of work in an R.C.C building construction.	C602.4	[AN]
9	Valuation of a masonry residential building by depreciation method.	C602.4	[AN]
10	Valuation of a reinforced Cement Concrete framed building (G+1) by depreciation method.	C602.4	[AN]
11	Fixation and calculation of rent of proposed Government Building.	C602.5	[AN]

12	Reports on estimates for the construction of infrastructural projects like buildings, highways and bridges.	C602.5	[AP]
Text Books:			
1	Dutta, B.N., “Estimating and Costing in Civil Engineering: Theory and Practice”, CBS Publishers & Distributors Pvt. Ltd., 2021.		
2	Kohli, D. D, and Kohli, R.C., “A Text Book of Estimating and Costing (Civil)”, S. Chand Publishing, 2012.		
3	Vazirani, V.N and Chandola, S.P., “Civil Engineering Estimation, costing & Valuation”, Khanna Publishers, 2015.		
Suggested Readings:			
1	Patil B.S., “Civil Engineering Contracts and Estimates”, Universities Press (India) Pvt. Ltd., 2015.		
2	Banerjee D.N., “Principles and Practices of Valuation”, V Edition, Estern Law House, 2015.		
3	Seetharaman S. and Chinnasamy M., “Estimation and Quantity Surveying”, Anuradha Publications, 2015.		
4	Upadhyay A.K, “Civil Estimation and Costing”, S.K. Kataria and Sons, New Delhi, 2015.		
IS Codes			
1.	IS 1200 Part 1 – 28 (Reaffirmed 2002), Methods of Measurement of works in Civil Engineering, Bureau of Indian Standards, New Delhi.		
2.	IS 3861:2002, Method of Measurement of Plinth, Carpet and Rentable Area of Buildings, Bureau of Indian Standards, New Delhi.		
3.	SP 27:1987 (Reaffirmed 2003), Handbook of Method of Measurement of Building Works, Bureau of Indian Standards, New Delhi.		
4.	Tamil Nadu Transparencies in Tenders Act, 2012.		
Web References:			
1	https://www.youtube.com/watch?v=woYm4WA2OiA		
2	https://www.youtube.com/watch?v=hDCDlN6uvVU		
Online Resources:			
1	https://nptel.ac.in/courses/105/103/105103093/		
2	https://www.coursera.org/learn/construction-cost-estimating		

Continuous Assessment									End Semester Examination	Total
Theory				Practical			Total (A+B)	Total Continuous Assessment		
Formative Assessment	Summative Assessment	Total	Total (A)	Formative Assessment	Summative Assessment	Total (B)				
80	120	200	100	75	25	100	200	50	50	100

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (10%) [80 Marks]**
C602.1-C602.2		Group Assignment - 1	**20**
C602.3		Case Study - 1	**20**
C602.4		Group Assignment - 2	**20**
C602.5		Case Study - 2	**20**

Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	**Summative Assessment (15%) [120 Marks]**		**End Semester Examination (35%) [100 Marks]**
	CIA1: (60 Marks)	**CIA2: (60 Marks)**	
Remember	10	10	10
Understand	10	10	10
Apply	30	30	30
Analyse	50	50	50
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination – Practical			
Bloom's Level	**Continuous Assessment (25%) [100 Marks]**		**End Semester Examination (15%) [100 Marks]**
	FA: (75 Marks)	**SA: (25 Marks)**	
Remember	-	-	-
Understand	20	20	20
Apply	30	30	30
Analyse	50	50	50
Evaluate	-	-	-
Create	-	-	-

Mapping of Course Outcomes (CO) with Programme Outcomes (PO)Programme Specific Outcomes (PSO) - Theory															
Cos	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	-	-	-	2	2	2	3	2	2	3	3	-	2
2	3	3	2	2	-	2	2	2	3	2	2	3	3	-	2
3	3	3	2	2	-	2	2	2	3	2	2	3	3	-	2
4	3	3	2	2	-	2	2	2	3	2	2	3	3	-	2
5	3	3	2	2	-	2	2	2	3	2	2	3	3	-	2
Avg.	**3**	**2.8**	**2**	**2**	**-**	**2**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**-**	**2**
1	Reasonably agreed					2	Moderately agreed					3	Strongly agreed		

Mapping of Course Outcomes (CO) with Programme Outcomes (PO)Programme Specific Outcomes (PSO) - Laboratory															
Cos	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	-	-	3	2	2	2	3	2	2	3	3	-	2
2	3	3	2	2	3	2	2	2	3	2	2	3	3	-	2
3	3	3	2	2	3	2	2	2	3	2	2	3	3	-	2
4	3	3	2	2	3	2	2	2	3	2	2	3	3	-	2
5	3	3	2	2	3	2	2	2	3	2	2	3	3	-	2
Avg.	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**-**	**2**
1	Reasonably agreed					2	Moderately agreed					3	Strongly agreed		

22CE603	DESIGN OF STEEL STRUCTURES	3/0/3/4.5
Nature of Course	Problem, Analytical	
Pre requisites	Mechanics of Solids	

Course Objectives:

1	To analyse and design the bolted and welded steel connections.
2	To analyse and design tension members.
3	To analyse and design compression members and flexural members.
4	To design plate girder, gantry girder and roof trusses.

Course Outcomes:
Upon completion of the course, students shall have ability to

C603.1	Interpret the Structural steel - types, grades, properties and analyse, design, detail bolted connections.	[AN]
C603.2	Analyse, design and detail Welded connections.	[AN]
C603.3	Analyse, design, detail tension members, splices and lug angles.	[AN]
C603.4	Analyse, design and detail Simple, built-up compression member, splices and column bases.	[AN]
C603.5	Analyse, design and detail laterally supported, unsupported beams, plate girders and gantry girder.	[AN]

Course Contents: Theory

Module 1- Structural Steel and Design of Connections **15 Hrs.**

General -Types of Steel -Properties of structural steel - I.S. rolled sections - Concept of Limit State Design in IS 800 - Design of Simple and eccentric Bolted and welded connections - Types of failure and efficiency of joint **—** Prying action

Module 2- Tension and Compression Members **15 Hrs.**

Behaviour and Design of simple and built-up members subjected to tension - Shear lag effect- Design of lug angles - tension splice -Design of simple and built-up compression members with lacings and battens –Compression splice- Design of column bases - slab base and gusseted base

Module 3 – Beams and Industrial Structures **15 Hrs.**

Design of laterally supported and unsupported beams - Design of built-up beams - Design of plategirders-Design of roof trusses (Design Principles only) – loads on trusses – purlin design using angle and channel sections **—** truss design, Design of joints and end bearings–Design of gantry girder (Design Principles only) – Pre Engineered Buildings (PEB) – An Overview – Comparison with Structural Steel buildings

Total Hours	**45 Hrs.**

Course Outcomes : Laboratory

Upon completion of the Laboratory, students shall have ability to		
C603.1	Analyse, design and detail bolted, welded connections using software packages.	[AN]
C603.2	Analyse design and detail tension members, compression members,column bases using software packages.	[AN]
C603.3	Analyse, design and detail laterally supported, unsupported and built-upbeams using software packages.	[AN]
C603.4	Analyse, design and detail the plate and gantry girder using softwarepackages.	[AN]
C603.5	Analyse, design the components of steel roof trusses using softwarepackages.	[AN]

Laboratory Course Content:

S. No.	List of Experiments	CO Mapping	BT
1	Design and detailing of Bolted Connections using softwarepackages.	C603.1	[AN]
2	Design and detailing of Welded Connection using softwarepackages.	C603.1	[AN]
3	Design and detailing of Tension Members and lug anglesusing software packages.	C603.1	[AN]
4	Design and detailing of simple and built-up Compression Members software packages.	C603.2	[AN]
5	Design and detailing of Column bases using software packages.	C603.2	[AN]
6	Design and detailing of Laterally unsupported Beams usingsoftware packages.	C60.3	[AN]
7	Design and detailing of Laterally supported Beams using software packages.	C602.3	[AN]
8	Design and detailing of Roof truss using software packages.	C603.4	[AN]
9	Design and detailing of Plate girder using software packages.	C603.4	[AN]
10	Design and detailing of Gantry girder design using softwarepackages.	C603.4	[AN]
11	Analysis, design and detail of steel workshop shed using software packages.	C603.5	[AN]
12	Planning, Analysis, design and detailing of a real time structure.	C603.1-C603.5	[AN]

Text Books:

1	Duggal S.K., Limit state design of steel structures, McGraw Hill Co., New Delhi, 2014.
2	Arya.A. S &Ajmani.J.L., Design of Steel Structures, New Chand & Bros. Roorkee. 2015
3	Subramanian, N. —Design of Steel Structuresǁ, Oxford university press,2018
Suggested Readings:	
1	Teaching Resource for Structural Steel Design, Vol. 1,2,3 INSDAG- Institute for Steel Development and Growth, Kolkatta ,2016
2	Negi L.S. Design of steel structures, McGraw Hill Co., New Delhi, 2014
3	Bhavikatti S.S., Design of Steel Structures (By limit state method as per IS 800:2007) I K International Publishing house Pvt.Ltd, 2010.
4	Ramachandra, Virendra Gehlot, Design of steel structures- Scientific Publishers, 2011
IS Codes	
1.	IS 800-2007, Code of practice for general construction in steel, Bureau of Indian Standards, New Delhi.
2.	SP 6 - 1964 Hand book for Structural engineers – Structural Steel Sections
3.	IS 875 (1-5)- Code of Practice for Design Loads for Building and Structures, Bureau ofIndian Standards, New Delhi.
Web References:	
1	http://www.steel-insdag.org/TM_Contents.asp
2	https://www.aisc.org/education/university-programs/teaching-aids/
Online Resources:	
1	https://nptel.ac.in/courses/105/105/105105162/
2	https://www.edx.org/course/connections-in-steel-structures

Continuous Assessment									**End Semester Examination**	**Total**
Theory				**Practical**			**Total (A+B)**	**Total Continuous Assessment**		
Formative Assessment	**Summative Assessment**	**Total**	**Total (A)**	**Formative Assessment**	**Summative Assessment**	**Total (B)**				
80	**120**	**200**	**100**	**75**	**25**	**100**	**200**	**50**	**50**	**100**

Formative Assessment based on Capstone Model - Theory			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (10%) [80 Marks]**
C603.1-C603.5	U	Outside Classroom Learning Experience -1	**40**

C603.1-C603.5	U	Outside Classroom Learning Experience -2	**40**

Assessment based on Summative and End Semester Examination - Theory

Bloom's Level	Summative Assessment (15%) [120 Marks]		End Semester Examination (35%) [100 Marks]
	CIA1: (60 Marks)	CIA2: (60 Marks)	
Remember	10	10	10
Understand	10	10	10
Apply	30	30	30
Analyse	50	50	50
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination – Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (15%) [100 Marks]
	FA: (75 Marks)	SA: (25 Marks)	
Remember	-	-	-
Understand	20	20	20
Apply	30	30	30
Analyse	50	50	50
Evaluate	-	-	-
Create	-	-	-

Mapping of Course Outcomes (CO) with Programme Outcomes (PO)Programme Specific Outcomes (PSO) - Theory

Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	-	-	-	2	2	2	3	2	2	3	3	-	2
2	3	3	2	2	-	2	2	2	3	2	2	3	3	-	2
3	3	3	2	2	-	2	2	2	3	2	2	3	3	-	2
4	3	3	2	2	-	2	2	2	3	2	2	3	3	-	2
5	3	3	2	2	-	2	2	2	3	2	2	3	3	-	2
Avg.	**3**	**2.8**	**2**	**2**	**-**	**2**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**-**	**2**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO) - Laboratory

Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	-	-	3	2	2	2	3	2	2	3	3	-	2

2	3	3	2	2	3	2	2	2	3	2	2	3	3	-	2
3	3	3	2	2	3	2	2	2	3	2	2	3	3	-	2
4	3	3	2	2	3	2	2	2	3	2	2	3	3	-	2
5	3	3	2	2	3	2	2	2	3	2	2	3	3	-	2
Avg.	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**-**	**2**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE604	Project Planning and Development Laboratory	0/0/2/1
Nature of Course	Practical application	
Pre requisites	Nil	

Course Objectives:

1	To understand the structure of the project and schedule the project
2	To define the roles and resource for various activities
3	To create organization and work breakdown structure of projects
4	To examine and track the project status in the report

Course Outcomes:
Upon completion of the course, students shall have ability to

C604.1	Categorize and create activities for the project	[AP]
C604.2	Classify the tasks and milestones associated with a project	[AP]
C604.3	Plan and allocate resource for the activities involved in a project	[AN]
C604.4	Determine the critical path for the projects	[AN]
C604.5	Analyze the optimum resource required by smoothing and leveling and track the project status in the report	[AN]

Course Contents:

Laboratory Component:

S. No	List of Experiments	CO Mapping	BT
1	Navigate and Customize the Project 2019 Interface, AddingTasks and Resources to a Project.	C604.1	[AP]
2	Creating Calendars and Changing Working Time with Calendars	C604.1	[AP]
3	Determination of Summary Tasks and Milestones	C604.2	[AP]
4	Determination of Critical Path and Activities using Ms Project	C604.3	[AN]
5	Allocation of Resource to Tasks and Resource leveling	C604.3	[AN]
6	Use of MS project to assign and review the Over – Allocated Resources	C604.4	[AN]
7	Identification of Critical path for simple and complex projects	C604.4	[AN]
8	Use of MS Project for Scheduling of activities in a 2 BHK Residential building	C604.5	[AN]
9	Scheduling and Allocating Resources to activities in a G+3 Multistoried Building using MS project	C604.5	[AN]
10	Tracking and Report generation for a project by updating theactivities with the use of MS Project	C604.5	[AN]

11	Planning and Scheduling using Primavera	C604.5	[AN]
12	Use of Primavera Visualizer for creating Time-Scaled Graphical Reports	C604.5	[AN]
		Total Hours:	**30 Hrs.**
Text Books:			
1	Cindy Lewis ,Carl Chatfield ,Timothy Johnson “Microsoft Project 2019 step by step”, Pearson Education ,India 2019 .		
2	Neeraj Kumar Jha “Construction Project Management –Theory and Practice” Pearson Education India; 2nd edition 2015		
3	Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi ,Third Edition ,2014.		
Suggested Readings:			
1	Charles Patrick ,Construction Project Planning & Scheduling ,Pearson ,2012		
2	Jimmie W.Hinze,”Construction Planning and Scheduling”,Prentice Hall Publication ,4th edition ,2011.		
Web References:			
1	https://www.oreilly.com/library/view/learning-microsoft-project/9781838988722/		
2	https://lecturenotes.in/subject/547/construction-management-cm		
Online Resources:			
1	https://onlinecourses.nptel.ac.in/noc19_cs70/preview		
2	https://www.linkedin.com/learning/microsoft-project-2019-essential-training/get-started-with-microsoft-project-2019-and-project-online-desktop?autoplay=true		

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
75	**25**	**100**	**60**	**40**	**100**

Assessment based on Continuous and End Semester Examination			
Bloom’s Level	**Continuous Assessment (60%) [100 Marks]**		**End Semester Practical Examination (40%) [100 Marks]**
	FA (75 Marks)	**SA (25 Marks)**	
Remember	10	10	10
Understand	10	10	10
Apply	30	30	30

Analyse	50	50	50
Evaluate	-	-	-
Create	-	-	-

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

Cos	Pos												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	2	3	-	-	2	2	2	3	1	2	2	-
2	3	2	1	2	3	-	-	2	2	2	3	1	2	2	-
3	3	3	2	2	3	-	-	2	2	2	3	1	2	2	-
4	3	2	1	2	3	-	-	2	2	2	3	1	2	2	-
5	3	2	1	2	3	-	-	2	2	2	3	1	2	2	-
Avg.	**3**	**2**	**1**	**2**	**3**	**-**	**-**	**2**	**2**	**2**	**3**	**1**	**2**	**2**	**-**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

SEMESTER VII

22CE701	DESIGN COMPREHENSIVE PROJECT	0/0/4/2
Nature of Course	Project	
Pre requisites	Nil	

Course Objectives:

1.	To provide students an opportunity to exercise their creative and innovative qualities in a group project environment.
2.	To improve the skill of addressing various problems related to Civil Engineering
3.	To estimate the ability of the student in transforming the theoretical knowledge studied so far into an application.
4.	To train the students to analyse the problems and its solutions, report preparation and to present and defend the report.

Course Outcomes:

Upon completion of the course, students shall have ability to

C701.1	Practice the way of investigation and exploration of scientific documents and case studies to Identify the existing problems in civil engineering domain.	[AP]
C701.2	Investigate the suitable components and interpretation using computational models to validate and justify his solutions	[AN]
C701.3	Choose peer groups to collaborate and bring out the sustainable products for commercialization.	[AP]
C701.4	Draft and compile the outputs of a project as a report.	[C]
C701.5	Present and Justify the outcomes of their project in an open platform.	[E]

Course Contents:

- This course is aimed to provide more weightage for identify and develop practical solutions to real life problems related to Civil Engineering industry.
- The theoretical knowledge, principles and practices gained from various subjects and software should be applied to develop effective solutions to various computing problems.
- Students could join (maximum 3) together, form a small team and execute a project.
- The project work could be done in the form of a project or internship in the industry, design project or analytical project or even a minor practical project in the college.
- Participation in any technical event / competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.
- Modeling Techniques, Design and Testing strategies should be documented properly.
- A committee consisting of Head of the department, the Supervisor of the design comprehension project and two senior faculty members of the department will perform the internal assessment of the Project (Phase I).
- A report on Project (Phase I) should be submitted for evaluation and project work should be presented and demonstrated before the panel of examiners.

Total Hours:	**15 Hrs.**

Tentative Assessment Method & Levels (based on Revised Bloom's Taxonomy)

Summative assessment based on Continuous and End Semester Examination

Revised Bloom's Level	Continuous Assessment [40 marks]			Project Book [20 marks]	End Semester Examination (Viva-Voce) [40 marks]
	Review – I [10 marks]	Review – II [10 marks]	Review – III [20 marks]		
Remember	-	-	-	-	-
Understand	-	-	-	-	-
Apply	50	40	30	30	30
Analyse	50	40	50	50	50
Evaluate	-	20	20	20	20
Create	-		20	20	20

Course Articulation Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	3	2	-	3	2	-	2	2	-	-	-	3	3	2	1
2	2	2	1	-	-	2	-	1	-	2	-	-	2	3	-
3	2	3	3	3	3	1	-	2	1	-	2	3	3	3	2
4	2	-	-	-	3	-	-	3	-	3	-	1	2	-	-
5	-	-	-	-	2	1	-	-	-	3	-	3	-	-	2

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

SEMESTER VIII

22CE801	PROJECT WORK	0/0/24/12
Nature of Course	Project	
Pre requisites	Nil	

Course Objectives:

1.	To provide students an opportunity to exercise their creative and innovative qualities in a group project environment.
2.	To improve the skill of addressing various problems related to Civil Engineering
3.	To estimate the ability of the student in transforming the theoretical knowledge studied so far into an application.
4.	To train the students to analyse the problems and its solutions, report preparation and to present and defend the report.

Course Outcomes:

Upon completion of the course, students shall have ability to

C801.1	Practice the way of investigation and exploration of scientific documents and case studies to Identify the existing problems in civil engineering domain.	[AP]
C801.2	Investigate the suitable components and interpretation using computational models to validate and justify his solutions	[AN]
C801.3	Choose peer groups to collaborate and bring out the sustainable products for commercialization.	[AP]
C801.4	Draft and compile the outputs of a project as a report.	[C]
C801.5	Present and Justify the outcomes of their project in an open platform.	[E]

Course Contents:

- This course is aimed to provide more weightage for identify and develop practical solutions to real life problems related to Civil Engineering industry.
- The theoretical knowledge, principles and practices gained from various subjects and software should be applied to develop effective solutions to various computing problems.
- Students could join (maximum 3) together, form a small team and execute a project.
- The project work could be done in the form of a project or internship in the industry, design project or analytical project or even a minor practical project in the college.
- Participation in any technical event / competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.
- Modeling Techniques, Design and Testing strategies should be documented properly.
- A committee consisting of Head of the department, the Supervisor of the design comprehension project and two senior faculty members of the department will perform the internal assessment of the Project (Phase I).
- A report on Project (Phase I) should be submitted for evaluation and project work should be presented and demonstrated before the panel of examiners.

Total Hours:	**15 Hrs.**

Tentative Assessment Method & Levels (based on Revised Bloom's Taxonomy)

Summative assessment based on Continuous and End Semester Examination

Revised Bloom's Level	Continuous Assessment [40 marks]			Project Book [20 marks]	End Semester Examination (Viva-Voce) [40 marks]
	Review – I [10 marks]	Review – II [10 marks]	Review – III [20 marks]		
Remember	-	-	-	-	-
Understand	-	-	-	-	-
Apply	50	40	30	30	30
Analyse	50	40	50	50	50
Evaluate	-	20	20	20	20
Create	-		20	20	20

Course Articulation Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	3	2	-	3	2	-	2	2	-	-	-	3	3	2	1
2	2	2	1	-	-	2	-	1	-	2	-	-	2	3	-
3	2	3	3	3	3	1	-	2	1	-	2	3	3	3	2
4	2	-	-	-	3	-	-	3	-	3	-	1	2	-	-
5	-	-	-	-	2	1	-	-	-	3	-	3	-	-	2

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

TAMIL

22TA101	HERITAGE OF TAMILS	1/0/0/1
Nature of Course:	C (Theory Concept)	
Pre requisites:	NIL	

Course Objectives:

1	To know various concepts of Tamil Language families.
2	To know about the essentialities of Heritage.
3	To understand the Aram concepts of Tamils and the cultural influence.

Course Outcomes:
Upon completion of the course, students shall have ability to

C101.1	Know about the language families in India, impact of religions and the contribution of Bharathiyar and Bharathidhasan.	[U]
C101.2	Observe the growth of sculpture, making of musical instruments and the role of temples in socio and economic lives.	[U]
C101.3	Understand the significance of folklore and martial arts.	[U]
C101.4	Learn the sangam literature, sangam age and overseas conquest of Cholas.	[U]
C101.5	Understand the contribution of Tamils to Indian Freedom Struggle, role of Siddha medicine and print history of Tamil Books.	[U]

Course Contents:

Language and Literature: 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.

Heritage - Rock Art Paintings to Modern Art – Sculpture: 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. **Folk And Martial Arts:** Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

Thinai Concept Of Tamils - 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. Contribution of Tamils to Indian national movement and indian culture: 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 Hours:	**15 Hrs.**
Text-cum-Reference Books:	
1	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித் தமிழ் – முனைவர் இல. சுந்தரம் . (விகடன் பிரசுரம்).
3	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4	பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
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 Civilization 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).
12	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C101.1	Understand	Quiz	20
C101.2	Understand	Seminar	20
C101.3	Understand	Seminar	20
C101.4	Understand	Quiz	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	40	40	40
Understand	60	60	60
Apply	-	-	-
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C101.1	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-
C101.2	-	-	-	-	-	-	-	1	1	-	-	1	-	-	-
C101.3	-	-	-	-	-	-	-	1	1	-	-	1	-	-	-
C101.4	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
C101.5	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-

22TA201	TAMILS AND TECHNOLOGY	1/0/0/1
Nature of Course:	C (Theory Concept)	
Pre requisites:	NIL	

Course Objectives:

1	To know about weaving, ceramic, design and construction technologies in sangam age.
2	To know the significance of technologies such as manufacturing, agriculture and irrigation.
3	To understand the development of Scientific Tamils and Tamil Computing.

Course Outcomes:
Upon completion of the course, students shall have ability to

C201.1	Describe about the weaving industry in sangam age and ceramic technology.	[U]
C201.2	Observe the design of houses, sculptures and construction of temples.	[U]
C201.3	Relate the various manufacturing materials and stone types in Silappathikaram.	[U]
C201.4	Understand the significance of agriculture and irrigation technology in ancient period.	[U]
C201.5	Explain the growth of scientific Tamil, Tamil computing and digitization of Tamil books.	[U]

Course Contents:

Weaving and Ceramic Technology: Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries. **Design and Construction Technology:** 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) - Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

Manufacturing Technology: 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. **Agriculture and Irrigation Technology:** Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu 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.

Scientific Tamil & Tamil Computing: 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 Hours: 15 Hrs.

Text-cum-Reference Books:

1	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித் தமிழ் – முனைவர் இல. சுந்தரம் . (விகடன் பிரசுரம்).

3	கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4	பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
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 Civilization 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).
12	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case Study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C201.1	Understand	Seminar	20
C201.2	Understand	Quiz	20
C201.3, C201.4	Understand	Quiz	20
C201.5	Understand	Seminar	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	40	40	40

Understand	60	60	60
Apply	-	-	-
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Course Outcome (CO)	**Programme Outcomes (PO)**												**Programme Specific Outcomes (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C201.1	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1
C201.2	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1
C201.3	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1
C201.4	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1
C201.5	-	-	-	-	-	-	-	-	-	1	-	1	-	-	1

PROFESSIONAL ELECTIVE

22CE901	Bridge Engineering and Design of Special Elements	3/0/0/3

Nature of Course	Problem Analytical
Pre-requisites	Design of Reinforced Concrete Structures

Course Objectives:

1.	To acquire knowledge in the design of reinforced concrete bridges.
2.	Able to analyze and design the slab bridge components and also know about the design principles of modern bridges.
3.	To know about the various substructure components and its requirements.
4.	To design the special RC elements and limit state of serviceability.

Course Outcomes:

Upon completion of the course, students shall have ability to

C901.1	Classify bridges, IRC loads acting on bridges and identify the specification of road bridges.	[U]
C901.2	Design of short span solid deck slab bridges for IRC loading.	[AP]
C901.3	Understand the design concepts of various types of bridges.	[U]
C901.4	Choose the bridge components and substructure.	[AP]
C901.5	Design of RC special elements and Limit State of Serviceability	[AN]

Course Contents:

Module 1: Introduction to Bridge and Design of deck slab **15 Hrs.**

Classification of Bridge – choice of type - IRC Specifications for road bridges – standard live loads – other forces acting on bridges - general design considerations - Design of deck slab bridge (supported on two side) for class AA load - Design of slab bridges (supported on all sides) for class AA load using Pigeauds Method.

Module 2: Design Principal of Bridges and its components **15 Hrs.**

General features and principal of bridge:Tee beam bridge, Plate girder bridge, Composite bridge, Box girder bridge, Steel truss bridge, Cable stayed bridge. Bearing - types - Design of elastomeric pad bearing - Piers - types - Bridge Foundation - types - Design of well foundation.

Module 3: Special RC Structures and Limit State of Serviceability **15 Hrs.**

Design of RC beams for combined effect (bending, shear and torsion) - Curved (plan) beams - Single span Deep beams - Design of Corbels - Parameters considered in limit state of serviceability - Short term deflection - long term deflection - Calculation of deflections in RC beams under working loads - Calculation of crack width in RC beams

Total Hours:	**45 Hrs.**

Text Books:

1.	Krishnaraju N., —Design of Bridges (Fifth edition), CBS Publishers, New Delhi, 2021.
2.	Ponnuswamy, S., Bridge Engineering, Tata McGraw-Hill, New Delhi, 2015.

3.	Jagadeesh T.R. and Jayaram M.A., —Design of Bridge Structures, 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2019.
4.	Punmia B.C. and Jain A.K, Limit State Design of Reinforced Concrete, Laxmi Publications Pvt.Ltd, New Delhi, 2019.
Reference Books	
1.	Johnson Victor D., —Essentials of Bridge Engineering‖, 6th Edition, Oxford and IBH Publishing Co., New Delhi, 2018.
2.	Raina V.K., —Concrete Bridge Practice Analysis, Design and Economics‖, 3rd Edition, Shroff Publishers and Distributors Pvt. Ltd., New Delhi, 2019.
3.	Sinha,S.N.Reinforced Concrete Design–Tata McGrawHill Publishing Company Ltd. New Delhi, 2019.
4.	Unnikrishna Pillai and Devdass Menon, Reinforced Concrete Design, Tata McGraw Hill Publishing Company Ltd. New Delhi, 2021.
IS Code Books :	
1.	IRC: 21-2000, Standard Specifications and Code of Practice for Road Bridges Section III Cement Concrete
2.	IRC: 6-2017, Standard Specifications and Code of Practice for Road Bridges Section II Loads and Load combinations
3.	IRC: 112-2011, Code of Practice for Concrete Road Bridges
4.	IRC: 78-2014, Standard Specifications and Code of Practice For Road Bridges, Section VII - Foundations and Substructure
5.	IRC: 83-1987, Standard Specifications and Code of Practice for Road Bridges Section IX Bearings, Part II Elastromeric Bearings.
6.	IS: 456-2000, Plain and Reinforced Concrete
Web References:	
1.	http://www.accessengineeringlibrary.com/browse/handbook-of-civil-engineeringcalculations-second-edition/p200128239975_59001
2.	http://science.howstuffworks.com/engineering/civil/bridge1.htm
3.	https://www.indianconcreteinstitute.org/
Online Resources:	
1.	http://nptel.ac.in/courses/105105165/
2.	http://www.youtube.com/playlist?list=PLZzO5hTp04ec6uwdZ_lem0kO_8ob1MtVt
3.	https://nptel.ac.in/courses/105/102/105102012/

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C901.1 & C901.2	Analyze	Assignment	20
C901.3	Apply	Technical Quiz	20
C901.4	Apply	Case Study and Presentation	20
C901.5 & C901.6	Analyze	Technical Report Submission	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	-	-
Understand	10	10	10
Apply	50	50	50
Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component – I (20 Marks)**	**Component – II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	2	3	4	5	6	7	8	9	10	12	12	1	2	3
1	2	2	3	2	-	-	-	-	-	1	-	-	1	-	3
2	2	3	3	2	-	-	-	-	-	1	-	-	1	-	3
3	2	3	3	2	-	-	-	-	-	1	-	-	1	-	3

4	2	2	3	2	-	-	-	-	-	1	-	-	1	-	3
5	2	3	3	2	-	-	-	-	-	1	-	-	1	-	3
Avg.	**2**	**2.6**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	-	**1**	**-**	**3**

1	Reasonably agreed		2	Moderately agreed		3	Strongly agreed

22CE902	CONDITION ASSESSMENT AND REHABILITATION OF STRUCTURES	3/0/0/3

Nature of Course	Theory Concept
Pre requisites	Nil

Course Objectives:

1	To recognize the importance of maintenance and assess quality of concrete by using various diagnosing techniques.
2	To understand the various structural damages and apply the methods to repair the concrete structures.
3	To understand the retrofitting and rehabilitation techniques for structural members.
4	To learn the concept used in various demolition techniques and case studies.

Course Outcomes:

Upon completion of the course, students shall have ability to

C902.1	Inspect and evaluate the damaged structure.	[AP]
C902.2	Suggest the suitable diagnosing techniques for concrete structures.	[AP]
C902.3	Analyse the structural damages by various monitoring and surface repairing techniques.	[AN]
C902.4	Apply suitable strengthening method for the damaged structural elements.	[AP]
C902.5	Apply the different techniques for stabilization of structures.	[AP]

Course Contents: Theory

Module 1: Maintenance and Diagnosis of Damage **15 Hrs.**

Facets of Maintenance - Importance of Maintenance - Various aspects of inspection - Assessment procedure for evaluating damaged structure - Design and construction errors - Deterioration ofcementations systems — Sulphate, Acid attack, Alkali Silica Reaction (ASR) - Diagnosis of concrete failures - Non-destructive testing systems - Assessment of rebar: Rebar detector and cover meter - Partially destructive testing systems: Penetration resistance, Pull-off resistance, Break-offresistance, Concrete core sampling and core testing.

Module 2: Cracks, Corrosion and repair techniques **15 Hrs.**

Causes of cracks in concrete structures - Types of Cracks in: Slab, Beam, Column - Methods tomonitor crack width changes in concrete - Influencing factors of corrosion in reinforced concrete -Chloride and Carbonation induced reinforcement corrosion - Corrosion damage of reinforced concrete — Corrosion testing systems: half cell potential meter and linear polarization resistance -Methods of surface repair in RC structures — Material selection, surface preparation, placement of repair material- Repairs to overcome strength, deflection, cracking, corrosion, chemical disruption,weathering, leakage and marine exposure.

Module 3: Strengthening Techniques **15 Hrs.**

Strengthening techniques: Foamed concrete, mortar and dry pack, Gunite and Shotcrete, epoxy injection, mortar repair for cracks, shoring and underpinning - Introduction of Strengthening of

Structural elements - Flexural strengthening - Beam shear capacity strengthening - Column strengthening –FRP Techniques -Recent development of seismic retrofit methods - Rust eliminators and polymers coating for rebars during repair - Methods adopted in lifting of buildings / structures and its benefits. Case Study — Failure study on existing building (only for Internal Assessment)	
Total Hours	**45 Hrs.**
Text Books:	
1	Vidivelli B., Rehabilitation of Concrete Structures, Standard Publishers Distributors, 2018.
2	Bhattacharjee J., Concrete Structures Repair Rehabilitation and Retrofitting, CBS Publishers, 2017.
3	Poonam I. Modi, Chirag N. Patel, Repair and Rehabilitation of Concrete Structures, PHI Learning Pvt. Ltd, 2016.
Reference Books:	
1	Gupta B. L. and Amit Gupta, Maintenance & Repair of Civil structures, Standard Publishers Distributors, New Delhi, 2015.
2	Varghese P.C., Maintenance, Repair & Rehabilitation and Minor Works of Buildings, Prentice Hall India Learning Private Limited, 2014.
3	Guha P. K., Maintenance and Repairs of Buildings, New Central Book Agency(P) Ltd., 2017.
4	Gahlot P S, and Sanjay Sharma, Building Repair and Maintenance Management‖, CBS Publishers, 2015.
IS Code of Practice:	
1	IS 13311 (Part 1):1992 Non-Destructive Testing of Concrete - Methods of Test -Ultrasonic pulse velocity Test, BIS, New Delhi.
2	IS 13311 (Part 2):1992 Non-Destructive Testing of Concrete - Methods of Test - Rebound Hammer, BIS, New Delhi.
3	IS 6925:1975 Methods of test for determination of water soluble chlorides in concrete admixtures, BIS, New Delhi.
4	IS : 2366: 1963 Methods of test for aggregates for concrete
5	ASTM C876 - 91(1999) Standard Test Method for Half-Cell Potentials of Uncoated Reinforcing Steel in Concrete
Web References:	
1	https://cpwd.gov.in/units/handbook.pdf
2	https://icjonline.com/journals/201202feb/files/2012_02_icj%20e%20journal.pdf
Online Resources:	
1	https://nptel.ac.in/courses/114106035/38
2	https://nptel.ac.in/courses/105104030/38

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C902.1	Apply	Technical Presentation	20
C902.2	Apply	Individual Assignment	20
C902.3&C902.4	Analyze	Technical Quiz	20
C902.5	Apply	Case Study Report	

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	30	20	20
Apply	60	50	50
Analyse	-	20	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	2	3	4	5	6	7	8	9	10	12	12	1	2	3
1	3	2	2	-	-	2	2	2	-	2	-	3	3	-	-
2	3	2	2	-	-	2	2	2	-	2	-	3	3	-	-
3	3	3	3	-	-	2	2	2	-	2	-	3	3	-	-
4	3	2	2	-	-	2	2	2	-	2	-	3	3	-	-
5	3	2	2	-	-	2	2	2	-	2	-	3	3	-	-
Avg.	3	2	2	-	-	2	2	2	-	2	-	3	3	-	-
1	Reasonably agreed					2	Moderately agreed				3	Strongly agreed			

22CE903	Design of Foundations and Retaining Structures	3/0/0/3

Nature of Course	Problem Analytical
Pre-requisites	Geotechnical Engineering

Course Objectives:

1.	To understand the significance of foundation in all civil engineering structures
2.	To design shallow and deep foundation considering the superstructure load and subsurface soil conditions
3.	To analyze and design earth retaining structures for different loading condition
4.	To apply suitable design method for foundations considering Codal provisions

Course Outcomes:

Upon completion of the course, students shall have ability to

C903.1	Understand the design concepts of different shallow foundation	[U]
C903.2	Design suitable shallow foundation based on superstructure loading and subsurface soil conditions	[AP]
C903.3	Design suitable deep foundation based on loading and subsurface conditions	[AP]
C903.4	Design earth retaining structures and understand the concept of foundation for dynamic loads	[AP]
C903.5	Understand the foundation design concepts for offshore structures and seismic load consideration	[U]

Course Contents:

Module 1: Shallow Foundation **15 Hrs**

Terzaghi's Bearing Capacity Theory – BIS Code Method – Isolated Footing Design – Rectangular Combined Footing Design – Trapezoidal Combined Footing Design – Strap Footing Design – Raft/Mat Foundation Design – Circular Rafts – Concept of Floating Foundation - Settlement of Foundations – Codal Provisions

Module 2: Deep Foundation **15 Hrs**

Types of Piles – Ultimate Load Carrying Capacity of Pile Groups – Efficiency of Pile Groups – Settlement of Pile Groups – Negative skin Friction/Downdrag - Design of Under-reamed Piles – Design of Pile Caps – Design of Pier and Caissons – Codal Provisions

Module 3: Earth Retaining Structures and Special Foundation **15 Hrs**

Earth Pressures – Design of Rigid, Flexible and Reinforced Soil Retaining Walls – Ground Anchors for Retaining Walls – Introduction to Design of Foundation for Dynamic Loads – Machine Foundation – Offshore Foundation – Seismic Load Considerations – Codal Provisions

Total Hours: 45 Hrs

Text Books:

1.	Swami Saran, "Analysis and Design of Substructure: Limit State Design", Oxford & IBH Publishing Co Pvt.Ltd, 2018.
2.	K.R. Arora, "Soil Mechanics and Foundation Engineering", Standard Publisher Dist., 2020
3.	V.N.S. Murthy, "Textbook Of Soil Mechanics And Foundation Engineering Geotechnical Engineering Series", CBS Publishers & Distributors Pvt. Ltd., 2018

Reference Books

1.	Wai-Fah Chen and Lian Duan, “Bridge Engineering Handbook - Substructure Design”, CRC Press, 2014
2.	N.S.V. Kameswara Rao, “Foundation Design – Theory and Practice”, Wiley Publisher, 2011
3.	Yung Ming Cheng, Chi Wai Law, Leilei Liu, “Analysis, Design and Construction of Foundations”, CRC Press, 2021
4.	K Aruna Moy Ghosh, “Foundation Design in Practice”, PHI, 2009
Web References:	
1.	https://theconstructor.org/geotechnical/caisson-types-construction-advantages/503/
2.	http://home.iitk.ac.in/~vinaykg/Iset495.pdf
3.	https://onlinecourses.nptel.ac.in/noc19_ce19/preview
4.	https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_FE_Lecture_Notes.pdf
Online Resources:	
1.	https://nptel.ac.in/content/storage2/courses/105101083/download/lec16.pdf
2.	https://nptel.ac.in/content/storage2/courses/105101083/download/lec20.pdf
3.	https://archive.nptel.ac.in/courses/105/104/105104162/
4.	http://www.nitttrc.edu.in/nptel/courses/video/105104162/L37.html

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C903.1 & C903.2	Analyze	Surprise Test	20
C903.3	Apply	Group Assignment	20
C903.4	Apply	Case Study and Presentation	20
C903.5 & C903.6	Analyze	Technical Report Submission	20

Assessment based on Summative and End Semester Examination			
Bloom’s Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	-	-
Understand	10	10	10
Apply	50	50	50

Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	**POs**												**PSOs**		
	1	2	3	4	5	6	7	8	9	10	12	12	1	2	3
1	3	2	-	1	-	-	-	-	-	-	-	1	2	-	-
2	2	3	-	2	-	1	-	-	-	-	-	-	3	-	-
3	2	3	-	2	-	1	-	-	-	-	-	-	3	1	-
4	3	2	-	2	2	2	1	2	1	2	-	1	2	2	1
5	3	3	-	2	2	1	-	1	-	-	-	1	2	2	-
6	3	2	-	2	2	1	-	1	-	-	-	-	2	1	-
Avg.	**2.7**	**2.5**	**-**	**1.8**	**2.0**	**1.2**	**1.0**	**1.3**	**1.0**	**2.0**	**-**	**1.0**	**2.3**	**1.5**	**1.0**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE904	GREEN BUILDING TECHNOLOGY	3/0/0/3

Nature of Course	Theory Concept
Pre requisites	-

Course Objectives:

1.	To understand the concepts of sustainability, energy and environment.
2.	To select materials to decrease environmental impacts.
3.	To understand the green buildings system implementation and its efficiency.
4.	To study and identify green building rating systems and their economic Aspects.

Course Outcomes:
Upon completion of the course, students shall have ability to

C904.1	Practice the ideology of green building concepts and demonstrate the Conventional Vs Green buildings.	[AP]
C904.2	Illustrate the philosophies of Integrated design, Ecological design and Regenerative design.	[AP]
C904.3	Assess and implement the different systems involved in green building design – water, energy, materials, land, air.	[AP]
C904.4	Interpret economic aspects of green building – quantifying short term and long-term benefits.	[AP]
C904.5	Evaluate the design on various rating systems -LEED, Green globes, GRIHA and EDGE	[AP]

Course Contents:

Module 1: Green Design Philosophies & Approach **15 Hrs.**

Historical Perspective Buildings - Conventional versus Green Buildings – Comparison - Minor and major aspects of Green Buildings - The Integrated Design Process - Green Building Documentation Requirements. Conventional, Contemporary and Future Ecological Design - Green Design to Regenerative Design - Eco Charrette process - SWOT analysis- Environmental, Social and Governance- Criteria

Module 2: Green building systems and its Implementation: **15 Hrs.**

Sustainable sites and landscaping - Enhancing ecosystems. Building envelope - selection of green materials, products and applications. Passive design strategies. Internal load reduction - Indoor environment quality - Building water and waste water management - Use of LEED / IGBC standards - Site Planning, Health and Safety Planning, Construction and Demolition -Waste Management - Reducing the Footprint of Construction Operations - Maximizing the Value of Building Commissioning - HVAC Systems, Lighting and cleaning systems for green buildings - Costs and Benefits of Building Commissioning - use of LEED/ IGBC standards

Module 3: Assessment and Economics of Green building: **15 Hrs.**

International Building Assessment Systems - The USGBC/ LEED Building Assessment Standard - The LEED Certification Process - The Green Globes Building Assessment Protocol - Example of a Platinum / Gold / Silver Building. Comparison of present Building Rating Systems - Code compilation requirements - LEED, GRIHA -EDGE- Economic aspects of Green Buildings - Quantifying Green Building Benefits - Managing Costs and Barriers. Short - & long -term environment benefits - Case studies of Green Buildings

Total Hours: 45 Hrs.

Text Books:	
1.	Jerry Edelson, Green Buildings A to Z, Understanding the buildings, www.newsociety.com,2008.
2.	Green building guidelines: Meeting the demand for low-energy, resource- efficient homes ǁ, Sustainable Buildings Industry Council, 2004.
3.	Guttila Yugantha Jayasinghe, A text book on Green Buildings Lambert Academic Publishing,2018.
Reference Books:	
1.	Charles J.Kibert, Sustainable Construction :Green Building DesignandDeliveryǁ,2ndEdition, Wiley, 2007.
2.	Jerry Yudelson, Green Buildings through Integrated Design, Tata McGraw Hill, 2008.
3.	Jeannie Leggett Sikora, Green Building Strategies: From Plan to Profitǁ Builder Books 2012.
Web References:	
1.	http://www.grihaindia.org/events/inno/pdf/25nov/sudarshan.pdf
2.	https://archive.epa.gov/greenbuilding/web/html/about.htm
Online Resources:	
1.	https://www.coursera.org/learn/renewable-energy-entrepreneurship
2.	https://www.edx.org/course/sustainability-in-architecture-an-interdisciplinary-introduction-0

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C904.1	AP	Quiz	20
C904.2	AP		
C904.3	AP	Outside Classroom Learning Experience - Report	20
C904.4	AP	Assignment	20
C904.5	AP	Case study	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10

Understand	10	10	10
Apply	30	30	30
Analyse	50	50	50
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	-	-	-	2	2	2	-	-		1	2	1
2	3	2	1	-	-	-	2	2	2	-	-		1	2	1
3	3	2	1	-	-	-	2	2	2	-	-		1	2	1
4	3	2	1	-	-	-	2	2	2	-	-		1	2	1
5	3	2	1	-	-	-	2	-	2	-	-		1	2	1
Avg.	3	2	1	-	-	-	2	2	2	-	-		1	2	1

1	**Reasonably agreed**	**2**	**Moderately agreed**	**3**	**Strongly agreed**

22CE905	GROUND IMPROVEMENT AND GEOSYNTHETICS	3/0/0/3

Nature of Course	Theory and Application
Pre requisites	Geotechnical Engineering

Course Objectives:

1.	To identify various challenges existing in ground improvement
2.	To acquaint with different ground improvement techniques
3.	To analyze the application of various Geosynthetics as soil reinforcement
4.	To recommend suitable ground improvement and soil stabilization for any field situation

Course Outcomes:
Upon completion of the course, students shall have ability to

C905.1	Understand the challenges in ground improvement and comprehend the significance of soil stabilization	[U]
C905.2	Analyze various compaction methods and deep mixing	[AN]
C905.3	Examine pre-compression and various draining	[AN]
C905.4	Recognize the concept of stone columns and grouting	[U]
C905.5	Recommend geotextiles, geogrids, geonets, geocomposites as soil reinforcement for relevant field condition	[AP]

Course Contents:

Module 1: Compaction and Deep Mixing **15 Hrs.**

Challenges in Ground Improvement – Significance of Soil Stabilization - Principles of Compaction – Vibro-floatation – Vibro-compaction - Dynamic Compaction - Shallow Stabilization with additives – Lime, Fly ash and Cement – Soil-Lime Column – Case Studies.

Module 2: Drains, Stone Columns and Grouting **15 Hrs.**

Pre-compression - Permeation - Sand Drains - Prefabricated Drains – Dewatering Systems – Concept of Electro-osmosis in ground improvement – Removal and Replacement of Soils - Stone Column - Grouting – Compaction and Jet Grouting - Case Studies

Module 3: Soil Reinforcement **15 Hrs.**

Mechanism of Soil Reinforment - Geosynthetics – Geotextiles and Geogrids in Roads, Retaining Walls and Embankments – Geonets and Geocomposites as Drains and Filters - Geosynthetics as Covers and Liners in Landfills and Slurry Ponds - Case Studies.

Total Hours:	**45 Hrs.**

Text Books:

1.	SIA, “Ground Improvement Techniques”, SIA Publishers & Distributors Pvt Ltd, 2022.
2.	Jie Han, “Principles and Practice of Ground Improvement”, John Wiley Publications, 2018.
3.	Purushothama Raj, P. "Ground Improvement Techniques", Laxmi Publications, 2016.

Reference Books:	
1.	Piyush Das and Deeksha Chandrakar, “Ground Improvement Techniques in Different Construction Work”, Notion Press, 2022.
2.	Bikas Chandra Chattopadhyay, Ground Improvement Techniques, PHI Learning, 2017.
3.	Peter G. Nicholson, “Soil Improvement and Ground Modification Methods”, Butterworth Heinemann, 2014.
4.	Nihar Ranjan Parta, “Ground Improvement Techniques” Vikas Publishing House, 2012.
Web References:	
1.	https://link.springer.com/chapter/10.1007/978-3-642-04460-1_25
2.	http://www.igs.org.in:8080/portal/igc-proceedings/igc-2019-surat-proceedings/TH9/TH9-9.pdf
3.	https://theconstructor.org/geotechnical/ground-improvement-techniques-soil-stabilization/1836/
Online Resources:	
1.	https://nptel.ac.in/courses/105/108/105108075/
2.	https://nptel.ac.in/courses/105/107/105107181/
3.	https://archive.nptel.ac.in/courses/105/108/105108075/

Continuous Assessment				End Semester Examination %	Total %
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment %		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C905.1	Analyze	Surprise Test	20
C905.2	Analyze		
C905.3	Apply	Group Assignment	20
C905.4	Apply	Case Study and Presentation	20
C905.5	Analyze	Technical Report Submission	20

Assessment based on Summative and End Semester Examination			
Bloom’s Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	-	-
Understand	10	10	10
Apply	50	50	50

Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	-	-	1	-	2	2	2	-	1	2	-	1
2	3	2	1	-	-	1	-	1	2	2	-	1	2	-	1
3	3	2	1	-	-	1	-	1	2	2	-	1	2	-	1
4	3	2	1	-	-	1	1	1	2	2	-	1	2	-	1
5	3	2	1	-	-	1	1	1	2	2	-	1	2	-	1
Avg.	3	2	1	-	-	1	1	1.3	2	2	-	1	2	-	1

1	**Reasonably agreed**	**2**	**Moderately agreed**	**3**	**Strongly agreed**

22CE906	PREFABRICATED STRUCTURES	3/0/0/3
Nature of Course	Practical application	
Pre requisites	-	

Course Objectives:

1.	To understand the different types of prefabricated elements and the concepts of modular construction.
2.	To understand the technologies used for fabrication and erection of prefabricated elements.
3.	To study the different types of joints used for structural connection in prefabricated structures.
4.	To understand the applications of codal provisions for abnormal loadings and progressive collapse.

Course Outcomes:
Upon completion of the course, students shall have ability to

C906.1	Apply prefabrication techniques on various components based on the requirements	[AP]
C906.2	Apply suitable standardization systems for prefabricated elements	[AP]
C906.3	Apply the suitable joints for structural connections on prefabricated members	[AP]
C906.4	Apply the suitable methods to avoid progressive collapse of the structure	[AP]
C906.5	Apply the various Codal provisions for abnormal loads to avoid structural collapse	[AP]

Course Contents:

Module 1: Introduction to Prefabricated Structures and components 20 Hrs.

Need for prefabrication – Principles – Materials – Comparison with conventional and Precast Prestressed construction under time and cost aspects - Types of prefabrication – Site and plant prefabrication - Economy of prefabrication – Plant layout - Modular coordination –Standardization – Systems – Production – Transportation – Erection. Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs-Ribbed floor panels – Wall panels – Columns – Shear walls- Footings- Storage of precast elements –Dimensional tolerances - Case studies related to application of prefabricated component in building construction.

Module 2: Design Principles and Joint in Structural Members 15 Hrs.

Disuniting of structures- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility –Ductile detailing - Allowance for joint deformation. Joints for different structural connections – Dimensions and detailing- Effective sealing of joints for waterproofing – Provisions for non-structural fastenings –Expansion joints- case studies related to joints in prefabricated structures

Module 3: Progressive Collapse and its preventive methods 10 Hrs.

Progressive collapse - Importance of avoidance of progressive collapse - Methods to prevent progressive collapse - Code provisions - Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc.- Case studies related to progressive collapse.

Total Hours:	**45 Hrs.**

Text Books:	
1.	Alfred Steinle, Hubert Bachmann and Mathias Tillmann, “Precast Concrete Structures”, Wiley, Ernst & Sohn GmbH & Co. KG, Berlin, Germany, 2019.
2.	Ulrich Knaack, “Prefabricated Systems: Principles of Construction”, Birkhauser Architecture; 1st Edition, 2010.
3.	“Handbook on Precast concrete for buildings”, ICI Bulletin 02, Indian Concrete Institute, 2016.
Reference Books:	
1.	Alejandro Bahamon, “PreFab-Prefabricated and Movable Architecture”, HarperCollins Design International, November 2002.
2.	Mokk L, “Prefabricated Concrete for Industrial and Public Structures”, Publishing House of the Hungarian Academy of Sciences, Budapest, 2007.
3.	Kim S. Elliott, “Precast Concrete Structures”, Butterworth-Heinemann Publications, 2002.
4.	“Structural Precast concrete Handbook”, Technology Development Division of the Building and Construction Authority, May 2001
Code Books:	
1.	IS 3414-1968 Reaffirmed 2000, Code of Practice for Design and Installation for Joints in Buildings, BIS, New Delhi.
2.	IS 10297-1982 Reaffirmed 2008, Code of Practice for Design and Construction of Floors and Roofs using Precast Reinforced/Prestressed Concrete Ribbed or Cored Slab Units, BIS, New Delhi.
3.	IS 11447-1985 Reaffirmed 2003, Code of Practice for construction with Large Panel Prefabricates, BIS, New Delhi.
4.	IS 15916 – 2010, Building design and erection using prefabricated concrete — code of practice, BIS, New Delhi.
5.	IS 4326-1993 Reaffirmed 2003, Earth Quake resistant design & construction of building - Code of practice, BIS, New Delhi.
6.	IS 13920-1993 Reaffirmed 2003, Ductile Detailing of Reinforced Concrete Structures subjected to seismic force - Code of practice, BIS, New Delhi.
7.	National Building Code of India 2005- Section 7, SP 7 (Group 1), Bureau of Indian Standards, New Delhi.
Web References:	
1.	https://civildigital.com/prefabricated-structures-prefabrication-concept-components-advantages-ppt/
2.	www.metcolleges.ac.in/Notes/CIVIL/FinalYear/CE2045/CE2045.docx
Online Resources:	
1.	https://www.concrete.org/topicsinconcrete/topicdetail/precast
2.	https://precast.org/education/classes/

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)
Formative Assessment based on Capstone Model

Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C906.1	Apply	Quiz	20
C906.2	Apply		
C906.3	Apply	Outside Classroom Learning Experience - Report	20
C906.4	Apply	Assignment	20
C906.5	Apply	Case study	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	-	-	-
Understand	60	60	60
Apply	40	40	40
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	-	1	-	2	2	2	-	-	-	2	2	-	1
2	3	-	-	1	-	2	2	2	-	-	-	2	2	-	1
3	3	-	-	1	-	2	2	2	-	-	-	2	2	-	1
4	3	-	-	1	-	2	2	2	-	-	-	2	2	-	1
5	3	-	-	1	-	-	-	-	-	-	-	2	2	-	1
Avg.	3	-	-	1	-	2	2	2	-	-	-	2	2	-	1

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE907	PRESTRESSED CONCRETE STRUCTURES	3/0/0/3

Nature of Course	Theory application
Pre requisites	-

Course Objectives:

1.	To understand the principles and methodologies of pre-stressing.
2.	To know the different types of losses and deflection of prestressed members
3.	To learn the design of prestressed concrete beams for flexural, shear and torsion
4.	To know the analysis of Composite elements

Course Outcomes:
Upon completion of the course, students shall have ability to

C907.1	Apply the principles and methodologies of prestressed concrete	[AP]
C907.2	Analyze prestressed concrete accounting for losses	[AN]
C907.3	Analyze and design the components of prestressed concrete	[AN]
C907.4	Check for deflection and cracks in concrete element	[AP]
C907.5	Analyze composite structures for their capacity	[AN]

Course Contents:

Module 1: Principles and Methodologies of Prestressing **15 Hrs.**

Principles of prestressing -methods of prestressing – materials required - Anchorage systems –Analysis of Sections, the effect of loading on tensile stresses in tendons- Losses of prestressing, Definition of structure types.

Module 2: Analysis, Design and Derailing of Prestressing Components **15 Hrs.**

Analysis of members under axial load, flexure, shear, and torsion, Design of members for axial load, flexure shear, and torsion. Detailing for members, Calculations for deflection and crack width, Transmission of prestress. Cable profiling, Concordant Cable profile. Design of anchorage. Prediction of long time deflections.

Module 3:Special structures **15 Hrs.**

Analysis of composite sections, Analysis of slabs, Analysis of compression members, Circular prestressing, Prestressed concrete pipes, Liquid storage tanks, and Ring beams. Software package for analyzing Prestressed concrete.

Total Hours:	**45 Hrs.**

Text Books:

1.	Krishna Raju N., "Prestressed Concrete", Tata McGraw Hill Education, Sixth Edition, 2018.
2.	Rajagopalan N., “Prestressed Concrete”, Narosa Publishing House, New Delhi, 2010.
3.	Praveen Nagarajan, “Prestressed Concrete Design” Pearson Education India, First edition, 2013.

Reference Books:

1.	Sinha N. C. and Roy S. K., “Fundamentals of Prestressed Concrete”, S Chand & Co,2011.
2.	Lin T.Y. and Ned H. Burns, “Design of Prestressed Concrete Structures”, John Wiley Sons, New York, 2015.

3.	Praveen Nagarajan, “Prestressed Concrete Design” Pearson Education India, First edition, 2013.
4.	Nawy, E. G., Prestressed concrete a fundamental approach 4th edition, Pearson Education, Inc. New Jersery, US., 2003
Code Books:	
1.	IS: 1343 – 1980 Code of Practice for Prestressed Concrete.
2.	IS: 2090 – 1983 Specification for High Tensile Steel Bars used in Prestressed Concrete.
3.	IRC: 18 – 2000 Design Criteria for Prestressed Concrete Bridges (Post-tensioned Concrete).
4.	IS: 784 – 2001 Prestressed Concrete Pipes (including fittings) – Specifications.
Web References:	
1.	https://lecturenotes.in/subject/245/prestressed-concrete-structures-pcs
2.	https://www.civillead.com/prestressed-concrete/
Online Resources:	
1.	https://nptel.ac.in/courses/105/106/105106118/
2.	https://nptel.ac.in/courses/105/106/105106117/

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C907.1	Apply	Tutorial	20
C907.2	Apply	Assignment	20
C907.3	Apply	Quiz	20
C907.4	Apply		
C907.5	Apply	PBL	20

Assessment based on Summative and End Semester Examination			
Bloom’s Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	10	10
Understand	30	10	10
Apply	30	40	50
Analyse	40	40	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	2	-	-	-	-	-	-	2	3	1	1
2	3	3	2	2	2	-	-	-	-	-	-	2	3	1	1
3	3	3	2	2	2	2	2	1	1	2	1	2	3	1	1
4	3	3	2	2	2	2	2	1	1	2	1	2	3	1	1
5	3	3	2	2	-	2	2	1	1	2	1	2	3	1	1
Avg.	3	2.8	1.8	1.8	2	2	2	1	1	2	1	2	3	1	1

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE908	SOIL DYNAMICS AND EARTHQUAKE ENGINEERING	3/0/0/3

Nature of Course	Problem Analytical
Pre requisites	Geotechnical Engineering

Course Objectives:

1.	To understand the basics of vibration and wave propagation in soils
2.	To analyze the stress strain behavior of soils and dynamic properties of soils
3.	To comprehend the plate tectonic theory, seismic risk and hazard, liquefaction potential
4.	To analyze the soil structure interaction during strong earthquake

Course Outcomes:
Upon completion of the course, students shall have ability to

C908.1	Understand the vibration and wave propagation in soil medium	[AP]
C908.2	Analyze the stress strain behavior of soils for static and dynamic loading	[AP]
C908.3	Recognize the significance of soil dynamic properties and measurement	[AP]
C908.4	Investigate the reason behind seismic loading and liquefaction phenomenon.	[AP]
C908.5	Comprehend seismic risk , seismic hazard and analyze soil structure interaction during strong earthquake.	[AP]

Course Contents:

Module 1: Vibration and Wave Propagation **15 Hrs.**

Theory of vibrations – Vibration measuring instruments – Vibration absorption and isolation techniques - Wave propagation in elastic continuum medium – Wave propagation in semi-infinite elastic continuum medium

Module 2: Dynamic Properties of Soils **15 Hrs.**

Characteristics of stress strain behavior of soils - Measurement of small strain and large strain - Dynamic soil properties – Laboratory tests – Field tests – Factors affecting dynamic properties – Dynamic bearing capacity and earth pressure.

Module 3: Seismology **15 Hrs.**

Strong ground motion – Causes - Plate tectonic theory – Seismic risk and hazard – Seismic instrumentation – Characterization and estimation of seismic parameters – Liquefaction potential – Seismic loads - Soil structure interaction during strong earthquake

Total Hours: 45 Hrs.

Text Books:

1.	Bharat Bhushan Prasad, “Fundamentals of Soil Dynamics and Earthquake Engineering”, PHI, 2013.
2.	Agnes Nolan, “Geotechnical Earthquake Engineering and Soil Dynamics”, NY research Press, 2015.
3.	Haluk Sucuoglu and Sinan Akkar, “Basic Earthquake Engineering”, Springer Nature, 2014.

Reference Books:

1.	Bharat Bhushan Prasad, “Advanced Soil Dynamics and Earthquake Engineering”,

	PHI, 2010.
2.	Hector Estrada and Luke S Lee, “Introduction to Earthquake Engineering”, CRC Press, 2014.
3.	Jonathan Knappett and R. F. Craig, “Craig’s Soil Mechanics”, CRC Press, 2019.
4.	Braja M. Das, G. V. Ramana, “Principles of Soil Dynamics”, Cengage Engineering, 2014.
Web References:	
1.	https://link.springer.com/book/10.1007/978-981-13-0562-7
2.	https://www.geoengineer.org/education/soil-dynamics
3.	https://www.vssut.ac.in/lecture_notes/lecture1623481301.pdf
Online Resources:	
1.	http://nitttrc.edu.in/nptel/courses/video/105101005/L01.html
2.	http://www.nitttrc.edu.in/nptel/courses/video/105101134/L03.html
3.	https://archive.nptel.ac.in/courses/105/107/105107066/

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C908.1	Analyze	Surprise Test	20
C908.2			
C908.3	Apply	Group Assignment	20
C908.4	Apply	Case Study and Presentation	20
C908.5	Analyze	Technical Report Submission	20
C908.6			

Assessment based on Summative and End Semester Examination			
Bloom’s Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	-	-
Understand	10	10	10
Apply	50	50	50
Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	-	1	-	-	-	-	-	-	-	1	2	-	-
2	2	3	-	2	-	1	-	-	-	-	-	-	3	-	-
3	2	3	-	2	-	1	-	-	-	-	-	-	3	1	-
4	3	2	-	2	2	2	1	2	1	-2	-	1	2	2	1
5	3	3	-	2	2	1	-	1	-	-	-	1	2	2	-
Avg.	2.7	2.5	-	1.8	2	1.2	1	1.3	1	2	-	1	2	1.5	1

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE909	SMART MATERIALS AND STRUCTURES	3/0/0/3

Nature of Course	Theory Application
Pre requisites	-

Course Objectives:

1.	To enable the students understand importance and structure of smart materials.
2.	To make the students understand the application of smart materials.
3.	To familiarize students with different types of smart materials used in engineering field.
4.	To develop the knowledge in actuators and sensors and their integration into a smart structure.

Course Outcomes:
Upon completion of the course, students shall have ability to

C909.1	Understand the concept of smart materials and their structural applications.	[U]
C909.2	Apply the vibration absorbers and fiber optics appropriately.	[AP]
C909.3	Apply the composite materials in smart structures.	[AP]
C909.4	Apply the shape memory techniques and alloys in Bridges.	[AP]
C909.5	Apply structural health monitoring using modern tools.	[AP]

Course Contents:

Module 1: Properties of Materials and Vibration Absorbers **15 Hrs.**

Introduction to smart materials and structures - Piezoelectric Materials and properties - Actuation of structural components - Shape Memory Alloys - Constitutive modelling of the shape memory effect, vibration control - Embedded actuators - Electro rheological and magneto rheological fluids - Mechanisms and Properties - Fiber Optics - Fiber characteristics - Fiber optic strain sensors. Parallel damped vibration absorber - Gyroscopic vibration absorber - Active vibration, absorber - Applications - Vibration Characteristics of mistuned systems - Analytical approach.

Module 2: Smart Composites **15 Hrs.**

Review of composite materials - Micro and Macro Mechanics - Modelling Composites based on classical laminated plate theory - Effect of shear deformation - Dynamics of smart composite beam - Finite element modeling of smart composite beams - Intelligent system design - Emergent system design.

Module 3: Smart Structures **15 Hrs.**

Application of Shape Memory - Alloys in Bridges – Concept of Smart Bridges – Application of ER Fluids - Application of MR Dampers in Different Structures – Application of MR Dampers in Bridges and High Rise Structures – Structural Health Monitoring - Application of Optical Fibres - Concept of Smart Concrete – Self Healing Polymers.

Total Hours:	**45 Hrs.**

Text Books:

1.	Michelle Addington and Daniel Schodek, Smart materials and new technologies, Elsevier, 2015
2.	You-lin Xu and Jia He Smart, Smart Civil structures, CRC Press, First edition 2017

3.	Anca Filimon, Smart materials, Apple Academic Press, 2018
Reference Books:	
1.	Srinivasan A.V and Michael McFarland, Smart structures, Cambridge University press, 2009
2.	Rajan Vepa, Dynamics of smart structures, Wiley, 2008
3.	Gandhi, M.V and Thompson, B.S., Smart Materials and Structures, Chapman and Hall, 1992
Web References:	
1.	https://www.youtube.com/watch?v=yXHIlowQntk
2.	https://www.scribd.com/document/87509211/Smart-Structures-and-Materials
Online Resources:	
1.	https://www.youtube.com/watch?v=ync30eHVD8s
2.	https://www.youtube.com/watch?v=b5IPJeCDEPw

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C909.1	Analyze	Case Study Report - 1	20
C909.2	Analyze	Technical Quiz	20
C909.3	Apply	Technical Presentation	20
C909.4			
C909.5	Analyze	Case Study Report - 2	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	-	-
Understand	10	10	10
Apply	30	30	30
Analyse	60	60	60
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	-	-	2	2	2	-	-	-	2	2	-	2
2	3	2	1	-	-	2	2	2	-	-	-	2	2	-	2
3	3	2	1	-	-	2	2	2	-	-	-	2	2	-	2
4	3	2	1	-	-	2	2	2	-	-	-	2	2	-	2
5	3	2	1	-	-	2	2	2	-	-	-	2	2	-	2
Avg.	3	2	1	-	-	2	2	2	-	-	-	2	2	-	2

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE910	AIR AND NOISE POLLUTION MANAGEMENT	3/0/0/3
Nature of Course	Theory Application	
Pre requisites	Nil	

Course Objectives:

1	To Understand about air Quality Criteria and air pollutants
2	To identify appropriate modelling solutions for air quality problems.
3	To find the solution for source inventory of air pollution and use proper Control measures.
4	To aware about the noise pollution causes and its abatement technologies

Course Outcomes:

Upon completion of the course, students shall have ability to

C910.1	Identify the sources, characteristics and effects of ambient and indoor air pollution.	[U]
C910.2	Apply Sampling methods to monitor air quality parameters and their influencing meteorological parameters.	[AP]
C910.3	Apply the suitable modeling software to predict the source of emission and dispersion characteristics.	[AP]
C910.4	Illustrate the relevant source-based noise monitoring parameters and evaluate the causes incurred on the society.	[AN]
C910.5	Practice the suitable noise level estimating equipment, and describe its techniques and significance.	[AN]

Course Contents: Theory

MODULE 1: Air Pollution Sources, Classification and Effects 15 Hrs.

Air Pollution and Global Climate - Air quality and emission standards - Air pollution indices - Air quality management in India. Sources and classification - Analysis of air quality scenarios – Exposure assessment – Socioeconomic Impact – Implication of meteorological conditions - Indoor Air Quality- Standards – Importance of indoor ventilation - Control methods

MODULE 2: Sampling and Modelling of air pollutants 15 Hrs.

Sampling and measurement of particulate and gaseous pollutants – Ambient, indoor and Stack sampling. Environmental factors – Meteorology - lapse rate and stability - Plume behavior - Estimation of plume rise - mixing depth - Dispersion models (Gaussian and Box) - USEPA Modelling software.

MODULE 3: Noise Pollution Monitoring and Control methods 15 Hrs.

Basics of acoustics - specification of sound - Sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources - Outdoor and indoor noise propagation - Psycho-acoustics (effects of noise on health, annoyance rating schemes) - Special noise environments - Infra-sound, ultrasound, impulsive sound and sonic boom; noise criteria - noise standards and limit values; noise instrumentation and monitoring procedure - Noise indices and control methods**.**

	Total Hours	**45 Hrs.**
Text Books:		
1	Rao.C.S. “Environmental Pollution Control Engineering”, New Age International Publishers, 2018.	
2	Rao M.N., and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, New Delhi, 2017	
3	Thad Godish, Wayne T. Davis “Air Quality, CRC Press, Newyork,2016	
4	Handbook of Noise Measurement – APG Peterson & EE Gross PH, Englewood cliffs New Jersey, latest edition.	
Reference Books:		
1	Lawrence K.Wang, Norman C Pererla, Yung – Tse Hung, “Air Pollution Control Engineering”, Tokyo, 2012	
2	Noel De Nevers, “Air Pollution Control Engineering”, Waveland Press, 2016.	
3	Wark, C.F. Warner & W.T. Davis “Air Pollution Control: its Origin and Control, Addision-Wesley, 1998	
4	Wayne R. Davis (Editor) Air & Waste Management Association, “Air Pollution Engineering Manual”, 2nd Edition, Wiley Publications, 2000	
Code Books:		
1	IS: 5182 (Part 1) - 2006, Indian standard methods for measurement of air pollution	
2	IS: 4167 - 1980, Indian standard Glossary of terms relating to air pollution	
3	NAAQS Guidelines for the measurement of ambient air pollutants by CPCB	
4	Evaluation of $PM_{2.5}$ Chemical Speciation Samplers for Use in the EPA National $PM_{2.5}$ Chemical Speciation Network	
Web References:		
1	https://www.epa.gov/criteria-air-pollutants/naaqs-table	
2	http://cpcb.nic.in/	
Online Resources:		
1	https://nptel.ac.in/courses/105102089	
2	http://www.envirocomp.org/	

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C910.1&C910.2	Understand	Presentation	20
C910.3	Apply	Assignment	20
C910.4	Apply	Quiz	20
C910.5 & C910.6	Analyze	Case study	

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	10	10
Understand	40	10	10
Apply	60	40	50
Analyse	-	40	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	2	3	4	5	6	7	8	9	10	12	12	1	2	3
1	-	3	-	1	-	-	-	-	-	-	-	1	1	1	2

2	2	-	-	2	-	-	1	2	-	-	-	1	-	-	1
3	3	2	-	-	-	1	-	-	1	-	-	1	3	-	2
4	1	2	-	1	-	-	1	-	1	-	-	-	2	-	1
5	3	3	-	1	-	3	-	1	-	-	-	1	1	-	1
6	1	3	-	1	-	-	-	1	-	-	-	1	2	1	1
Avg.	**2.0**	**2.6**	**-**	**1.2**	**-**	**2.0**	**1.0**	**1.3**	**1.0**	**-**	**-**	**1.0**	**1.8**	**1.0**	**1.3**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE911	ASSESSMENT OF CONTAMINATED SITE AND REMEDIATION	3/0/0/3
Nature of Course	Theory and Application	
Pre-requisites	-	

Course Objectives:

1	To identify the sources, types and effects of contamination
2	To analyze various challenges in contaminated site assessment
3	To assess the contaminated environment effectively
4	To apply suitable remediation technologies for the assessed contaminated site

Course Outcomes:
Upon completion of the course, students shall have ability to

C911.1	Identify the sources and pathways of surface and groundwater contamination	[AN]
C911.2	Investigate the contaminated surface water and groundwater site and suggest suitable remediation technologies	[AP]
C911.3	Analyze the contamination pathway of land and subsurface	[AN]
C911.4	Analyze the contaminant transport mechanism and assess the contaminated sites	[AN]
C911.5	Recommend appropriate methods for an effective land reclamation	[AP]

Course Contents:

Module 1: Surface and Groundwater Contamination **15 Hrs.**

Contamination pathways of surface water and groundwater – site investigation and risk assessment – pump and treat, permeable reactive barrier walls – application of emerging techniques in surface water and groundwater management – case studies

Module 2: Land and Subsurface Contamination **15 Hrs.**

Sources and pathways of contamination - contaminant transport mechanisms – soil and contaminant interaction – contaminant characteristics – waste containment in landfills and slurry ponds – leachate – site assessment – case studies

Module 3: Remediation Technologies **15 Hrs.**

Contamination site risk assessment – existing remediation technologies for contaminated site – emerging integrated remediation techniques – IoT in monitoring contamination and remediation process - Case Studies

Total Hours **45 Hrs.**

Text Books:

1.	Yue Rong, Fundamentals of Environmental Site Assessment and Remediation, CRC Press, 2018
2.	William J. Deutsch. Ground Water Geochemistry. Fundamentals and Applications to Contamination. Lewis Publishers, New York, 2010
3.	Yong Sik Ok, Jörg Rinklebe, Deyi Hou, Daniel C.W. Tsang, Filip M.G. Tack, Soil and Groundwater Remediation Technologies, CRC Press, 2020

Suggested Readings:

1	Jo Strange and Nick Langdon, Contaminated Land: Investigation, Assessment and Remediation – Design and Practice Guides, ICE, 2008

2	Asante-Duah, Management of Contaminated Site Problems, Taylor and Francis Ltd, 2019
3	Martin N. Sara, Site Assessment and Remediation Handbook, Second Edition,Lewis Publishers, 2008
4	Maria C. Hernandez Soriano, Environmental Risk Assessment of Soil Contamination, IntechOpen, 2014.
Web References:	
1	Clu-In Contaminated Site Clean-up Information EPA www.clu-in.org
2	ITRC Guidance Documents and other Information ITRC www.itrcweb.org
3	https://ocw.mit.edu/courses/1-34-waste-containment-and-remediation-technology-spring-2004/pages/lecture-notes/
4	https://www2.mst.dk/udgiv/publications/2002/87-7972-280-6/pdf/87-7972-281-4.pdf
Online Resources:	
1	https://nptel.ac.in/content/storage2/courses/105103025/pdf/pdf4.pdf
2	https://hppcb.nic.in/NGT/Vol-II.pdf
3	https://onlinecourses.nptel.ac.in/noc23_ce11/preview
4	https://www.epa.gov/remedytech/remediation-technologies-cleaning-contaminated-sites

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C911.1 & C911.2	Analyze	Surprise Test	20
C911.3	Apply	Group Assignment	20
C911.4	Apply	Case Study and Presentation	20
C911.5 & C911.6	Analyze	Technical Report Submission	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	-	-
Understand	10	10	10
Apply	50	50	50
Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	2	3	4	5	6	7	8	9	10	12	12	1	2	3
1	3	2	-	1	-	-	-	-	-	-	-	1	2	-	-
2	2	3	-	2	-	1	-	-	-	-	-	-	3	-	-
3	2	3	-	2	-	1	-	-	-	-	-	-	3	1	-
4	3	2	-	2	2	2	1	2	1	2	-	1	2	2	1
5	3	3	-	2	2	1	-	1	-	-	-	1	2	2	-
Avg.	**2.7**	**2.5**	**-**	**1.8**	**2.0**	**1.2**	**1.0**	**1.3**	**1.0**	**2.0**	**-**	**1.0**	**2.3**	**1.5**	**1.0**
1	Reasonably agreed					2	Moderately agreed				3	Strongly agreed			

22CE912	COMPUTING TECHNIQUES IN ENVIRONMENTAL ENGINEERING	3/0/0/3

Nature of Course	Theory Concepts
Pre requisites	-

Course Objectives:

1	To educate the students to know about the computing techniques used in environmental engineering.
2	To make students aware about numerical models and their significance in environmental engineering.
3	To explain the student about artificial intelligence tools like ANN, Fuzzy logic and genetic algorithm applications in environmental engineering.
4	To prepare students to gain knowledge on data handling management usinf=g modelling tools.

Course Outcomes:

Upon completion of the course, students shall have ability to

C912.1	Understand the various computing techniques available for environmental engineering.	U
C912.2	Apply the principles of ANN and GA for solving environmental problems.	AP
C912.3	Apply the principles of Fuzzy logic and for solving environmental problems.	AP
C912.4	Work in the statistical analysis software SYSTAT.	AP
C912.5	Employ modern advanced computing tool MATLAB software in environmental studies.	AP

Course Contents: Theory

Module 1: Soft Computing and Artificial Intelligence **15 Hrs.**

Introduction to computing techniques – algorithms and flowcharts, numerical methods - solution to ordinary and partial differential equation using finite difference, finite element and finite volume methods, numerical integration and differentiation.

Module 2: Artificial Intelligence and Fuzzy Logic **15 Hrs.**

Knowledge based expert system concepts - principle of Artificial Neural Network (ANN) – perceptron learning rule, neural network structure – neural network operations – ANN Algorithm – Application of ANN Model to environmental field. Fuzzy logic principles - fuzzy logic and the theory of uncertainty - fuzzy set theory- fuzzy membership function, fuzzy relations, fuzzy rule, and applications of the fuzzy set theory to inference and control, clustering, and image processing.

Module 3: Data Management and Environmental Modeling **15 Hrs.**

Data base structure - data acquisition - data warehouse - DBMS - RDBMS - data analysis – network data sharing - Statistical Analysis (SYSTAT) - regression - factor analysis - histogram – scatter diagram - goodness of fit – big data analysis. Introduction to MATLAB Software – MATLAB applications in environmental – pollutants transport, decay and degradation modeling using MIKE 21 – MODFLOW - case studies.

Total Hours	**45 Hrs.**

Text Books:

1	Aliev R. A, and Aliev Rashad, "Soft Computing and its Applications", World Scientific

	Publications Co. Pte. Ltd. Singapore, 2017.
2	Chepra S. C. and Canele R. P., "Numerical Methods for Engineers", McGraw-Hill, a business unit of The McGraw-Hill Companies, Inc., 1221 Avenue of the Americas, New York, NY 10020. 6th Edition 2018.
3	Zannetti P, “Computer Techniques in Environmental Studies IV: Co-published with Computational Mechanics Publications”, Springer, 1992.
4	Mathews J. H. and Fink K.D. "Numerical methods using MATLAB", Pearson Education 2018.
Suggested Readings:	
1	G. Latini, G. Passerini, P. Zannetti, C. A. Brebbia, “Development and Application of Computer Techniques to Environmental Studies: v. 10”, WIT Press, 2004.
2	Tanvir Islam, Prashant K. Srivastava, Manika Gupta, Xuan Zhu, Saumitra Mukherjee, “Computational Intelligence Techniques in Earth and Environmental Sciences”, Springer Dordrecht, 2014.
3	Rama Karri, R Gobinath, Mohammad Hadi Dehghani, “Soft Computing Techniques in Solid Waste and Wastewater Management”, Elsevier, 2021.
4	Data-Driven Modeling: Using MATLAB in Water Resources and Environmental Engineering, Springer; 2014.
Web Reference:	
1	https://www.hindawi.com/journals/mpe/si/941234/
2	https://www.lancaster.ac.uk/data-science-of-the-natural-environment/blogs/green-computing-a-contribution-to-save-the-environment
3	https://www.sciencedirect.com/book/9780323898614/computers-in-earth-and-environmental-sciences
Online Resources:	
1	https://in.coursera.org/learn/finite-element-method
2	https://in.coursera.org/specializations/machine-learning-introduction
3	https://in.coursera.org/learn/predictive-modeling-machine-learning

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)

Formative Assessment based on Capstone Model

Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C912.1 to C912.5	Apply	MOOC Certifications	20
C912.1 to	Analyze	Technical Report / Case Study	20

C912.5			
C912.1 to C912.5	Apply	Assignment	20
C912.1 to C912.5	Analyze	Technical Quiz	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	30	30	30
Apply	50	50	50
Analyse	10	10	10
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	**POs**												**PSOs**		
	1	2	3	4	5	6	7	8	9	10	12	12	1	2	3
1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
2	-	3	2	2	3	-	-	2	-	3	-	3	-	2	2
3	-	3	2	-	2	3	-	2	-	2	-	3	-	2	2
4	2	2	-	-	3	-	2	2	-	-	3	-	2	3	2
5	-	-	-	-	2	1	2	-	2	2	-	-	3	3	2
Avg.	**2.5**	**2.7**	**2.0**	**2.0**	**2.5**	**2.0**	**2.0**	**2.0**	**2.0**	**2.3**	**3.0**	**3.0**	**2.7**	**2.5**	**2.0**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE913	GROUND AND SURFACE WATER POLLUTION	3/0/0/3

Nature of Course	Theory
Pre requisites	-

Course Objectives:

1.	To reduce the presence of disease-causing organisms and associated health risks to an acceptable safe level.
2.	To obtain quantitative information on the physical, chemical, and biological characte of ground water
3.	To identify ground water polluted areas in order to ensure safe drinking water supplies
4.	To implement ground water conservation through participatory management approach

Course Outcomes:
Upon completion of the course, students shall have ability to

C913.1	Identify the sources of groundwater contaminants and its transport	[U]
C913.2	Examine the treatment techniques adopted for ground and surface water pollution for various developments	[AP]
C913.3	Analyze the characteristics of aquifers and estimate the ground water flow using various methods	[AP]
C913.4	Understand the various techniques used for the management of stormwater pollution	[U]
C913.5	Recognize the concepts of ground water pollution due to industrial and agricultural activities	[AP]

Course Contents: Theory

Module 1: Groundwater contamination, monitoring and Remediation 15 Hrs.

Principles – causes and sources of contamination – fate contaminants in ground water – Transport of contaminants in groundwater – Initial site assessment – Subsurface site assessment – Soli treatment techniques – Pump and treat techniques – Insitu treatment techniques – Gound water usage in agricultural developments.

Module 2: Groundwater Flow and Hydraulics of wells 15 Hrs.

Introduction – hydrologic cycle and interactions - Groundwater and Aquifers – Fundamental equations of groundwater flow – Confined aquifers – Unconfined aquifers – Combined confined and unconfined flow – Wells – Two dimensional problems – Non-steady (Transient) flow - Determination of aquifer characteristics – Design considerations – Interface flow.

Module 3: Storm water pollution management 15 Hrs.

Integrated storm water management – non-point source pollution – Best management practices – Field monitoring programs – Discharge treatment – Irrigation systems – use of agricultural chemicals – Urban and industrial development – modifications in river valleys – Challenges and opportunities in water quality and supply – Characteristics in aquatic environment.

Total Hours	**45 Hrs.**

Text Books:

1.	David H.F. Liu., Bela G. Liptak., Groundwater and Surface Water Pollution, 1st Edition, CRC Press, 2000

2.	K. V. Ellis., G. White., A. E. Warn., Surface Water Pollution and its Control, 1st Edition, Red Globe Press London, 2019
3.	J.J. Fried., Groundwater Pollution, Elsevier Science, 2002
Reference Books:	
1.	Shery McMillan., Soil and Ground water pollution, Syrawood Publishing House, 2016
2.	K.L. Katsifarakis., Groundwater Pollution Control, Progress in Water Resources, Hard, 2000
3.	Ramakar Jha, Vijay P. Singh, Vivekanand Singh, L.B. Roy, Roshni Thendiyath, Groundwater and Water Quality, Springer, 2022
4.	Thomas C. Winter., Judson W. Harvey., O. Lehn Franke., William M. Alley., Ground Water and Surface Water, 1st Edition, Denver, Colorado, 1998
Web References:	
1.	https://archive.nptel.ac.in/courses/105/105/105105042/
2.	https://archive.nptel.ac.in/courses/105/101/105101214/
Online Resources:	
1.	https://www.routledge.com/Groundwater-and-Surface-Water-Pollution/Liu-Liptak/p/book/9780367399214
2.	https://pubs.usgs.gov/circ/circ1139/pdf/circ1139.pdf

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C913.1	Remember	Quiz	20
C913.2	Understand	Assignment	20
C913.3	Apply	Case study	20
C913.4 & C913.5	Apply	Presentation	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	20	20	20

Apply	40	40	30
Analyse	30	30	40
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination									
Continuous Assessment (40%) [200 Marks]									End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks				CA 2 : 100 Marks					
SA 1 (60 Marks)	FA 1 (40 Marks)			SA 2 (60 Marks)	FA 2 (40 Marks)				
	Component - I (20 Marks)	Component - II (20 Marks)			Component - I (20 Marks)	Component - II (20 Marks)			

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	-	-	1	-	2	2	2	-	2	2	-	1
2	3	2	1	-	-	1	-	1	2	2	-	1	2	-	1
3	3	2	1	-	-	1	-	1	2	2	-	1	2	-	1
4	3	2	1	-	-	1	1	1	2	2	-	1	2	-	1
5	3	2	1	-	-	1	1	1	2	2	-	1	2	-	1
Avg.	3	2	1	-	-	1	1	1.2	2	2	-	1.2	2	-	1

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE914	IRRIGATION AND WATER RESOURCES ENGINEERING	3/0/0/3

Nature of Course	Theory
Pre requisites	Nil

Course Objectives:

1.	To understand the need and mode of irrigation.
2.	To study about minimizing water losses and on farm development works.
3.	To Understand the design of canals, distribution of water and control

Course Outcomes:

Upon completion of the course, students shall have ability to

C914.1	Identify the different types of irrigation methos and its application	[U]
C914.2	Assess the hydraulic design of canal head works	[AP]
C914.3	Apply the concepts of design of wells and canals	[AP]
C914.4	Apply the remedial measures for river control works	[AP]
C914.5	Identify the basic concepts of water resources planning, reservoir capacity, their yield predictions, types, and applications	[AP]

Course Contents:

Module 1: Irrigation Methods and Diversion works **15 Hrs.**

Need and mode of irrigation – Advantages - types of irrigation – consumptive use of water – Duty and delta – Relationship – Factors affecting duty – Irrigation Methods - Well irrigation - Tank irrigation – Flooding methods – Merits and demerits – Sprinkler irrigation – Drip irrigation – Diversion head works - Weir and Barrage– Layout of Weir - Tanks, sluices, and weirs - Factors affecting location and type of dams – Forces on a dam – Hydraulic design of Gravity dams.

Module 2: Canal Irrigation and Impounding Structures **15 Hrs.**

Classification of canals and wells - Alignment of canals – Classification of canals – Design of lined and unlined canals - Canal drops – Cross drainage works - Canal head works – Canal regulators – River training works – classification and objectives - Need for optimization of water use - Percolation ponds – Participatory irrigation management – Water Resources – estimation of water requirements for irrigation and drinking – Design of flood levees and flood walls - Reservoirs – types – site selection – zones of storage- reservoir sedimentation and control – basics of flood routing.

Module 3: Water Resources Management and Planning **15 Hrs.**

Water resources of India and Tamil Nādu – Description of water resources planning - Economics of water resources – Consumptive and non-consumptive use of water – Water quality – scope and aims of master plan – National water policy – Water Budget – flood estimation by empirical formula – Importance of rain water harvesting - Conjunctive use of surface and ground water – investigation for reservoir planning – site selection for reservoir – mass curve and demand curve – calculation of safe yield from a reservoir – determination of reservoir capacity – sedimentation and control

Total Hours:	**45 Hrs.**

Text Books:

1.	Santhosh Kumar Garg, “Irrigation and Hydraulic Structures”, Khanna Publishers, New Delhi, 2011.

2.	Punmia BC and Pande B B Lal, “Irrigation and Waterpower Engineering”, Laxmi Publications Pvt Ltd., New Delhi, 2009.
3.	Garg S.K, “Hydrology and Water Resources Engineering”, Khanna Publishers, India, 2011
Reference Books:	
1.	Asawa G L,” Irrigation Engineering”, New Age International Publishers, New Delhi, 2009.
2.	Duggal K.N. and Soni J.P. “Elements of Water Resources Engineering”, New Age International Pvt. Ltd., New Delhi, 2010.
3.	Sahasrabudhe S R, “Textbook of Irrigation Engineering” Katson Books,2012.
4.	Gurcharan Singh.,”Irrigation Engineering” Standard Book house, New Delhi,2009.
Web References:	
1.	https://ieeexplore.ieee.org/document/7534790/
2.	https://www.aboutcivil.org/irrigation-engineering-water-resources-lectures.html
Online Resources:	
1.	https://nptel.ac.in/courses/105104140/
2.	http://nptel.ac.in/courses/105104103/
3.	https://www.ieee.org/sitemap.html

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C914.1	Understand	Online Quiz	5
C914.2	Apply	Group Assignment	5
C914.3, C914.4	Apply	Group Assignment	5
C914.5	Apply	Technical Presentation	5

Assessment based on Summative and End Semester Examination			
Bloom’s Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	40	10	20
Understand	40	20	10
Apply	20	40	30
Analyse	-	30	20
Evaluate	-	-	20
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	2	-	-	-	2	-	-	-	-	3	-	2
2	3	3	2	2	-	-	-	2	-		-	-	3	-	2
3	3	3	2	2	-	-	-	2	-	-	-	-	3	-	2
4	3	3	2	2	-	-	-	2	-	-	-	-	3	-	2
5	3	3	2	2	-	-	-	2	-	-	-	-	3	-	2
Avg.	3	3	2	2	-	-	-	2	-	-	-	-	3	-	2

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE915	REMOTE SENSING AND GIS	3/0/0/3

Nature of Course	Theory application
Pre requisites	-

Course Objectives:

1.	To Acquire Knowledge about various concepts of remote sensing.
2.	To have a clear understanding about EMR interaction with atmosphere.
3.	To achieve knowledge on GIS techniques and map projections.
4.	To acquaint with several advanced modeling and application of GIS.

Course Outcomes:
Upon completion of the course, students shall have ability to

C915.1	To understand the basic components of remote sensing techniques	[U]
C915.2	To Apply the concepts of remote sensing techniques for atmospheric characteristics analysis	[AP]
C915.3	To understand the positions of satellites and its uses in remote sensing technology	[U]
C915.4	To study the basic of Geographical Information systems and its uses in remote sensing technologies	[U]
C915.5	Analyze the concepts involved in GIS by using modern methods	[AN]
C915.6	Identify field applications of GIS in various resource management	[AP]

Course Contents:

Module – 1 Remote Sensing **15 Hrs.**

Definition – Components of Remote Sensing – Active and Passive Remote Sensing – EMR spectrum - EMR interaction with atmosphere and earth**:** Atmospheric characteristics – Scattering of EMR – Raleigh, Mie, Non-selective and Raman Scattering – EMR Interaction with Water vapour and ozone – Atmospheric Windows – Significance of Atmospheric windows – EMR interaction with Earth Surface Materials - Spectral Signature – Spectral Signature curves – EMR interaction with water, soil and Earth Surface.

Module – 2 Optical and Microwave Remote Sensing **15 Hrs.**

Satellites - Classification – Based on Orbits – Sun Synchronous and Geo Synchronous – Based on Purpose – Earth Resources Satellites, Communication Satellites, Weather Satellites, Spy Satellites – Satellite Sensors - Resolution – Spectral, Spatial, Radiometric and Temporal Resolution – Description of Multi Spectral Scanning – Along and Across Track Scanners – Description of Sensors in Landsat, SPOT, IRS series – Current Satellites - Radar – Speckle - Back Scattering – Side Looking Airborne Radar – Synthetic Aperture Radar – Radiometer – Geometrical characteristics.

Module – 3 Geographic Information System **15 Hrs.**

GIS – Components of GIS – Hardware, Software and Organisational Context – Data – Spatial and Non-Spatial – Maps – Types of Maps – Projection – Types of Projection - Data Input – Digitizer, Scanner – Editing – Raster and Vector data structures – Comparison of Raster and Vector data structure – Analysis using Raster and Vector data – Retrieval, Reclassification, Overlaying, Buffering – Data Output – Printers and Plotters.

Total Hours:	**45 Hrs.**

Text Books:	
1.	M.Anji Reddy, “Text book of Remote sensing and GIS”, B.S.Bublications., 2017.
2.	S.Kumar, “Basics of Remote sensing and GIS”, Laxmi Publications., 2016
3.	S.K.Sinha, “Fundamentals of Remote sensing and GIS”, Ayushman Publication house., 2014
4.	K.S. Jauhari, “Remote Sensing and GIS”, A pragati’s Edition., 2014
Reference Books:	
1.	Basudeb Bhatta, “Remote sensing and GIS”, Oxford publishers., 2016
2.	Lillesand, Kiefer and Chipman, “Remote sensing and Image interpretation”, Wiley., 2016
3.	S.S.Manugula and Veeranna Bommakanti, “Photogrammetry, GIS and Remote sensing”, Educreation Publishing., 2018
4.	Kang-tsung Chang, Introduction to Geographic Information Systems: 9th Edition, 9781259929649, McGraw-Hill Education, 2018
Web References:	
1.	http://www.gdmc.nl/oosterom/PoGISHyperlinked.pdf
2.	https://www.researchgate.net/publication/323945547_Fundamentals_of_GIS
Online Resources:	
1.	https://doc.arcgis.com/en/arcgis-online/reference/what-is-agol.htm
2.	https://geogeek.xyz/download-gis-book-pdf-fundamentals-gis-arcgis-10-manual.html

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C915.1 & C915.2	Apply	Presentation	20
C915.3 & C915.4	Understand	Assignment	20
C915.5	Analyze	Quiz	20
C915.6	Apply	Case study	20

Assessment based on Summative and End Semester Examination			
Bloom’s Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	

Remember	-	10	10
Understand	40	20	20
Apply	60	40	50
Analyse	-	30	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	3	2	3	3	1	2	-	2	-	1	2	1	2	2
2	2	2	3	2	3	1	2	-	2	-	1	2	-	2	2
3	2	3	2	3	3	1	-	-	2	-	-	-	1	2	2
4	2	2	1	3	3	-	2	-	2	-	1	2	1	2	2
5	2	3	2	3	3	-	2	-	2	-	-	2	1	-	2
Avg.	2	3	2	3	3	1	2	-	2	-	1	2	1	2	2

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE916	SURFACE WATER HYDROLOGY	3/0/0/3
Nature of Course	Theory Analytical	
Pre requisites	-	

Course Objectives:

1.	To understand all the components of the hydrological cycle.
2.	To study the concept of mechanics of rainfall, its spatial and temporal measurement, and their applications.
3.	To understand the different types of simple statistical analysis and application of probability distribution of rainfall and runoff.

Course Outcomes:
Upon completion of the course, students shall have ability to

C916.1	Understand and the basics of precipitation, abstraction, hydrologic cycle	[U]
C916.2	Understand the hydrograph, types and their application	[U]
C916.3	Analyze the flood routing and its methods	[AN]
C916.4	Apply the concepts of Groundwater hydrology and methods	[AP]
C916.5	Analyze the reservoir capacity using various methods	[AN]

Course Contents:

Module– 1 Precipitation and Abstraction: 15 Hrs.

Hydrologic cycle–Types of precipitation–Forms of precipitation–Measurement of rainfall–Spatial measurement methods–Temporal measurement methods –Frequency analysis of point rainfall –Intensity, duration, frequency relationship–Probable maximum precipitation. Losses from precipitation – Evaporation losses – Reservoir evaporation – Infiltration losses – Infiltration capacity–Measurement of infiltration–Infiltration indices–Effective rainfall**.**

Module – 2 Runoff, Hydrographs and Flood Routing 15 Hrs.

Watershed, Catchment, and basin – Catchment characteristics – Factors affecting runoff – estimation using empirical formula - Hydrographs: Factors affecting hydrograph–Base flow separation– Derivation of unit hydrograph –S-curve hydrograph–Unit hydrograph of different deviations - Synthetic unit hydrograph. Flood Routing: Flood frequency studies–Recurrence interval– Gumbel's method– Flood routing – Reservoir flood routing – Muskingum's channel routing– Flood control.

Module – 3 Groundwater Hydrology and Reservoirs: 15 Hrs.

Types of aquifers–Darcy's law–Dupuit's assumptions–Confined aquifer–Unconfined aquifer– Recuperation test–Transmissibility–Specific capacity–Pumping test–Steady flow analysis only – Reservoirs – Classification of reservoirs – principles and design – site selection – spillways – area – capacity – storage estimation – sedimentation – life of reservoirs – rule curve.

Total Hours:	**45 Hrs.**

Text Books:

1.	Subramanya. K, "Engineering Hydrology", Tata McGraw-Hill Publishing Co., Ltd.,2013
2.	Raghunath, H. M., "Hydrology", New Age International Publishers, 2ndedition, 2015

3.	Madan Mohan Das, “Hydrology”, Prentice Hall India Learning Pvt. Ltd., 2011
Reference Books:	
1.	Daniel Webster, “Hydrology”, Wentworth Press, 2016
2.	Manish kumar goyal, “Engineering Hydrology”, PHI Learning., 2012
3.	Mysooru R. Yadupathi Putty, “Principles of Hydrology”, I K International Publishing House Pvt.Ltd, 2011
4.	Jayarami Reddi.P., “A Textbook of Hydrology”, Laxmi Publications, New Delhi, 2016
Web References:	
1.	http://www.univpgri-palembang.ac.id/perpus fkip/Perpustakaan/Geography/Hidrologi/Hidrologi%20Dasar.pdf
2.	https://hydrologie.org/BIB/Publ_UNESCO/TP_006_E.pdf
Online Resources:	
1.	https://easyengineering.net/engineering-hydrology-book-pdf-by-k/
2.	http://www.geo.uu.nl/~wwwhydro/folder.pdf

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C916.1	Understand	Objective type Quiz	5
C916.2	Understand	Assignment	5
C916.4	Apply	Assignment	5
C916.3, C316.5	Analyze	Assignment / Tutorial	5

Assessment based on Summative and End Semester Examination			
Bloom’s Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	-	-
Understand	60	40	30
Apply	40	40	40
Analyse	-	20	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	1	2	-	-	-	-	-	1	2	1	1	2	-
2	3	2	2	1	-	2	1	1	-	1	-	1	1	2	2
3	3	2	1	-	-	-	-	1	-	1	-	1	2	1	1
4	1	3	2	-	-	2	1	1	-	1	1	1	2	1	-
5	3	2	2	1	-	2	1	1	-	1	-	1	1	2	2
Avg.	2.7	1.8	1.7	1.3	-	1.8	1.3	1	-	1	1.5	1	1.3	1.7	1.8

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE917	SOLID AND HAZARDOUS WASTE MANAGEMENT	3/0/0/3

Nature of Course	Theory Application
Pre requisites	Nil

Course Objectives:

1.	To understand the necessity and importance of professional solid waste management
2.	To learn the methods and means of waste collection and transfer of solid and hazardous wastes
3.	To study the different treatment approaches for MSW hazardous wastes
4.	To study the design and operation of Municipal and Hazardous landfills

Course Outcomes:
Upon completion of the course, students shall have ability to

C917.1	Examine the functional elements of municipal solid waste management system	[AP]
C917.2	Analyze the role of PPP in waste management	[AN]
C917.3	Evaluate the various processing technologies for MSW	[AP]
C917.4	Analyze the various options for disposal of Municipal Solid Waste	[AN]
C917.5	Identify and classify the hazardous wastes	[U]

Course Contents: Theory

Module 1: Fundamentals of Solid Waste Management **10 Hrs**

Types and sources of solid waste, non-hazardous and hazardous waste-Pre sent scenario and need for solid and hazard waste management- Legislations on management and handling of solid wastes and hazardous waste - Elements of integrated waste management and roles of stakeholders - Financing and Public Private Participation for waste management. Effects of improper solid waste management

Module 2: Municipal Solid Waste Management **20 Hrs**

Source-types-composition-Estimation of physical, chemical Characteristics. Collection services-Types of collection system-Analysis of collection routes- Types of transfer stations-Transport means and methods-Location of transfer stations. Processing of MSW-Onsite storage and Processing methods. Offsite Processing- combustion, pyrolysis, gasification, incineration-Principles of aerobic and anaerobic composting- Co-digestion of solid waste- Waste to Energy Concept. Disposal of MSW-Sanitary Landfill-siting Considerations-design and Operation of sanitary landfill-Leachate and Gas Collection –monitoring system. Reuse of disposal sites

Module 3: Hazardous Waste Management **15 Hrs**

Types of Hazardous Wastes –Source of generation- Characterisation-TCLP tests-Storage, labelling and handling of hazardous wastes- Effects of improper management – Treatment and disposal of Hazardous wastes -Hazardous waste management in India. Environmental Risk assessment-case studies-Remediation of Hazardous Landfill sites

Total Hours:	**45 Hrs.**

Text Books:	
1.	M N Rao and Razia Sultana “Solid and Hazardous Waste Management”, Bs Publication,2016
2.	Bhide A.D and Sundaresan, B.B. “Solid Waste Management Collection, Processing and Disposal”, 2008.
3.	George Tchobanoglous, Hilary Theisen and Samuel Vigil. “Integrated Solid Waste Management”, McGraw-Hill Publishers, 2010.
4.	John Pichtel. Waste management Practices Municipal, hazardous and Industrial Taylor and Francis 2005.
Reference Books:	
1.	Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2014.
2.	A Design Approach Sincero, A.P., and Sincero, G.A., “Environmental Engineering” PHI Learning 2012.
3.	Vesilind, P. A and Worrel W.A “Solid Waste Engineering” –, Cengage Learning 2014.
4.	Peavy, H.S., Rowe, D.R., and Tchobanoglous, G. “Environmental Engineering” McGraw-Hill Publishers, 2016.
Web References:	
1.	https://www.nptel.ac.in/courses/105106056/
2.	http://nptel.ac.in/courses/120108005/
Online Resources:	
1.	http://mohua.gov.in/publication/manual-on-solid-waste-management-systems-cpheeo-2000.php
2.	https://www.epa.gov/hw

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C917.1 & C917.2	Apply	Presentation	4
C917.3	Apply	Assignment	4
C917.4	Analyze	Quiz	4
C917.5	Apply	Case study	4

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember		10	10
Understand	40	20	20
Apply	60	40	50
Analyse	-	30	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	2	-	2	2	2	2	-	-	3	1	2	2
2	3	2	2	2	-	1	2	2	2	-	-	2	2	2	2
3	2	2	2	2	-	1	-	2	1	-	-	2	1	2	2
4	3	3	2	1	-	1	1	-	1	-	-	3	1	2	2
5	2	2	2	1	-	-	1	1	2	-	-	2	1	3	2
Avg.	2.7	2.1	2	1.6	-	1.4	1.5	1.8	1.6	-	-	2.4	1.3	2.8	2

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE918	OPERATION AND MAINTENANCE OF WATER AND WASTEWATER TREATMENT SYSTEMS	3/0/0/3

Nature of Course	Theory
Pre requisites	Nil

Course Objectives:

1.	To focus on the wastewater transport system and the theory and design technique for the wastewater treatment process
2.	To educate the student on the various Operation and Maintenance aspects of Common Effluent Treatment Plants
3.	To learn the physical/chemical/biological characteristics and evaluation technique for water and wastewater
4.	To study the management principles about wastewater and water treatment process

Course Outcomes:
Upon completion of the course, students shall have ability to

C918.1	Understand the knowledge on effluent analysis and sampling techniques.	[U]
C918.2	Apply the concepts for the analysis of effluents in various laboratory techniques	[AP]
C918.3	Understand the basic concepts on operation and maintenance of waste water treatment plants.	[U]
C918.4	Analyze the engineering application, and design technique for the wastewater treatment unit process.	[AN]
C918.5	Apply the various concepts used for the management of water and wastewater by various management techniques	[AP]

Course Contents: Theory

Module 1: Sampling and analysis of effluents **15 Hrs.**

Introduction – Sampling procedures – Analysis of samples- Determination of pH using pH meter -Color – Conductivity – Solids – Estimation of dissolved oxygen (D.O) – winklers method -Estimation of biochemical oxygen demand (BOD) – Estimation of biochemical oxygen demand (COD) – Estimation of chloride (Mohrs method) – Estimation of Sulphate (turbidimetric method) -83 Code of practice for analytical laboratories – Work tables – Glassware – Safety – Handling in laboratory – Pipetting and others – Laboratory equipment and glassware – Equipment -Glassware – Case Studies.

Module 2: Operation and Maintenance of Treatment Units **15 Hrs.**

Screening – Bar screens – Equalization – Equalization basins – Strategy for operation – Physicochemical treatment- processes- – Flash mixer – Clarifiers – Operation guidelines for clarifier -Operation and maintenance – Start-up and maintenance inspection -Chemical feed systems -Rapid mix and flocculators – Clarifiers – Normal operation – Chemical feed system – Flash mixer -Flocculation tanks – Clarifiers – Abnormal operation – Safe working habits – Jar test for selection of coagulant and their dosages- Sludge management – Case Studies.

Module 3: Water treatment and management **15 Hrs.**

Waste water in Industry- Home and Agriculture – Various waste water treatment processes – Optimization – Benefits and costs – Microbial and sanitation water treatment – Biofilm formation and removal – Microbial trend analysis – Pretreatment system and equipment - Main aspects of water management – Hydrological cycle – Hydrosphere – Water transport – Water exchange – Causes and problems in irrigation, rural water, urban water – Water conservation resource management

Total Hours: 45 Hrs.

Text Books:	
1.	Mackenzie L. Davis., Water and Wastewater Engineering: Design Principles and Practice, McGraw Hill, 2010
2.	J. Paul Guyer., An Introduction to Water Supply Systems Operation and Maintenance, Createspace Independent Pub, 2014
3.	Metcalf and Eddy, Wastewater Engineering – Treatment – Disposal – Reuse Tata McGraw Hill. 3rd Edition, 1999
Reference Books:	
1.	P.C.Bansil “Water Management in India”, Concept Publishing company, New Delhi, First Edition, 2004.
2.	G.S.Bridie and J.S.Bridie “Water Supply and Sanitary Engineering”, Dhanpat Raj Publishing company (P) Ltd., New Delhi, 7th Edition, 2003.
3.	S.C. Rangwala, “Water supply and Sanitary Engineering”, Eighteenth Edition, Charotar Publishing House, 2003.
4.	Pandey G.N., “Text Book of Chemical Technology”, Vikas Publishing House Pvt. Ltd., New Delhi, 1992
Web References:	
1.	https://archive.nptel.ac.in/courses/105/105/105105201/
2.	https://www.coursera.org/learn/water
Online Resources:	
1.	https://www.pseau.org/outils/ouvrages/wrc_introduction_to_operation_and_maintenance_of_water_distribution_systems_2014.pdf
2.	

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C918.1	Remember	Quiz	4
C918.2	Understand	Assignment	4
C918.3	Apply	Case study	4
C918.4 & C918.5	Apply	Presentation	4

Assessment based on Summative and End Semester Examination			
Bloom’s Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	

Remember	10	10	10
Understand	20	20	20
Apply	40	40	30
Analyse	30	30	40
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	2	-	2	2	2	2	-	-	3	1	2	2
2	3	2	2	2	-	1	2	2	2	-	-	2	2	2	2
3	2	2	2	2	-	1	-	2	1	-	-	2	1	2	2
4	3	3	2	1	-	1	1	-	1	-	-	3	1	3	2
5	2	2	2	1	-	-	1	1	2	-	-	2	1	2	2
Avg.	2.6	2.2	2	1.6	-	1.2	1.5	1.75	1.6	-	-	2.4	1.2	2.2	2

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE919	COMPUTER SIMULATION APPLICATIONS IN TRANSPORTATION ENGINEERING	3/0/0/3
Nature of Course	Theory Application	
Pre requisites	Nil	

Course Objectives:

1	To understand the principles and methodologies of computer simulations.
2	To know the different types of simulation methods and tools
3	To learn to develop and evaluate models for traffic flow and congestion
4	To know the analysis of transportation planning and policy

Course Outcomes:

Upon completion of the course, students shall have ability to

C919.1	Study the principles and concepts of computer simulation techniques in transportation engineering.	[AP]
C919.2	Evaluate the strengths and limitations of different simulation methods and software tools.	[E]
C919.3	Use traffic simulation software to develop and evaluate models of traffic flow and congestion.	[AN]
C919.4	Analyze transportation system performance and make recommendations for improvements based on simulation results	[AN]
C919.5	Study the role of simulation in transportation planning and policy analysis	[AN]

Course Contents: Theory

Module 1: Traffic flow theory and simulation **15 Hrs.**

Introduction to traffic flow theory - Characteristics of traffic flow: speed, density, and flow - Traffic flow models: macroscopic, mesoscopic, and microscopic models - Applications of traffic flow models in transportation engineering - Traffic flow equations: continuity and momentum equations - Traffic flow simulation models and software tools

Module 2: Microscopic traffic simulation **15 Hrs.**

Types of microscopic traffic simulation models: car-following models and lane-changing models - Traffic simulation software tools: SUMO, VISSIM, AIMSN - Input data for microscopic traffic simulation - Simulation output data - Calibration and validation of microscopic traffic simulation models - Simulation of mixed traffic - Simulation of connected and automated vehicles (CAVs).

Module 3: Macroscopic traffic simulation **15 Hrs.**

Traffic simulation software tools: PARAMICS, TRANSIMS, EMME - Input data for macroscopic traffic simulation - Simulation output data - Calibration and validation of

macroscopic traffic simulation models - Simulation of network performance and traffic control strategies - Simulation of transit systems - Simulation of pedestrian flow and crowd dynamics.	
Total Hours	**45 Hrs.**
Text Books:	
1	Huapu Lu, Tian Zong, and Yunlong Zhang, Traffic Simulation and Data: Validation Methods and Applications in Transportation Planning, CRC Press, 2018
2	Louis G. Birta, Modelling and Simulation: Exploring Dynamic System Behaviour (Simulation Foundations, Methods and Applications), Springer; 2013.
3	Bernard Zeigler , Guide to Modeling and Simulation of Systems of Systems (Simulation Foundations, Methods and Applications), Springer; 2012.
Reference Books:	
1	Margaret L. Loper , Modeling and Simulation in the Systems Engineering Life Cycle: Core Concepts and Accompanying Lectures (Simulation Foundations, Methods and Applications, Springer, 2015.
2	Dietmar P.F. Möller, Introduction to Transportation Analysis, Modeling and Simulation: Computational Foundations and Multimodal Applications, Springer; 2014.
3	David J. Murray-Smith, Testing and Validation of Computer Simulation Models: Principles, Methods and Applications (Simulation Foundations, Methods and Applications), Springer; 2015.
4	Andreas Tolk, Advances in Modeling and Simulation: Seminal Research from 50 Years of Winter Simulation Conferences (Simulation Foundations, Methods and Applications), Springer; 2017.
Web References:	
1	https://www.hindawi.com/journals/mpe/2013/768031/
2	https://conservancy.umn.edu/handle/11299/156925
Online Resources:	
1	https://www.eclipse.org/sumo/
2	https://www.vskills.in/certification/tutorial/computer-simulation-in-logistics/

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C919.1	Apply	Assignment	20
C919.2	Apply	Assignment	20
C919.3 & C919.4	Apply	Quiz	20
C919.5	Apply	PBL	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	10	10
Understand	30	10	10
Apply	30	40	40
Analyse	20	20	20
Evaluate	20	20	20
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	2	3	4	5	6	7	8	9	10	12	12	1	2	3
1	3	2	1	1	3	-	1	1	1	1	-	1	1	-	2
2	3	2	1	1	3	-	1	1	1	1	-	1	1	-	1

3	3	2	1	1	3	-	1	1	1	1	-	1	1	-	2
4	3	2	1	1	3	-	1	1	1	1	-	1	1	-	2
5	3	2	1	1	3	-	1	1	1	1	-	1	1	-	2
Avg.	**3**	**2**	**1**	**1**	**3**	**-**	**1**	**1**	**1**	**1**	**-**	**1**	**1**	**-**	**2**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE920	Construction Personnel Management	3/0/0/3
Nature of Course	Theory Concept	
Pre requisites	Nil	

Course Objectives:

1	To understand various aspects of manpower management in construction.
2	To learn the leadership skills and organizational behavior
3	To study the principles of safety and health management
4	To understand the concept of total quality management

Course Outcomes:

Upon completion of the course, students shall have ability to

C920.1	To understand the importance of planning	[U]
C920.2	To develop the interpersonal skills	[AP]
C920.3	To recognize the need of performance and motivation	[U]
C920.4	To improve the management and developments methods the need of training and development	[U]
C920.5	To create managing technologies and to understand the quality of work life	[AP]

Course Contents: Theory

Module 1: Manpower Planning and Organization **15Hrs.**

Manpower Planning process ,Organizing, Staffing, directing, and controlling – Estimation, manpower requirement – Factors influencing supply and demand of human resources – Role of HR manager – Personnel Principles-Requirement of Organization – Organization structure – Organization Hierarchical charts – Staffing Plan - Development and Operation of human resources - Managerial Staffing – Recruitment – Selection strategies – Placement and Training.

Module 2: Human Relations And Organizational Behaviour **15Hrs.**

Basic individual psychology – Approaches to job design and job redesign – Self managing work teams – Intergroup – Conflict in organizations – Leadership-Engineer as Manager – all aspects of decision making – Significance of human relation and organization development – Individual in organization – Motivation – Personality and creativity – Group dynamics, Team working – Communication and negotiation skills.

Module 3: Management and Development Methods **15Hrs.**

Wages and Salary, Employee benefits, Employee appraisal and assessment – Employee services – Safety and Health Management – Special Human resource problems – Productivity in human resources – Innovative approach to designing and managing organization – Managing New Technologies – Total Quality Management – Concept of quality of work life – Levels of change in the organizational Development – Requirements of organizational Development.

	Total Hours	**45 Hrs.**
Text Books:		
1	Memori1a,C.B., “Personnel Management”,12th Edition Himalaya Publishing House Pvt.Ltd., 2012	
2	Monappa A. & M.S. Saiyadaiu , "Personnel Management" ,Tata McGraw Hill,2006	
3	Martin loosemore, "Human Resource Management in Construction Projects", Spon Press,2003	
Reference Books:		
1	Carleton Counter II and Jill Justice Coutler, "The Complete Standard Handbook of Construction Personnel Management", Prentice	
2	Charles D Pringle, Justin Gooderi Longenecter, Management, CE Merril Publishing Co. 1981.	
3	Dwivedi R.S, "Human Relations and Organisational Behaviour", Macmillian India Ltd.,2005.	
4	Josy.J. Familaro, "Handbook of Human Resources Administration", McGraw-Hill International Edition, 1987.	
Web References:		
1	https://www.slideshare.net/ShaikhIrshad/personnel-management-23944323.	
2	https://www.slideshare.net/mannukumar14/reward-construction-personnel-management	
3	https://www.slideshare.net/srinidhiraman/human-resource-management-ppt-43320777	
Online Resources:		
1	https://www.coursera.org/learn/project-management-foundations	
2	https://www.coursera.org/specializations/human-resource-management	

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**
Assessment Methods & Levels (based on Blooms’ Taxonomy)					
Formative Assessment based on Capstone Model					

Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C920.1	Understand	Online quiz	20
C920.2	Understand	Assignment	20
C920.3 & C920.4	Apply	Seminar presentation	20
C920.5	Apply	Assignment	20

Assessment based on Summative and End Semester Examination

Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	10	10	10
Understand	40	40	40
Apply	50	50	50
Analyse	-	-	
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	12	12	1	2	3
1	1	1	-	-	-	2	-	-	3	3	3	-	-	2	-
2	1	1	-	-	-	2	-	-	3	3	3	-	-	2	-
3	1	1	-	-	-	2	-	-	3	3	3	-	-	2	-

4	1	1	-	-	-	2	-	-	3	3	3	-	-	2	-
5	1	1	-	-	-	2	-	-	3	3	3	-	-	2	-
Avg.	**1**	**1**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**2**	**-**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE921	Economics and Business Finance	3/0/0/3
Nature of Course	Theory Concept	
Pre requisites	Nil	

Course Objectives:

1	Understand the market dynamics namely demand elasticity of demand and pricing in different market structures.
2	Analyze how capital budgeting decisions are carried out for selecting the best investment proposal.
3	Learn how organizations make important investment and financing decisions.
4	Analyze a company's financial statements and come to a reasoned conclusion about the financial situation of the company.

Course Outcomes:

Upon completion of the course, students shall have ability to

C921.1	To understand the concepts of Managerial Economics.	[U]
C921.2	To interpret the relationship between the Economic concepts with Construction Economics	[U]
C921.3	To study about the financial system of an organization.	[AP]
C921.4	Determine the investment decisions of organizations by applying capital budgeting methods and Strategies.	[AP]
C921.5	Interpret the financial statement by using Fundamental accounting concepts and Ratio analysis	[AP]

Course Contents: Theory

Module 1: Managerial and Construction Economics **15Hrs.**

Economics: Concepts and Importance's – Managerial Economics - Engineering Economics – Support Matters of Economy related to Engineering –Market demand and supply - Economic law of production - Choice of Technology - Role of Civil Engineering in Industrial Construction development in Housing, transport, energy and other infrastructures – Economics of ecology, environment, energy resources – Local material selection – Form and functional designs .

Module2: Analysis of Financial Statement **15Hrs.**

The need for financial management - Types of financing – Source of Finance: Financing instruments– Short term borrowing – Long term borrowing – Leasing – Equity financing – Internal and External generation of funds –– Loans to Contractors –

Security and risk aspects Balance Sheet - Profit and Loss account – Cash flow and Fund flow analysis – Ratio analysis Financial Control - Centralized management. **Module 3: Accounting Method** **15Hrs.** Accounting - Cash basis of accounting – Accrual basis of accounting – Percentage completion method – Completed contract method – Accounting for tax reporting purposes and financial reporting purposes – Accounting Standards– Audit - Quality Control.	
Total Hours	**45 Hrs.**
Text Books:	
1	ShashiK.Gupta, R.K. Sharma., “Management Accounting- Principles and Practice”, Kalyani Publishers., 2016.
2	Aryasri, “Managerial Economics and Financial Analysis”, TMH publications, 4th Edition, 2012.
3	M. Kasi Reddy, Saraswathi, “Managerial Economics and Financial Analysis”, PHI Publications, New Delhi, 2 nd Edition, 2012.
Reference Books:	
1	D.N. Dwivedi, “Managerial Economics”, Vikas Publication House Pvt.Ltd, 2nd Edition, 2012.
2	S.N. Maheshwari & S.K.Maheshwari, “Financial Accounting”, Vikas Publication House Pvt.Ltd, 4th Edition, 2012.
3	R.Narayana Swamy, “Financial Accounting- A managerial Perspective”, Pearson publications, 1st Indian Reprint Edition, 2012.
Web References:	
1	https:// www.slideshare.net/glory1988/managerial-economics-and-financial analysis.
2	https://thenthata.web4kurd.net/mypdf/managerial-economics-and-financialanalysis.
3	https:// bookshallcold.link/pdfread/managerial-economics-and-financial analysis
Online Resources:	
1	https://www.coursera.org/specializations/managerial-economics-business-analysis
2	https://www.coursera.org/specializations/business-value-project-management

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative Assessment based on Capstone Model

Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C921.1	Understand	Online quiz	20
C921.2	Understand	Assignment	20
C921.3& C921.4	Apply	Seminar presentation	20
C921.5	Apply	Online Quiz	20

Assessment based on Summative and End Semester Examination

Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	-	-	-
Understand	40	30	50
Apply	60	70	50
Analyse	-	-	
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	2	3	4	5	6	7	8	9	10	12	12	1	2	3
1	1	-	-	-	-	2	-	3	-	1	3	1	3	-	-
2	1	-	-	-	-	2	1	3	-	1	3	1	3	-	-
3	1	-	-	-	-	2	-	3	-	1	3	1	3	-	1
4	1	-	-	-	-	2	1	3	-	1	3	1	3	-	1
5	1	-	-	-	-	2	1	3	-	1	3	1	3	-	2
Avg.	1	-	-	-	-	2	1	3	-	-	3	1	3	-	2
1	Reasonably agreed					2	Moderately agreed				3	Strongly agreed			

22CE922	HIGHWAY CONSTRUCTION AND MANAGEMENT	3/0/0/3

Nature of Course	Theory application
Pre requisites	-

Course Objectives:

1.	To Analyse various analysis and design procedures of pavements.
2.	To prepare for the subgrade and construction of pavement
3.	To prepare for the subgrade and construction of pavement
4.	To implement the maintenance and pavements management systems

Course Outcomes:
Upon completion of the course, students shall have the ability to

C922.1	Apply the philosophy of different methods for the design of pavements.	[AP]
C922.2	Use the design principles of flexible pavements	[AN]
C922.3	Use the design principles of rigid pavements	[AN]
C922.4	Apply the construction techniques for rigid pavement and joints	[AP]
C922.5	Evaluate the pavements repair techniques and strengthening techniques for pavements	[AN]

Course Contents:Theory

Module 1: Design of Flexible Pavements **15 Hrs.**

Pavement Composition - Comparison of Flexible and Rigid pavement - Properties of Materials – Aggregates, Cement, Bitumen - Factors affecting pavement design - Design wheel load: ESWL, Repetition of loads - Introduction to design methods: CBR, Empirical design and mechanistic-empirical design - Design of Flexible pavement: CBR method (IRC method) - Equipment and machineries used in road construction - Method of flexible pavement construction.

Module 2: Design of Rigid Pavement **15 Hrs.**

Design of Rigid pavement: Westergaard's analysis, IRC method - Stages of Construction - Sub-grade: Earthwork grading and construction of embankments and cuts for roads, preparation of subgrade. Drainage Consideration in Pavement - Method of cement concrete pavement construction - Construction of various types of joints.

Module 3: Pavement Maintenances and Management Systems **15 Hrs.**

Pavement Maintenances: Types - Pavement distress in flexible pavements: Alligator Cracking, Depressions, Corrugations, Potholes, Rutting, swelling – Pavement distress in rigid pavements: Joint Spalling, Faulting, Polished Aggregate, Pumping, Punch out. Pavement Management Systems – Pavement evaluation, roughness, present serviceability index, skid resistance, structural evaluation, evaluation by deflection measurements – Strengthening of pavements - Overlay -Principles of Benkelman Beam Method–Highway Project formulation.

Total Hours: 45 Hrs.

Text Books:

1.	Khanna S K & C E G Justo and Justo, Highway Engineering, Nemchand & Sons publisher, 2020
2.	Pratab Chraborthy and Animesh Das, Principles of Transportation Engineering, PHI Learning Pvt. Ltd, 2017.
3.	Saxena S C, Text book of Highway and Traffic Engineering, CBS publishers & distributors private limited, New Delhi, 2020

Reference Books:

1.	Sharma S K, Principles, Practice and design of highway Engineering, S.Chand & Co Ltd, New Delhi, 2014.

2.	Srinivasa Kumar R, Pavement Design, Orient Blackswan Private Limited - New Delhi, 2013
3.	Sathish Modh, Introduction to Disaster Management, Macmillan publishers, 2nd edition, New Delhi, 2009
4.	Singh B.K.,‖ Handbook of Disaster Management: Techniques and Guidelines‖, Rajat Publications, 2008.
Code Books:	
1.	IRC: 58 - 2015 Guidelines for the Design of Plain Jointed Rigid Pavements for Highways
2.	IRC:37-2018 Guidelines for the Design of Flexible Pavements
Web References:	
1.	https://drive.google.com/file/d/1C2jGmbCF58JuwS4I-4Dibl9hHIP3-64h/view
2.	https://drive.google.com/file/d/1afPJycv9m2Pz3erMLJvXZm--pE0BWNax/view
Online Resources:	
1.	http://nptel.ac.in/courses/105101087/
2.	https://www.coursera.org/lecture/mastering-bitumen/25-understanding-design-of-flexible- pavements-and-types-of-aggregates-e7MPH

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C922.1	Apply	Quiz	20
C922.2	Apply		
C922.3	Apply	Presentation	20
C922.4	Apply	Assignment	20
C922.5	Apply	Case study	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	10	10
Understand	30	10	10
Apply	30	40	50
Analyse	40	40	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	1	-	-	2	1	1	-	-	2	2	-	-
2	3	2	2	1	-	-	2	1	1	-	-	2	2	-	-
3	3	2	2	1	-	-	2	1	1	-	-	2	2	-	-
4	3	2	2	1	-	-	2	1	1	-	-	2	2	-	-
5	3	2	2	1	-	-	2	1	1	-	-	2	2	-	-
Avg.	3.0	2	2	1	-	-	2	1	1	-	-	2	2	-	-

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE923	MARKETING MANAGEMENT	3/0/0/3

Nature of Course	Theory application
Pre requisites	-

Course Objectives:

1.	To provide basic knowledge about functional areas of marketing and practices.
2.	To familiarize and illustrate the application of marketing mix elements .
3.	To provide in depth knowledge on marketing segmentation ,positioning and targeting
4.	To provide knowledge on emerging trends in marketing.

Course Outcomes:
Upon completion of the course, students shall have ability to

C923.1	Understand the marketing elements and its application	[U]
C923.2	Apply and evaluate different techniques in the practical market space to meet the upcoming challenges	[AN]
C923.3	Design sources of marketing tools for better application in the market	[AN]
C923.4	Evaluate the developed designs for better utilization in the marke	[AN]
C923.5	Analyze the emerging marketing trends	[AN]

Course Contents:

Module 1: Introduction to Marketing **15 Hrs.**

Defining Marketing Concepts- Marketing Opportunity Analysis: Scanning the Marketing Environment Ethics in Marketing. Introduction to Marketing Mix (Product, Place, Price, Promotion, People, Process) Market Segmentation-Selecting bases for Segmenting Consumer Markets –Market Segmentation Process –Evaluation Market Potential and Company Performance Targeting-Positioning and Differentiation.

Module 2: Product Management **15 Hrs.**

Hierarchy -Classification of Product-New Product Development-Product Life Cycle-Brand Management –Brand Equity –Associated Brands –Global Branding Packaging Labeling-Buyer Behavior- Factors affecting business buying behavior –Understand the Monetary Value of product for the customer - Stages-Marketing Channel-Retailing-Wholesaling and Logistics

Module 3: Pricing and Promotion **15 Hrs.**

Price Decision –Concept ,Significance of pricing Decision –Factors affecting Price determination ;Pricing Methods and Techniques –Pricing policies and strategies –Promotion Decision –Communication Process ;Promotion mix –advertising ,sales promotion ,publicity and public relations –Media selection –Advertising effectiveness –Sales promotion –tools and technique

Total Hours:	**45 Hrs.**

Text Books:

1.	Philip Kotler, MithileswarJha,Kevin Lane Keller, Abraham Koshy (2013). Business Marketing: Concepts and Cases (14th ed), Pearson Publishing.

2.	Ramaswamy V.S. and Namakumari S (2012). Marketing Management: Planning, Implementation and Control (5th ed), Macmillan.
3.	Rajan Saxena (2009). Marketing Management (3rd ed), Tata McGraw Hill
Reference Books:	
1.	R Kumar& Goel (2013). Marketing Management (2nd ed), UDH Publishers, 2013.
2.	Tapan Panda (2012). Marketing Management (2nd ed), Excel Books
Web References:	
1.	https://www.marketo.com
2.	https://www.marketingeye.com
Online Resources:	
1.	https://www.coursera.org/learn/marketing-management
2.	https://www.coursera.org/learn/product-management

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C923.1	Analyze	Online Quiz-1	20
C923.2 - C923.3	Apply	Assignment-1	20
C923.4	Apply	Assignment-2	20
C923.5	Analyze	Online Quiz-2	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	-	-
Understand	30	20	20
Apply	30	30	30
Analyse	40	50	50
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	3	3	-	3	-	-	-	3	3	2	2	2	-
2	3	2	3	3	-	3	-	-	-	3	3	2	2	2	-
3	3	2	3	3	-	3	-	-	-	3	3	2	2	2	2
4	3	2	3	3	-	3	-	-	-	3	3	2	2	2	2
5	3	2	3	3	-	3	-	-	-	3	3	2	2	2	-
Avg.	3	2	3	3	-	3	-	-	-	3	3	2	2	2	2

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE924	LEAN STARTUP MANAGEMENT	3/0/0/3

Nature of Course	Theory application
Pre requisites	-

Course Objectives:

1.	To understand the challenges in becoming entrepreneurs
2.	To identify opportunities for business startup, developing a business model and a plan
3.	To recognize the legal issues and norms of the regulatory authorities governing the start- ups
4.	To apply the management skills in business and financial risks

Course Outcomes:
Upon completion of the course, students shall have ability to

C924.1	Understand the strategy for lean startup	[U]
C924.2	Identify the challenges and opportunities in lean startup	[AP]
C924.3	Develop and use business models and growth drivers	[AP]
C924.4	Analyze market size, cost structure, revenue streams and value chain	[AN]
C925.5	Plan business finance and understand cash flow strategy	[AN]

Course Contents:

Module 1: Business Startup **15 Hrs.**

Basics and road map – origin and types – product execution – research study on startup failure - small business, medium business and tech startups – incubators, corporators/accelerators, mentors, investors, government support – sole proprietorship and partnership firms - understanding the customers – assess market opportunities – minimum viable product – value proposition – customer segments – build measure learn process

Module 2: Business Model Development **15 Hrs.**

Channels and partners – revenue model and streams – key resources – activities – customer relationships – customer development processes – business model canvas – lean model – Byju‘s, Paytm, Oyo rooms, Uber, Amazon, Google, Facebook, Fintech and Freemium Business Models - templates - product/service to market – market plan including digital and viral marketing – role of advertisement in marketing - understanding SAAS (Software as a Service)

Module 3: Business Finance and Legal Regulatory **15 Hrs.**

Business plan and access to funding – visioning the venture – startup finance – costs, profits and losses – cash flow, angel investors, venture capitalists, bank loans and key elements of raising money – legal structure – regulatory, corporate social responsibility, standards and Taxes

Total Hours:	**45 Hrs.**

Text Books:

1.	Steve Blank, The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company, K & S Ranch, 1st edition, 2019
2.	Steve Blank, The Four Steps to the Epiphany: Successful Strategies for Products That Win, K&S Ranch, 5th edition, 2020

3.	Eric Ries, The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Crown Business, 2017
Reference Books:	
1.	Steve Blank, Holding a Cat by the Tail, K&S Ranch Publishing LLC, 2018
2.	Karal T. Ulrich, Steven D. Eppinger, Maria C. Yang, Product Design and Development, McGraw Hill, 7th Edition, 2020
3.	Peter Thiel and Blake Masters, Zero to One: Notes on Startups, or How to Build the Future, Currency; Illustrated Edition, 2019
Web References:	
1.	https://www.collectivecampus.io/blog/the-difference-between-design-thinking-lean-startup- and-agile
2.	https://netmind.net/en/design-thinking-vs-lean-startup/
Online Resources:	
1.	http://theleanstartup.com/
2.	https://hbr.org/2013/05/why-the-lean-start-up-changes-everything

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C924.1	Apply	Quiz	20
C924.2	Apply		
C924.3	Apply	Presentation	20
C924.4	Apply	Assignment	20
C924.5	Apply	Case study	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	-	-
Understand	30	20	20
Apply	30	30	30
Analyse	40	50	50
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	2	1	-	-	-	-	-	3	2	3	2	2	2	-
2	1	2	1	-	-	-	-	-	3	2	3	2	2	2	-
3	1	2	1	-	-	-	-	-	3	2	3	2	2	2	-
4	1	2	1	-	-	-	-	-	3	2	3	2	2	2	-
5	1	2	1	-	-	-	-	-	3	2	3	2	2	2	-
Avg.	1	2	1	-	-	-	-	-	3	2	3	2	2	2	-

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE925	RISK AND RELIABILITY ANALYSIS OF CIVIL INFRASTRUCTURE SYSTEMS	3/0/0/3

Nature of Course	Theory application
Pre requisites	-

Course Objectives:

1.	To identify the feasibility of risk and reliability in civil infrastructure systems
2.	To assess risk and reliability in civil infrastructure systems
3.	To relate risk and reliability in decision making process
4.	To analyze, evaluate and manage risk and reliability in civil infrastructure systems

Course Outcomes:

Upon completion of the course, students shall have ability to

C925.1	Understand the feasibility of risk and reliability in civil infrastructure systems	[U]
C925.2	Identify the risk and reliability in engineering projects	[AP]
C925.3	Analyze risk and reliability using existing methods and models	[AP]
C925.4	Assess the risk and reliability and make decisions in engineering	[AN]
C925.5	Manage risk and reliability in engineering projects	[AN]

Course Contents:

Module 1: Business Startup **15 Hrs.**

Importance of Risk in Civil Engineering infrastructures – Risk-Related terminology and definitions – fundamental of risk, risk planning, risk identification - importance of risk analysis – elements and types of risk analysis – risk Assessments – types of risk assessments - probabilistic risk assessment (PRA) – strength of PRA - Steps in conducting a PRA.

Module 2: Business Model Development **15 Hrs.**

Decision making techniques using risk information - Economic methods - Non economic techniques - scenario and logical modelling, development and quantification – Risk Events and factors - representation of risk values and risk acceptance criteria.

Module 3: Business Finance and Legal Regulatory **15 Hrs.**

Concept of simulations – Monte Carlo Simulation – simulation usage in risk identifications – limitations - cost benefit analysis – optimization criteria – risk analysis and management of projects – environmental health and safety risk assessment - evaluating public activities - case studies.

Total Hours:	**45 Hrs.**

Text Books:

1	Charles Yoe, Principles of Risk Analysis – Decision making under uncertainty, 2nd Edition, CRC Press, 2019
2.	Cheryl a. Wilhelmsen, Risk Assessment: Tools, Techniques, and Their Applications, 2nd Edition, Wiley, 2019
3.	Boardman, T. et al. — Cost-Benefit Analysis: Concepts and Practicell (Upper Saddle River, NJ), Prentice-Hall, 2018.

Reference Books:

1.	Vose, David , Risk Analysis: A Quantitative Guide, 3 rd Edition, John Wiley & Sons Ltd, 2018

2.	Modarres M,. Kaminskiy, V. Krivtsov, Reliability Engineering and Risk Analysis: A Practical Guide, 2nd Edition, CRC Press, Taylor & Francis Group, 2017
3.	B. M. Ayyub,Risk Analysis in Engineering and Economics, Chapman-Hall/CRC Press, 2019
Web References:	
1.	https://ocw.mit.edu/courses/engineering-systems-division/esd-72-engineering-risk-benefit-analysis-spring-2007/lecture-notes/
2.	https://www.pmi.org/learning/library/risk-analysis-project-management-7070
Online Resources:	
1.	https://nptel.ac.in/courses/105103023/21
2.	https://nptel.ac.in/courses/110107081/22

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C925.1	Apply	Quiz	20
C925.2	Apply		
C925.3	Apply	Assignment	20
C925.4	Apply	Assignment	20
C925.5	Apply	Case study	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	-	-
Understand	30	20	20
Apply	30	30	30
Analyse	40	50	50
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	2	-	-	-	-	-	-	3	2	3	2	2	1	-
2	1	2	-	-	-	-	-	-	3	2	3	2	2	1	-
3	1	2	-	-	-	-	-	-	3	2	3	2	2	1	-
4	1	2	-	-	-	-	-	-	3	2	3	2	2	1	-
5	1	2	-	-	-	-	-	-	3	2	3	2	2	1	-
Avg.	1	2	-	-	-	-	-	-	3	2	3	2	2	1	-

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE926	ROAD TRANSPORT MANAGEMENT AND ECONOMICS	3/0/0/3
Nature of Course	Theory Application	
Pre requisites	Nil	

Course Objectives:

1	Understand the role and economic importance of road transport in various industries and sectors
2	Evaluate the effects of government regulation on demand and supply in the road transport industry
3	Develop skills in pricing and revenue management for road transport services.
4	Analyze real-world regulatory and emerging trends issues in road transport management

Course Outcomes:

Upon completion of the course, students shall have ability to

C926.1	Understand the factors affecting demand and supply of road transport services	[U]
C926.2	Analyze travel behavior and apply forecasting techniques to estimate demand for road transport services	[AN]
C926.3	Analyze the effects of market power on pricing and competition.	[AN]
C926.4	Analyze real-world pricing and competition issues in road transport management	[AN]
C926.5	Analyze the impacts of regulatory and emerging trends issues on road transport management and economics.	[AN]

Course Contents: Theory

Module 1: Demand and Supply Analysis in Road Transport **15 Hrs.**

Economics of road transport with modes of transport - Factors affecting demand and supply of road transport services, including pricing, competition, and regulation - Forecasting techniques for estimating demand and capacity planning for optimizing supply - Case studies and exercises applying demand and supply analysis to road transport management

Module 2: Pricing and Competition in Road Transport **15 Hrs.**

Pricing strategies and tactics used in road transport markets, including price discrimination, bundling, and yield management - Market structure and competition in road transport, including oligopoly and monopolistic competition - Government intervention in pricing and competition, including price controls and antitrust regulation - Case studies and exercises analyzing pricing and competition issues in road transport management

Module 3: Regulation and Emerging Trends in Road Transport **15 Hrs.**

Regulatory framework for road transport, including safety and environmental regulations - Infrastructure planning and development, including public-private partnerships and funding mechanisms - Emerging trends and technologies in road transport, including digitalization, automation, and alternative fuels - Case studies and exercises exploring regulatory and emerging trends issues in road transport management

Total Hours	**45 Hrs.**

Text Books:	
1	Ravinder N. Batta, Economics of the Road Transport, Kalpaz Publications, 2008
2	Kenneth D Boyer, Principles of Transportation Economics, Addison-Wesley Publishers, 2017.
3	Emile Quinet, Roger Vickerman, Principles of Transport Economics, Elgar Publishing, Incorporated, 2015.
Reference Books:	
1	Stephen Iso, The Implementation and Effectiveness of Transport Demand Management Measures: An International Perspective, Routledge; 1st edition, 2017
2	Måns Nilsson, Paving the Road to Sustainable Transport: Governance and innovation in low-carbon vehicles, Routledge; 1st edition, 2016
3	Fenelon, K.G, The Economics of Road Transport, Routledge; 1st edition, 2018.
4	John H.E. Taplin, Cost–Benefit Analysis and Evolutionary Computing: Optimal Scheduling of Interactive Road Projects, Edward Elgar Publishing Ltd, 2015
Web References:	
1	https://onlinecourses.nptel.ac.in/noc21_ce72/preview
2	https://onlinecourses.nptel.ac.in/noc21_ce35/preview
Online Resources:	
1	https://openknowledge.worldbank.org/entities/publication/f632bbcc-023f-547a-bab4-0f4ec3173371
2	https://www.abacademies.org/articles/logistics-management-practices-in-road-freight-transport-companies-8522.html

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C926.1	Apply	Quiz	20
C926.2	Apply		
C926.3	Apply	Assignment	20
C926.4	Apply	Assignment	20
C926.5	Apply	Case study	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	-	-
Understand	30	20	20
Apply	30	30	30
Analyse	40	50	50
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	2	-	-	-	-	-	-	3	2	3	2	2	1	-
2	1	2	-	-	-	-	-	-	3	2	3	2	2	1	-
3	1	2	-	-	-	-	-	-	3	2	3	2	2	1	-
4	1	2	-	-	-	-	-	-	3	2	3	2	2	1	-
5	1	2	-	-	-	-	-	-	3	2	3	2	2	1	-
Avg.	1	2	-	-	-	-	-	-	3	2	3	2	2	1	-

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE927	VALUATION OF REAL PROPERTIES	3/0/0/3

Nature of Course	Theory Concept
Pre requisites	Nil

Course Objectives:

1	To understand fundamental concepts on the valuation of Civil Engineering structures.
2	To analyze different technicalities involved in the valuation of properties.
3	To understand all legal practices to be adopted in practices of valuation.
4	To apply different methods of valuation of properties.

Course Outcomes:
Upon completion of the course, students shall have ability to

C927.1	Perform valuation of a property with appropriate methods.	[AP]
C927.2	Appraise different legal norms, constraints involved in the valuation of properties, and Indian accounting standards.	[AN]
C927.3	Appraise the different approaches to value-income, market and the cost approach.	[AN]
C927.4	Analyze the factors influencing the life of the building and estimating the future life.	[AN]
C927.5	Compute various methods of computation of depreciation, functional technological and economic obsolescence.	[AP]

Course Contents: Theory

Module1: Valuation of Property **15 Hrs.**

Types of Value - Basic elements of Value Marketability, Utility, Scarcity, and Transferability - Factors affecting Valuation - Physical, Economic, Legal and Social - Highest and Best Use, Value in Use, Value in Exchange - Real Property: Rights and Interests in Real Estate, Types of ownerships and Types of occupancy in Real Estate - Annuities, Capitalization, Rate of Capitalization, Years Purchase, Sinking Fund, Redemption of Capital, Reversionary Value - Construction and use of Valuation Tables Urban Infrastructure and its influence on Value of Real Estate - Real Estate Market and its characteristics, Investment in Real Estate, Factors influencing Demand and Supply Schedule in Real Estate - Different valuation methods and problems on it.

Module 2: Income Approach to Value **15 Hrs.**

Relation between Income and Value - Valuation of Property affected by the Rent Control Act, Licensed property under the Easement Act and Leasehold properties under the Transfer of Property Act - Derivation of Yield Rate from Market Derived Data. - Remunerative Rate of Interest and Accumulative Rate of Interest -Types of rent: Outgoings, income, Yield, Years Purchase-Determination of Market Rent and Standard Rent-Lease: lessor and lessee: Types of Leases, Lease provisions and Covenants. Valuation of Lessor‘s Interest, Lessee‘s Interest including Sub-Lease in Leased Property. Premature Termination of Lease or Surrender of Lease. - Real Estate as an Investment, Yield from Real Estate vis à - vis other forms of Investments-sound Investment Comparison. - Investment Decisions: Discounted Cash Flow Techniques - Internal Rate of Return (IRR) and Net Present Value (NPV) Profit Method.

Module 3: Cost Approach to Value and Documentation **15 Hrs.**

Methods of Cost - Estimates for Buildings - Life of Building: Economic/Physical/Legal. - Factors affecting life of the building. - Total Life, Age, Estimating Future Life - Various methods of Computation of Depreciation, Functional, Technological and Economic Obsolescence – Reproduction Cost / Replacement cost, Depreciated Replacement Cost (DRC) working, adopting

DRC as Value subject to Demand and Supply aspect - Land Value by Market Approach and Building Value by Cost Estimation Method for Owner Occupied Bungalows, Factories, Public Buildings.	
Total Hours	**45 Hrs.**
Text Books:	
1	Rangwala., Valuation of Real Properties, Charotar Publishing House, 2015.
2	Douglas Scarrett, and Sylvia Osborn, Property Valuation: The Five methodsǁ, Routledge, 2014.
3	Joshua Kahr and Michael C. Thomsett, Real Estate Market Valuation and Analysis, John Wiley &Sons, Inc., 2005.
Reference Books:	
1	David Isaac and John O'Leary, Property Valuation Techniques:13, Palgrave Macmillan, 2013.
2	Syamales Datta, Mastering Real Estate Valuation, Syamales Datta, 2018.
3	Peter Wyatt, Property Valuation, Wiley-Blackwell, 2013.
4	Andrew Baum, David Mackmin & Nick Nunnington, The Income Approach to Property Valuation, Routledge, 2017.
Code Books:	
1	Handbook on Best Practices for Registered Valuers, The Institute of Chartered Accountants of India, 2021
2	Guidelines for Valuation of Immovable Properties, 2018
Web References:	
1	https://cpwd.gov.in/Publication/GuidelinesProperties2009.pdf
2	https://www.mca.gov.in/Ministry/pdf/Notice_14042020.pdf
3	https://pmmodiyojana.in/tamil-nadu-guideline-value/#content
Online Resources:	
1	https://nptel.ac.in/courses/105/103/105103093/
2	https://pvaivpo.org/
3	https://iica.nic.in/valuation/

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)
Formative Assessment based on Capstone Model

Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C927.1	Apply	Quiz	20
C927.2	Apply		
C927.3	Apply	Assignment	20
C927.4	Apply	Assignment	20
C927.5	Apply	Case study	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	-	-	-
Understand	30	20	20
Apply	30	30	30
Analyse	40	50	50
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	-	-	-	2	2	2	2	3	-	2	-
2	3	3	2	2	-	-	-	2	2	2	2	3	-	2	-
3	3	3	2	2	-	-	-	2	2	2	2	3	-	2	-
4	3	3	2	2	-	-	-	2	2	2	2	3	-	2	-
5	3	3	1	1	-	-	-	2	2	2	2	3	-	2	-
Avg.	3	2.6	1.6	1.6	-	-	-	2	2	2	2	3	-	2	-

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

EMERGING ELECTIVE

22CE007	Applications of Sensors and IoT in Civil Engineering	3/0/0/3

Nature of Course	Theory
Pre requisites	Nil

Course Objectives:

1.	To learn the various types of sensors, sensor output signal types, calibration techniques, formulation of system equation and its characteristics
2.	To obtain the basic knowledge about transducers and its classifications
3.	To familiarize students with applications of different sensors
4.	To understand the basic concept of IoT

Course Outcomes:
Upon completion of the course, students shall have ability to

C007.1	Understand various sensor types, sensor characteristics and signal types.	[U]
C007.2	Understand the classification and types of transducers.	[U]
C007.3	Analyse the applications of different sensors	[AP]
C007.4	Understand and explain the concept of IoT	[AP]
C007.5	Analyze applications of IoT in real time scenario	[AP]

Course Contents:

Module 1: Sensor Classification, Characteristics and Signal Types 15 Hrs.
Basics of Measurement – Classification of Errors – Error Analysis – Static and Dynamic Characteristics of Transducers – Performance Measures of Sensors – Classification of Sensors – Sensor Calibration Techniques – Sensor Outputs - Signal Types - Analog and Digital Signals, PWM and PPM.

Module 2: Transducers and Other Special Sensors 15 Hrs.
Role of transducers in instrumentation- Advantages of electrical transducers - Classification of transducers - Analog and Digital, Active and passive, Primary and Secondary transducers - Sensors for environmental Monitoring, Humidity Sensor, Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.

Module 3: Applications of IoT in Civil Engineering 15 Hrs.
Evolution of Internet of Things – Enabling Technologies – Simplified IoT Architecture – IoT applications: Business models for the IoT, Smart city, Smart mobility and transport, Industrial IoT, Smart health, Environment monitoring and surveillance – Home Automation – Smart Agriculture

Total Hours: 45 Hrs.

Text Books:

1.	Patranabis.D, Sensors and Transducers, 2nd Edition, Prentice Hall India Ltd,2003
2.	Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017
3.	Samuel Greengard, The Internet of Things, The MIT Press, 2015

Reference Books:

1.	Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012

2.	IOT (Internet of Things) Programming: A Simple and Fast Way of Learning, IOT Kindle Edition.
3.	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
4.	ArshdeepBahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015
Web References:	
1.	https://www.arduino.cc/
2.	https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet
Online Resources:	
1.	https://nptel.ac.in/courses/114106035/38
2.	https://nptel.ac.in/courses/105104030/38

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C007.1	Understand	Assignment	20
C007.2	Apply	Assignment	20
C007.3 & C007.4	Apply	Quiz	20
C007.5	Apply	Group Assignment	20

Assessment based on Summative and End Semester Examination			
Bloom’s Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	20	20	20
Understand	30	30	30
Apply	50	30	30
Analyse	-	20	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	1	1						1		3	2	2	
2	2	2	1	1						1		3	2	2	
3	2	2	2	1						1		3	2	2	
4	2	2	2	1						1		3	2	2	
5	2	2	2	1						1		3	2	2	
Avg.	2	2	1.6	1						1		3	2	2	

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE008	BUILDING AND TOWN PLANNING	3/ 0/ 0/ 3
Nature of Course	Theory Concept	
Pre requisites	-	

Course Objectives:

1	Interpret various policies, strategies on issues related to urban development.
2	Discuss contents of regional plan, Master plan, DCR planning and development of Industrial estates and SEZ.
3	Analyze the constraints of Plan implementation –Industrial, financial and Legal constraints.
4	Summarize principles of sustainable transportation and to know the significance of relation between urban development and environment

Course Outcomes:
Upon completion of the course, students shall have ability to

C008.1	Interpret National policies and Strategies on Urban Development.	U
C008.2	Discuss contents of Master plan, Detailed development plan and DCR Planning.	U
C008.3	Analyze Industrial, financial and legal constraints of plan implementation.	AP
C008.4	Summarize different principles and methods of sustainable transportation.	U
C008.5	Discuss its implications on Environment and resources and to know economic benefits of sustainable transportation.	AP

Course Contents: Theory

Module 1 - Urban planning and Development **15 Hrs.**

Introduction-Definition of terms, Explanation of concepts, National policies and strategies on issues related to Urban development – Trends of Urbanization- Positive and Negative impacts of Urban Development Principles of planning – Types and levels of Urban plans, Stages in the planning process. -Scope and content of Regional Plan, Master Plan, Detailed Development Plan, Structure Plan, Sub Regional Plan, DCR planning and developments of industrial estates, SEZ, Development strategies, formulation and evaluation.

Module 2 - Plan implementation and urban Management **15 Hrs.**

Constraints for plan implementation – Industrial, Financial and Legal Constraints, Institutional Arrangements for Urban Development – Financing of Urban Developments - Decision Support System for Urban Management – Involvement of public, private, NGO, CBO & Beneficiaries.

Module 3 - Sustainable urban and Transport principles	**15 Hrs.**
Urban Environmental Sustainability, Urban Sustainable Development, Methods and Tools for Sustainable Appraisal, Sustainable Transportation – Principles, indicators and its implications Environment and Resources- Economic Benefits of Sustainable Transportation Urban region and environment- Sustainability Assessment, Future Scenarios, Shape of Urban Region, Managing the change, Integrated Planning, Sustainable Development- City Centre, Development Areas, Inner City Areas, Suburban Areas, Periurban and Country side, Economy and Society.	
Total Hours	**45 Hrs.**

Text Books:	
1	Goel .S.L, “Urban Development and Management”, Deep and Deep publications, New Delhi, 2018.
2	Rangwala. S.C. “Town Planning” Charotar Publishing House. Anand, 2019.
3	Gary Hack,” Local Planning: Contemporary Principles and Practice” ICMA Press, 2015.
Suggested Readings:	
1	Singh.V.B, “Revitalized Urban Administration in India”, Kalpaz publication, New Delhi, 2018.
2	Joe Ravetz, “City Region 2020 – Integrated Planning for a Sustainable Environment”, 2019.
3	Sustainable Transportation and TDM – Planning the balances, “Economic, Social and Ecological objectives”; Victoria Transport Policy Institute, 2007.
4	Kevin Lynch, “Site planning”, MIT Press, Cambridge, MA, 1984.
Web References:	
1	https://www.sustainablelearning.com/resource/my-green-city
2	https://guides.library.harvard.edu/gsd/urban/print
Online Resources:	
1	http://nptel.ac.in/courses/105107067/
2	https://www.edx.org/course/sustainable-urban-environments-trinityx-course-

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C008.1 to C008.5	Apply	Technical Report through Case Study	20
C008.1 to C008.3	Analyze	Assignment	20
C008.4 to C008.5	Apply	Assignment	20
C008.1 to C008.5	Analyze	Technical Quiz	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	10	10	10
Apply	30	30	30
Analyse	50	50	50
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Programme Outcomes (PO)Programme Specific Outcomes (PSO) - Theory

Cos	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	-	-	-	2	2	2	-	-	-	1	2	-
2	3	2	1	-	-	-	2	2	2	-	-	-	1	2	-
3	3	2	1	-	-	-	2	2	2	-	-	-	1	2	-
4	3	2	1	-	-	-	2	2	2	-	-	-	1	2	-
5	**3**	**2**	**1**	**-**	**-**	**-**	**2**	**2**	**2**	**-**	**-**	**-**	**1**	**2**	-
Avg.	**3.0**	**2.3**	**-**	**2.0**	**-**	**2.0**	**-**	**2.0**	**1.0**	**2.0**	**1.0**	**1.0**	**2.0**	**2.4**	-

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE009	ENVIRONMENTAL ETHICS AND MANAGEMENT	3/0/0/3

Nature of Course	Theory Concepts
Pre requisites	-

Course Objectives:

1	To know in depth that our existence is impossible if the nature does not exist.
2	To increase public awareness about environmental issues, explore possible solutions.
3	To inculcate the skills for environmental performance assessment in terms of legal compliance, pollution prevention and continual improvement.
4	To impart an understanding of systems approach to Environmental Management as per ISO 14001.

Course Outcomes:

Upon completion of the course, students shall have ability to

C009.1	Demonstrate the importance of environmental ethics.	U
C009.2	Explain the various elements of Corporate Environmental Management systems and audits complying with international environmental management system standards.	U
C009.3	Apply the knowledge of science and engineering fundamentals to pollution prevention assessment and environmental performance evaluation.	AP
C009.4	Develop environmental management systems for organisations.	AP
C009.5	Conduct research pertinent to pollution prevention and communicate effectively to different stakeholders as well as engage in independent life-long learning.	AN

Course Contents: Theory

Module 1: ENVIRONMENTAL ETHICS **15 Hrs.**

Introduction to environmental ethics - History of environmental ethics – Anthropocentrism - Ecological footprint analysis - Indigenous world views – Ecofeminism - Deep Ecology - Animal Rights - Social Ecology - Socially Just Conservation - Global ethics in practice - Corporate social responsibility (CSR) - Climate Justice - Food Security - Water rights – Fishing - Population Growth- Case study.

Module 2: ENVIRONMENTAL MANAGEMENT STANDARDS **15 Hrs.**

Unique Characteristics of Environmental Problems - Classification of Environmental Impact Reduction Efforts - Systems approach to Corporate environmental management – Business Charter for Sustainable Production and Consumption – Tools and Barriers – Evolution of Environmental Stewardship – National policies on abatement of pollution and conservation of resources – Charter on Corporate responsibility for Environmental protection – Environmental quality objectives – Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking.

Module 3: ENVIRONMENTAL MANAGEMENT SYSTEM **15 Hrs.**

ISO 14000 family- EMS as per ISO 14001 – benefits and barriers of EMS – Understanding the organisation and its context – Understanding the needs and expectations of interested parties – Determining the scope of the environmental management system – Leadership and commitment – Environmental policy – Organizational roles, responsibilities and authorities – Actions to address risks

and opportunities – Environmental objectives and planning – Resources – Competence – Awareness – Communication – Documented Information – Operational Planning and Control – Emergency preparedness and response- Monitoring, measurement, analysis and evaluation – Management review- Case study.	
Total Hours	**45 Hrs.**
Text Books:	
1	Robin Attfield, "Environmental Ethics: A Very Short Introduction", Oxford University Press, 2018.
2	ISO 14001/14004:2015 Environmental management systems – Requirements and Guidelines – International Organisation for Standardisation, 2015.
3	Marek Bugdol and Piotr Jedynak, Integrated Management Systems, Springer International, 2015.
4	Milton P Dentch, "The ISO 14001: 2015 Implementation Handbook: Using the Process Approach to Build an Environmental Management System", ASQ Quality Press, 2016.
Suggested Readings:	
1	Gregory Bassham, "Environmental Ethics: The Central Issues", Hackett publishing company, 2021.
2	ISO 14031:2013, Environmental management -- Environmental performance evaluation Guidelines, International Organisation for Standardisation, 2015.
3	Paul L Bishop 'Pollution Prevention: Fundamentals and Practice', McGraw- Hill International, Boston, 2004.
4	Christopher Sheldon and Mark Yoxon, "Environmental Management Systems: A Step-by-Step Guide to Implementation and Maintenance", Routledge, 2006.
Web Reference:	
1	https://www.conserve-energy-future.com/environmental-ethics.php
2	https://www.epa.gov/ems#:~:text=An%20Environmental%20Management%20System%20(EMS,and%20increase%20its%20operating%20efficiency.
Online Resources:	
1	https://www.coursera.org/learn/environmental-management-ethics
2	https://www.udemy.com/topic/environmental-management/

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**
Assessment Methods & Levels (based on Blooms' Taxonomy)					
Formative Assessment based on Capstone Model					
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**		**FA (16%) [80 Marks]**	

C009.1 to C009.5	Apply	MOOC Certifications	20
C009.1 to C009.5	Analyze	Technical Report through Case Study	20
C009.1 to C009.5	Apply	Assignment	20
C009.1 to C009.5	Analyze	Technical Quiz	20

Assessment based on Summative and End Semester Examination

Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	20	20	20
Apply	40	40	40
Analyse	30	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

Continuous Assessment (40%) [200 Marks]					**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**		
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**	
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	**POs**												**PSOs**		
	1	2	3	4	5	6	7	8	9	10	12	12	1	2	3
1	3	-	-	-	-	-	-	3	-	-	-	1	-	3	-
2	3	3	-	2	-	2	-	2	1	2	-	-	-	2	2
3	3	2	-	2	-	-	-	2	1	2	1	-	2	2	2
4	3	2	-	2	-	2	-	2	1	2	-	-	2	2	2
5	3	2	-	2	-	2	-	1	1	2	1	-	2	3	1
Avg.	**3.0**	**2.3**	**-**	**2.0**	**-**	**2.0**	**-**	**2.0**	**1.0**	**2.0**	**1.0**	**1.0**	**2.0**	**2.4**	**1.8**

22CE010	ENVIRONMENTAL GEOTECHNICS	3/0/0/3
Nature of Course	Theory	
Pre requisites	Environmental Engineering and Geotechnical Engineering	

Course Objectives:

1	To understand the mechanism involved in Soil–Water–Air Interaction.
2	To study the nature of pollution and effect of pollution on environment.
3	To learn about the process of waste management and regulations on waste handling and management
4	To study the various techniques of waste disposal methods for protect our environment

Course Outcomes:

Upon completion of the course, students shall have ability to

C010.1	Comprehend interdisciplinary issues pertaining to environment and geotechnical engineering.	[U]
C010.2	Develop sustainable and environmentally sound solutions for geotechnical problems	[AP]
C010.3	Understand the relevance of various legal aspects involved in addressing environmental consequences associated with geotechnical issues	[U]
C010.4	Identify the suitable mode of disposal for the treated wastewater without endangering the environment	[AP]
C010.5	Analyze the techniques involved in the remediation of contaminated soil	[AN]

Course Contents: Theory

Module 1: Soil- Water- Environment Interaction **15 Hrs.**

Environmental cycles - Soil and water - Environmental interaction relating to geotechnical problems - Effect of pollution on soil - water behavior - Soil fabric and structure – Gravitational and surface forces - Intersheet and interlayer bonding in the clay minerals - Basic structural units of clay minerals - Effect of drying, shrinkage, swelling and cracking characteristics of soil - Electrochemical characteristics of soil-water system – Sensitivity of soil - Mechanisms and Reactions of Soil–Water–Air Interaction in the Environment

Module 2: Contaminant transports through porous media **15 Hrs.**

Characteristics and classification of contaminants – Potential problems in soils due to contaminants - Ground water flow – Sources of groundwater contamination – Contaminant transport – Pollution of aquifers by mining and liquid wastes – Ground water pollution downstream of landfills – Transport mechanisms - CPCB rules and regulations on waste handling and management – Criteria for selection of sites for waste disposal – Disposal techniques -Disposal systems for typical wastes - Ground modification and waste modification techniques in waste management

Module 3: Soil contamination and remediation	**15 Hrs.**
Liners and covers for waste disposal – rigid and flexible liners – Leachate and gas collection system – Engineered landfills (including basal liner and cover liner systems) – components – design criteria - Hydrological design for groundwater pollution control - Chemical Analysis of Contaminated Soils - Tools for Monitoring Contaminated Soils - Site Characterization - Soil contamination and remediation technology for both ground and aquifers.	
Total Hours	**45 Hrs.**

Text Books:	
1	Fang H.Y. and Chaney R.C., "Introduction to Environmental Geotechnology" CRC Press, 2016.
2	Sarsby R.W., "Environmental Geotechnics" ICE Publishing, 2013.
3	Hsai Yang Fang and John Daniel, "Introduction to Environmental Geotechnology", CRC press, Taylor and Francis, Second Edition, 2013
4	Sharma H.D. and Reddy K.R., "Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies" John Wiley & Sons, 2016
Suggested Readings:	
1	Yong R.N., Mulligan C.N., Fukue M., "Sustainable Practices in Geoenvironmental Engineering" CRC Press, 2017.
2	Bleam W., "Soil and Environmental Chemistry" Academic Press, 2016
3	Reddi L.N. and Inyang H. I., "Geoenvironmental Engineering, Principles and Applications" CRC Press, 2014
4	Thompson C. and Nathanail P., "Chemical Analysis of Contaminated Land" Wiley-Blackwell, 2017
Web References:	
1	https://ascelibrary.org/journal/jggefk
2	http://164.100.161.188/cms/Latest-Manual-Part-B-Operation-and-Maintenance-2013.php
3	http://mohua.gov.in/cms/Latest-Manual-Part-C-Management-2013.php
4	http://cpheeo.gov.in/cms/manual-on-municipal-solid-waste-management-2016.php
Online Resources:	
1	https://www.icevirtuallibrary.com/toc/jenge/
2	http://nptel.ac.in/courses/105106119/

Continuous Assessment					**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**	**End Semester Examination**	
80	**120**	**200**	**40**	**60**	**100**
Assessment Methods & Levels (based on Blooms' Taxonomy)					
Formative Assessment based on Capstone Model					
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**		**FA (16%) [80 Marks]**	

C010.1 – C010.2	Apply	Assignment	20
C010.3	Understand	Seminar	20
C010.4	Apply	Quiz	20
C010.5	Analyze	Case study	20

Assessment based on Summative and End Semester Examination

Bloom's Level	Summative Assessment (24%) [120 Marks]		End Semester Examination (60%) [100 Marks]
	CIA1 : [60 Marks]	CIA2 : [60 Marks]	
Remember	10	10	10
Understand	40	20	20
Apply	50	40	50
Analyse	-	30	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	12	12	1	2	3
1	3	3	2	2	-	2	2	2	2	-	-	3	1	3	2
2	3	2	2	2	1	1	2	2	2	-	-	2	2	2	2
3	2	2	2	2	1	1	-	2	1	-	-	2	1	2	2
4	3	3	2	1	-	1	1	-	1	-	-	3	1	3	2
5	3	3	3	-	1	2	2	1	1	-	-	3	2	3	2
Avg.	**3.0**	**2.3**	**2**	**2.0**	**1**	**1.5**	**2**	**2.0**	**1.5**	**-**	**-**	**3**	**1.5**	**1.9**	**2**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE011	LOW CARBON BUILDING MATERIALS AND SYSTEMS	3/0/0/3

Nature of Course	Theory Concept
Pre requisites	Nil

Course Objectives:

1.	To give an overview of carbon neutral approaches adopted in the construction industry.
2.	To use low carbon building materials and understand its significance.
3.	To understand the significance of alternate roofing and flooring systems
4.	To understand the various techniques in optimization of Embodied and operational energy.

Course Outcomes:
Upon completion of the course, students shall have ability to

C011.1	Interpret the policies in carbon neutral approach adopted in construction industry	[U]
C011.2	Evaluate the different ideologies in embodied energy calculations.	[U]
C011.3	Summarize the various low carbon construction materials and its significance	[U]
C011.4	Highlight the alternative roof and floor systems and its low environmental impact.	[U]
C011.5	Understand embodied and operation energy optimization techniques.	[U]

Course Contents:

Module 1 – Carbon Neutral Approach and Energy Concepts **15 Hrs**

Construction Industry – Carbon Emissions – Introduction – Current Scenario – Future Possibility – Constraints – Carbon Neutral Approach policies in Infrastructure industry – National & International Scenario – Embodied Energy – Introduction – Components – Cradle to Gate vs Cradle to Site vs Cradle to Grave to Cradle to Cradle approaches in Embodied Energy – Operational Energy – Introduction – Components

Module 2 – Low Carbon Materials and Systems **15 Hrs**

Adobe, Cob, Wattle and Daub, Rammed Earth, Earthcrete, Lime Prepearation, Lime plastering, mud plastering, Bamboo, Random Rubble, Rubble Trench Foundations, Reclaimed and Recycled products / upcycling – Masonry vaults & domes, Alternate Roofing systems – Filler slabs – Composite beam and Panel roofs – Jack arch roof (curved panel) – Reinforced soil cement block work flat panel

Module 3 - Embodied Energy Calculation and Optimization **15 Hrs**

Embodied Energy – Calculation – Methods – Optimization techniques – Operational Energy – Calculation – Methods – Optimization techniques – Simulation techniques – Role of softwares

Total Hours:	**45 Hrs.**

Text Books:

1.	Bruce King ,The New Carbon Architecture: Building to cool the climate, New Society Publishers ,2017
2.	David Benjamin, Embodied Energy and Design: Making Architecture between Metrics and Narratives, Lars Muller Publisher ,2017

3.	Seetal Solanki, Why Materials Matter: Responsible Design for a Better World, Prestel Publisher ,2018
Reference Books:	
1.	Sustainable Design, David Bergman, Princeton Architectural Press,2018
2.	Sustainable Residential Architecture, Ana Maria Alvarez, Fire Fly books Pvt. Ltd. 2014
3.	Energy / People / Buildings: Making sustainable architecture work, Judit Kampian, Hattie Harman, RIBA Publishing ,2021
4.	Designing for the Climate Emergency: A Guide for Architecture Students, Sofie Pelsmaker, Adan Hoggard, RIBA Publishing ,2022
Web References:	
1.	https://www.lowcarbonmaterials.com/
2.	http://urbanplanet.info/europe/low-carbon-materials/
Online Resources:	
1.	https://www.classcentral.com/course/edx-essential-tools-for-the-low-carbon-economy-7859
2.	https://www.cseindia.org/online-training-program-on-low-carbon-pathways-for-industrial-sectors-11519

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model (8%)			
Course Outcome	**Bloom's Level**	**Assessment Component**	**FA (16%) [80 Marks]**
C011.1- C011.5	U	Project Based Learning	80

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	10	10	10
Apply	30	30	30
Analyse	50	50	50
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	-	-	-	2	2	2	-	-	-	1	2	1
2	3	2	1	-	-	-	2	2	2	-	-	-	1	2	1
3	3	2	1	-	-	-	2	2	2	-	-	-	1	2	1
4	3	2	1	-	-	-	2	2	2	-	-	-	1	2	1
5	3	2	1	-	-	-	2	2	2	-	-	-	1	2	1
Avg.	3	2	1	-	-	-	2	2	2	-	-	-	1	2	1

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE012	METRO RAIL ENGINEERING AND INFRASTRUCTURE	3/0/0/3

Nature of Course	Theory Concept
Pre requisites	Nil

Course Objectives:

1.	To acquire the knowledge of metro rail systems, planning and financials.
2.	To understand the working of mechanical components in metro rail systems.
3.	To learn the civil engineering structures in metro rail engineering.
4.	To know the functioning systems and advancements in metro rail systems.

Course Outcomes:

Upon completion of the course, students shall have ability to

C012.1	Fathom the knowledge of metro rail establishments.	[U]
C012.2	Figure out the ventilation and safety requirements for metro rail systems.	[AN]
C012.3	Recommend the structural concepts for a metro rail infrastructure.	[AP]
C012.4	Appraise the facilities requirements and management systems for a metro rail infrastructure.	[AN]
C012.5	Address the electrification systems required for metro rail functioning.	[AP]

Course Contents: Theory

Module 1: Basics of Metro Rail Systems **15 Hrs**

Origin of Metro Rail System – Overview of World Metro Systems– Need for Metro rail network – Metro rail planning, selection and financials – Rolling stock – Vehicle dynamics and structure – Tunnel ventilation systems – Air conditioning for stations and buildings – Fire control systems – Lifts and escalators.

Module 2: Civil Engineering Aspects **15 Hrs**

Overview and construction methods - Elevated and Underground stations, Viaducts and bridges, Underpass tunnels – Initial surveys and Investigation – Construction planning & Management – Construction Quality and Safety systems – Depots – Commercial and Service buildings – Traffics management – Multimodal transportation– Pedestrian facilities —– Permanent way: systems and facilities management. Safety measures in Metro.

Module 3: Metro Rail Functioning Systems **15 Hrs**

OHE – Traction power – Substations: TSS and ASS – Power SCADA – Standby and backup systems – Operation Control Centre (OCC and BCC) – SCADA and other control systems – Signaling systems –Platform screen doors – Automatic fare collections – Green buildings: Certification systems and benefits, Carbon credits and clear air mechanics – Environmental and social safeguards.

Total Hours:	**45 Hrs.**

Text Books:

1.	Paul Garbutt, “WORLD METRO SYSTEMS Urban Transport Trains Light Railway Underground Subway”, Capital Transport, 2006.
2.	Ramachandran M., “Metro Rail Projects in India: A study in Project Planning”, Oxford University Press; 2011.

3.	Daniel Martins, “Electrical Power systems and control centers”, CRC Press, 2016.
Reference Books:	
1.	Umesh Rai B., “Handbook of Research on Emerging Innovations in Rail Transportation Engineering”, IGI Global Publishers, 2016.
2.	Catherine Zerdoun, “Underground: Subways and Metros of the world”, Firefly Books, 2016.
3.	Mark Ovenden “Metro Maps of the World” Capital Transport Publishing, 2003.
4.	Ethan N. Elkind “Metro Rail and Future of the city” University of California, 2014.
Web References:	
1.	Manual for standard sand specifications for railway stations, 2009.
2.	The Metro railways (Operation and Maintenance) ACT, 2002.
Online Resources:	
1.	https://themetrorailguy.com/metro-rail-projects-in-india/
2.	https://www.railway-technology.com/projects/delhi-metro/

Continuous Assessment(40 Marks)				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C012.1	Analyze	Online Quiz	20
C012.2	Apply	Assignment	20
C012.3 & C012.4	Analyze	OCLE	20
C012.5	Analyze	Online Quiz	20

Assessment based on Summative and End Semester Examination			
Bloom’s Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	-	-
Understand	30	25	25
Apply	40	40	40
Analyse	30	35	35
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks			CA 2 : 100 Marks			
SA 1 (60 Marks)	FA 1 (40 Marks)		SA 2 (60 Marks)	FA 2 (40 Marks)		
	Component - I (20 Marks)	Component - II (20 Marks)		Component - I (20 Marks)	Component - II (20 Marks)	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	1	2	-	-	-	1	-	1	2	1	1	2	-
2	3	2	2	1.	-	2	1	1	-	1	-	1	1	2	2
3	3	2	1	-	-	-	-	1	-	1	-	1	2	1	1
4	1	3	2	-	-	2	1	1	-	1	1	1	2	1	-
5	3	2	2	1	-	2	1	1	-	1	-	1	1	2	2
Avg.	2.7	1.8	1.7	1.3	-	1.8	1.3	1.0	-	1.0	1.5	1.0	1.3	1.7	1.8

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE013	NANOTECHNOLOGY IN CIVIL AND ENVIRONMENTAL ENGINEERING	3/0/0/3

Nature of Course	Theory
Pre requisites	Nil

Course Objectives:

1.	To understand the integration of nanotechnology principles into civil and environmental engineering.
2.	To recognize how nanoscale phenomena influence material properties, environmental interactions, and infrastructure performance.
3.	To develop the construction materials using nanoparticles
4.	To explore the diverse range of nanomaterials used in environmental engineering

Course Outcomes:
Upon completion of the course, students shall have ability to

C013.1	Understanding of the fundamental principles of nanotechnology and	[AP]
C013.2	Develop skills in analyzing the structure and properties of nanomaterials	[AN]
C013.3	Comprehend the applications of nanomaterials in construction materials, including concrete, cement, and steel	[AP]
C013.4	Investigate the applications of nanotechnology in water and wastewater treatment.	[AP]
C013.5	Assess the role of nanotechnology in sustainable infrastructure development, and air purification	[AP]

Course Contents:

Module 1: Fundamentals of Nanotechnology **15 Hrs.**

Significances of nanotechnology in civil engineering – Properties: size-dependent properties, surface area, quantum effects. Types: nanoparticles, nanofibers, nanocomposites - Nanoscale - Materials Science - Structure of materials at the nanoscale - Properties of nanomaterials - Synthesis and characterization of nanomaterials - Mechanical and chemical properties of nanomaterials.

Module 2: Nanotechnology in Materials Science **15 Hrs.**

Nanomaterials and their applications in construction materials - Functionalized nanomaterials and their use in concrete and cement - Development of self compacting concrete - self-healing concrete using nanotechnology - Nanoparticles and their use in enhancing the properties of steel cables – carbon nanotubes

Module 3: Nanotechnology in Environmental Engineering **15 Hrs.**

Applications of nanotechnology in water and wastewater treatment - Nanosensors for environmental monitoring - Nanomaterials and their use in air purification - Nanotechnology and its role in sustainable infrastructure development

Total Hours: 45 Hrs.

Text Books:	
1.	Ghasan Fahim Huseien, Kwok Wei Shah, “Sustainable Nanomaterials for the Construction Industry”, CRC Taylor & Francis Group publisher, 2022
2.	Sulabha K. Kulkarni, “Nanotechnology:Principles and Practices", Springer International publisher, New Delhi, 2014
3.	Rabia Nazir, “Nanotechnology Applications in Environmental Engineering”, IGI Global publisher, 2018
Reference Books:	
1.	Charles P. Poole Jr. and Frank J Owens, “Introduction to Nanotechnology", John Wiley & Sons Publisher, Canada, 2003
2.	Annibale Luigi Materazzi, Antonella D'Alessandro, Filippo Ubertini, Nanotechnology in Cement-Based Construction, Jenny Stanford Publishing 2020
3.	M. H. Fulekar, Bhawana Pathak, “Environmental Nanotechnology”, CRC Taylor & Francis Group publisher, 2017
Web References:	
1.	https://nanografi.com/blog/applications-of-nanomaterials-in-the-construction-industry/
2.	https://www.gcelab.com/blog/category/civil-engineering
Online Resources:	
1.	https://learning.makeintern.com/course/nanotechnology-in-civil-engineering/
2.	https://www.engineeringcivil.com/nanotechnology-in-civil-engineering.html

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C013.1 – C013.2	Apply	Assignment - 1	20
C013.3	Analyze	Quiz	20
C013.4	Apply	Assignment - 2	20
C013.5	Apply	Seminar	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	20	20	20
Apply	50	50	50
Analyse	20	20	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	
2	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	
3	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	
4	**2**	**1**		**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**
5	**2**	**1**		**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**
Avg.	**2**	**2**	**2**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**3**

1	**Reasonably agreed**	**2**	**Moderately agreed**	**3**	**Strongly agreed**

22CE014	PROJECT FORMULATION AND IMPLEMENTATION	3/0/0/3

Nature of Course	Theory Concepts
Pre requisites	-

Course Objectives:

1.	To examine the techniques and procedures relevant for project planning and implementation in developing countries, especially infrastructure projects pertaining to environmental sector.
2.	To impart the students about the project appraisal practices and financial schemes.
3.	To enable the students to understand about project identification, feasibility analysis, and design.
4.	To enable the students to understand about project implementation, monitoring and evaluation.

Course Outcomes:
Upon completion of the course, students shall have ability to

C014.1	Understand the project cycle, key elements in project formulation, methods and tools for project formulation.	[U]
C014.2	Apply the expertise of capital cost estimation, market and demand analysis, technical, environmental, financial and economic analysis.	[AP]
C014.3	Exercise his wisdom in time and value of money, investment criteria, internal rate of return, cost benefit analysis, project risk analysis and appraisal of marketing strategy.	[AP]
C014.4	Apply his knowledge on funding options for urban and rural development projects, tender procedure, transparency, resource management & risk management.	[AP]
C014.5	Understand need and techniques for monitoring project performance.	[U]

Course Contents:

Module 1: Project Formulation and Analysis **15 Hrs**

Overview of the project cycle – planning process and project planning – search for project ideas – strategies in capital allocation – key elements in project formulation – methods and tools for project formulation – project identification and selection – preparation of feasibility reports as per government policies (AMRUT / JnNURM). Capital cost estimation – market demand analysis – technical analysis – environmental analysis – financial and economic analysis – cash flow generation.

Module 2: Project Appraisal and Financing **15 Hrs**

Time and value of money – investment criteria – internal rate of return – net present value, cost benefit analysis, and social cost benefit analysis – project risk analysis – appraisal of marketing strategy – pricing and credit worthiness and management capabilities. Funding options for urban and rural development projects – tender procedure – transparency in government tender rules.

Module 3: Project Implementation, Monitoring And Evaluation **15 Hrs**

organizational aspects in project management – network techniques for project management – resource management - risk management. Need and techniques for monitoring – service Level benchmark performance and process monitoring – monitoring Schedules – Penalty and Bonus points.

Total Hours:	**45 Hrs.**

Text Books:	
1.	Clifford F Gray, Erik W Larson , “Project Management-The Managerial Process” Tata Mcgraw-Hill Publishing Co Ltd
2.	Jack Meredith, Samuel J. Mantel Jr. “Project Management- A Managerial Approach” John Wiley and Sons.
3.	John M Nicholas “Project Management for Business and Technology” Prentice Hall Of India Pvt Ltd.
4.	James P Lewis “ Project Planning ,Scheduling And Control” Tata McGraw-Hill.
Reference Books:	
1.	Detailed Project Report: Preparation Toolkit (Sub-mission for Urban Infrastructure and Governance), Government of India.
2.	David I. Cleland, “Project Management: Strategic Design and Implementation”, McGraw-Hill Inc.,US, 2007.
3.	PMI, “Project Management Body of Knowledge GUIDE GUIDE PROJECT MGMT BODY KNOWLEDGE: (Pmbok Guide)”, Pearson Education, 2009.
4.	Scott Berkun, “The Art of Project Management”, O′Reilly, 2005.
Web References:	
1.	www.india.gov.in national portal for India.
2.	https://www.agora-parl.org/resources/aoe/project-formulation-and-implementation.
3.	https://www.wallstreetmojo.com/project-management-books/
Online Resources:	
1.	https://www.coursera.org/learn/project-planning-execution
2.	https://www.futurelearn.com/courses/fundamentals-of-project-planning-and-management
3.	https://www.classcentral.com/course/projects101-3292

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C014.1 to C014.5	Apply	MOOC Certifications	20
C014.1 to C014.5	Analyze	Technical Report / Case Study	20
C014.1 to C014.5	Apply	Assignment	20
C014.1 to C014.5	Analyze	Technical Quiz	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	30	30	30
Apply	50	50	50
Analyse	10	10	10
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	-	-	-	-	-	-	-	-	-	1	-	3	-
2	3	3	-	2	-	2	-	-	1	2	-	-	-	2	2
3	3	2	-	2	-	-	-	3	1	2	1	-	2	2	2
4	3	2	-	2	-	2	-	3	1	2	-	-	2	2	2
5	3	2	-	2	-	2	-	3	1	2	1	-	2	3	1
Avg.	3	2.3	-	2	-	2	-	3	1	2	1	1	2	2.4	1.8

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE015	RURAL WATER SUPPLY AND ONSITE SANITATION SYSTEMS	3/0/0/3

Nature of Course	Theory application
Pre requisites	Nil

Course Objectives:

1.	To Understand healthful housing and swimming pool operation and maintenance
2.	To Understand Rural and Urban water supply and sanitation
3.	To educate Rural and Urban water supply and sanitation
4.	

Course Outcomes:
Upon completion of the course, students shall have ability to

C015.1	Identify the problems pertaining to rural water supply and sanitation.	[U]
C015.2	Design water supply and sanitation systems for rural communities.	[AP]
C015.3	Design low-cost waste management systems for rural areas	[AP]
C015.4	Plan and design an effluent disposal mechanism.	[AN]
C015.5	Apply the various process involved in the solid waste management system	[AN]

Course Contents: Theory

Module-1: Rural water supply and treatment methods **15 Hrs.**

Rural Water Supply: Issues of rural water supply –Various techniques for rural water supply- merits- Need for a protected water supply, investigation and selection of water sources, water borne diseases, protection of well waters, drinking water quality standards.- rural water quality monitoring and surveillance- operation and maintenance of rural water supplies - Low -Cost Water Treatment: Introduction – Epidemiological aspects of water quality- methods for low- cost water treatment - Specific contaminant removal systems

Module-2: Rural Sanitation and disposal methods **15 Hrs.**

Rural Sanitation: Introduction to rural sanitation- Community and sanitary latrines - Planning of wastewater collection system in rural areas- Treatment and Disposal of wastewater -Conservancy, public latrine, concept of Eco-sanitation, trenching and composting methods, Two pit latrines, aqua privy, W.C, septic tank, soak pit - Compact and simple wastewater treatment units and systems in rural areas- stabilization ponds - septic tanks - Imhoff tank- soak pits- low-cost excreta disposal systems- Effluent disposal.

Module- 3: Solid waste Management **15 Hrs.**

Industrial Hygiene and Sanitation: Occupational Hazards- Schools- Public Buildings- Hospitals- Eating establishments- Swimming pools – Cleanliness and maintenance and comfort- Industrial plant sanitation - Disposal of Solid Wastes- Composting- land filling- incineration- Biogas plants - Rural health - Other specific issues and problems encountered in rural sanitation.

Total Hours:	**45 Hrs.**

Text Books:

1.	C. E. McCombs, “Municipal and Rural Sanitation”, McGraw Hill Company, 2013.
2.	Sanjay Gupta, “Rural Water Supply and Sanitation”, Vayu Education of India, 1st Edition, 2014.

3.	Green Well Allan, “Rural Water Supply”, BiblioLife, 2012.
Reference Books:	
1.	Richard C. Carter, “Rural Community Water Supply”. Practical Action Publishing, 2008.
2.	Forrest Blythe Wright, “Rural Water Supply and Sanitation”, Krieger Publishing Company, 3rd Edition, 2007.
3.	E.G. Wagner and J.N. Lanoix, “Excreta Disposal for Rural areas and small communities”, W.H.O. Publication, Geneva,2003.
4.	Babbit H.E and Donald J.J., “Water supply Engineering”, Mc - Graw Hill Book Co., New York, 2012.
Web References:	
1.	https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-ce07/
2.	https://www.ircwash.org/sites/default/files/503-96RU-14531.pdf
Online Resources:	
1.	https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-ce16/
2.	https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-ce45/

Continuous Assessment(40 Marks)				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C015.1	Apply	Online Quiz	20
C015.2	Apply	Assignment	20
C015.3	Apply	Assignment	20
C015.4 - C015.5	Analyze	Seminar presentation	20

Assessment based on Summative and End Semester Examination			
Bloom’s Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	20	20	20
Understand	30	20	20
Apply	30	30	30
Analyse	20	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination								
Continuous Assessment (40%) [200 Marks]								End Semester Examination (60%) [100 Marks]
CA 1 : 100 Marks				CA 2 : 100 Marks				
SA 1 (60 Marks)	FA 1 (40 Marks)			SA 2 (60 Marks)	FA 2 (40 Marks)			
	Component - I (20 Marks)	Component - II (20 Marks)			Component - I (20 Marks)	Component - II (20 Marks)		

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	-	1	-	-	1	1	-	-	-	1	1	1	1
2	3	-	-	1	-	-	2	-	2	-	1	1	2	-	-
3	3	-	-	2	-	-	2	2	2	-	1	1	1	1	1
4	3	-	-	-	-	-	1	1	2	-	1	1	3	1	1
5	3	-	-	2	-	-	2	2	2	-	1	1	3	-	-
Avg.	3	-	-	1.5	-	-	1.3	1.3	2.0	-	1.0	1.0	1.8	1.0	1.0

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE016	SMART CITY PLANNING AND DEVELOPMENT	3/0/0/3
Nature of Course	Theory Concept	
Pre requisites	Nil	

Course Objectives:

1	To understand the different characteristics of a smart city.
2	To gain exposure to the global context of smart cities and smart cities mission of Indian Government.
3	To critically evaluate the smart cities mission -its feasibility and constraints.
4	To analyse and achieve a balance between smart and sustainable development of cities.

Course Outcomes:

Upon completion of the course, students shall have ability to

C016.1	Describe characteristics of a smart city like smart economy, smart people, smart governance, smart mobility and smart environment.	[Ap]
C016.2	Involve in Public private partnership model of urban governance.	[Ap]
C016.3	Discuss global context of smart cities and smart cities mission of Indian Government.	[Ap]
C016.4	Critically evaluate the smart cities.	[Ap]
C016.5	Describe the global context of smart cities and smart cities mission of Indian Government.	[Ap]

Course Contents: Theory

Module1: Smart City & Global Experiences **15 Hrs.**

Smart cities –concept -origin – ideology-Typologies and different meanings - Wired city –Virtual city – Intelligent city –Information city – Digital city –Smart community –Knowledge city –Learning city – Sustainable city - Green City - Characteristics of smart cities - smart economy –smart people – smart governance – smart mobility– smart environment –smart living-Strategies and policies - Approaches towards smart cities in various countries-Smart city planning in advanced economies – economic, financial viability – social implications Smart city planning in Global South economic, financial viability – social implications - Case Study.

Module 2: Smart cities Mission in India **15 Hrs.**

Smart city mission - Objectives – features – coverage and duration - Preconditions and criteria for the selection of smart city - actions and tools for smart cities Strategies –retrofitting, redevelopment, Greenfield – Brownfield- Pan city Governance and management –special purpose vehicles - smart solutions – arranging finance and funds – Public Private Partnership (PPP) model of urban governance

Module3: Critical Evaluation of Smart Cities **15 Hrs.**

Smart City -Smartness Quotient- Critical evaluation of the smart city Concept - The contradiction of being ‗smart '– smart vs. dull – fast vs. slow – the urban and digital divide social divide - Financial and economic viability of smart city in the Global South Critical evaluation of smart city development projects in India - Balance between smart and sustainable development of cities.

Total Hours	**45 Hrs.**

Text Books:	
1	Mani N., Smart Cities & Urban Development in India**,** New Century Publications, 1st edition, 2016.
2	Amitabh Satyam, The Smart City Transformations: The Revolution of the 21st Century**,** Bloomsbury, India, 2017.
3	Arun Firodia, Smart City, Vishwakarma Publications, 2015.
Reference Books:	
1	Beth Simone Noveck, Smart Citizens, Smarter State: The Technologies of Expertise and the Future of Governing, Harvard University Press, First Printing edition, 2015.
2	Poonam Sharma, Sustainable Smart Cities in India Springer International Publishing, 2017.
3	Stan McClellan, Smart Cities Applications, Technologies, Standards, and Driving Factors, Springer International Publishing, 2018.
4	Stephen Goldsmith, The Responsive City: Engaging Communities Through Data-Smart Governance, Wiley and sons, 2014.
Web References:	
1	http://smartcities.gov.in/content/
2	http://www.smart-cities.eu/
Online Resources:	
1	https://www.coursera.org/learn/smart-cities
2	https://www.edx.org/course/smart-cities-ethx-ethx-fc-03x-1

Continuous Assessment(40 Marks)				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C016.1	Apply	Online Quiz	20
C016.2	Apply	Assignment	20
C016.3	Apply	Assignment	20
C016.4 - C016.5	Apply	Seminar presentation	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	20	20
Understand	30	20	20
Apply	50	60	60
Analyse	-	-	
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	-	-	2	2	2	-	-	-	-	1	2	1
2	3	2	1	-	-	2	2	2	-	-	-	-	1	2	1
3	3	2	1	-	-	2	2	2	-	-	-	-	1	2	1
4	3	2	1	-	-	2	2	2	-	-	-	-	1	2	1
5	3	2	1	-	-	2	2	2	-	-	-	-	1	2	1
Avg	3	2	1	-	-	2	2	2	-	-	-	-	1	2	1

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE017	SUSTAINABLE CONSTRUCTION MATERIALS AND METHODS	3/0/0/3
Nature of Course	Theory Application	
Pre requisites	Nil	

Course Objectives:

1	To be aware of sustainability principles and eco-friendly building materials.
2	To comprehend the process of green building certification.
3	To gain knowledge of cost analysis in sustainable construction.
4	To unearth the latest technologies in sustainable construction.

Course Outcomes:

Upon completion of the course, students shall have ability to

C017.1	Deliberate the concepts of the green building and sustainable technologies for building construction.	[AP]
C017.2	Identify and select the suitable alternative sustainable and eco-friendly materials.	[AN]
C017.3	Estimate the impact created by the conventional building materials on the environment and its influence on climate change.	[AN]
C017.4	Value the green building certification and environmental assessment process.	[AP]
C017.5	Assess the energy demands and suitable contemporary sustainable construction practices.	[AN]

Course Contents: Theory

Module 1: Principles of Sustainability **15 Hrs.**

Sustainability – Environmental challenges – Global warming –Sustainable Development goals, concepts and components – Greenhouse gas emissions – sustainable construction - Green energy technology – Energy conservation in buildings – Operational energy reduction and net zero building – Impact of energy and atmosphere in a building – Sustainable urban development – Resource limitations to materials.

Module 2: Sustainable and Eco-Friendly Materials and Concepts **15 Hrs.**

Role of sustainable materials: Carbon from Cement, alternative cements and Cementitious material, Alternative fuel for cements for reduction in carbon emission – Sustainability issues of concrete– Alternative construction material for sustainability – Eco-friendly building materials: Types, Properties, Benefits – Optimization for design of building for energy efficiency – Urban heat island – Microclimatic modification through greening – Modern methods of sustainable construction – Sustainable index for material selection.

Module 3: Sustainability Assessment Methods **15 Hrs.**

Leadership in Energy and Environmental Design (LEED) certification process – Green building rating (IGBC) and Green Rating for Integrated Habitat Assessment (GRIHA) certification process – Sustainable materials cost analysis – Environmental Assessment methods for materials: Life cycle Assessment, Embodied Energy, Embodied Carbon –Lean manufacturing – IoT applications in sustainable construction – Future energy systems – Challenges in adopting sustainable methods.

Total Hours	**45 Hrs.**

Text Books:	
1	Robert Brinkmann, Introduction to Sustainability, Wiley India Pvt. Ltd., 2016.
2	Charles J Kibert, Sustainable Construction: Green Building Design and Delivery, Wiley India Pvt. Ltd., India, 4th Edition, 2016.
3	Umberto Desideri and Francesco Asdrubali, Handbook of Energy Efficiency in Buildings, Elsevier, 1st Edition, 2018.
Reference Books:	
1	Ravindra K. Dhir OBE, GUrmel S., Ghataora and Ciaran J. Lynn, Sustainable Construction Materials, 1st Edition, Woodhead Publishers, 2016.
2	Spiro N. Pollalis, Andreas Georgoulias Stephen J.Ramos and Daniel Schodek, Infrastructure Sustainability and Design, Routledge Publishers, 2012
3	William Spence and Eva Kultermann, Construction Materials, Methods and Techniques: Building for a Sustainable Future, Cengage Learning Publishers, 2011.
4	Indian Building Congress, Practical Handbook on Energy Conservation in Buildings, Nabhi Publication, 1stedition, 2008.
Code Books:	
1	The Energy Conservation Building Code (ECBC), Bureau of Energy Efficiency, Govt. of India, 2017.
2	Eco-Niwas Samhita(Energy Conservation Building Code for Residential Buildings), Bureau of Energy Efficiency, Govt. of India, 2018.
3	National Building Code, Bureau of Indian Standards, Govt. of India, 2016.
4	International Green Construction Code, International Code Council, Inc. (ICC) and ASHRAE, 2018.
5	LEED Practices, Certification, and Accreditation Handbook, Sam Kubba, 2009.
6	ISO 14020 – 14025, Environmental labels and declarations, 2018.
7	GRIHA Rating and IGBC Rating
Web References:	
1	https://www.thespruce.com/eco-friendly-building-materials-1821766
2	https://dozr.com/blog/sustainable-building-materials
3	TERI-Griha‘s Green Design practices (www.teriin.org/bcsd/griha/griha.htm)
Online Resources:	
1	https://onlinecourses.swayam2.ac.in/arp19_ap75/preview
2	https://www.classcentral.com/course/swayam-sustainable-materials-and-green-buildings-14316
3	https://www.edx.org/course/environmental-technologies-in-buildings

Continuous Assessment(40 Marks)				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C017.1	Analyze	Online Quiz	20
C017.2	Apply	Assignment	20
C017.3 & C017.4	Analyze	Seminar presentation	20
C017.5	Analyze	Online Quiz	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	-	-
Understand	30	25	25
Apply	40	40	40
Analyse	30	35	35
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	-	-	2	2	2	-	-	-	3	2	-	2
2	3	2	1	-	-	2	2	2	-	-	-	3	2	-	2
3	3	2	1	-	-	2	2	2	-	-	-	3	2	-	2
4	3	2	1	-	-	2	2	2	-	-	-	3	2	-	2
5	3	3	2	-	-	2	2	2	-	-	-	3	2	-	2
Avg	**3.0**	**2.2**	**1.2**	-	-	2	2	2	-	-	-	3	2	-	2

1	**Reasonably agreed**	**2**	**Moderately agreed**	**3**	**Strongly agreed**

22CE018	WASTE TO ENERGY	3/0/0/3

Nature of Course	Theory
Pre requisites	Nil

Course Objectives:

1.	To enable students to understand the concept of Waste to Energy.
2.	To understand the principles associated with effective energy management and to apply these principles in the day to day life
3.	To learn about the best available technologies for waste to energy.
4.	To link legal, technical and management principles for the production of energy form waste

Course Outcomes:
Upon completion of the course, students shall have ability to

C018.1	Apply the knowledge about the operations of Waste to Energy Plants	[AP]
C018.2	Analyze the various aspects of Waste to Energy Management Systems	[AN]
C018.3	Apply the knowledge in planning and operations of Waste to Energy plants.	[AP]
C018.4	Identify different sources of solid waste and characteristics of municipal solid waste	[AN]
C018.5	Analyze the global scenario of environmental concerns and health hazards by the generation of E-waste.	[AN]

Course Contents:

Module 1: INTRODUCTION TO WASTE AND WASTE PROCESSING **15 Hrs.**

Solid waste sources, types, composition, properties - Municipal solid waste: Physical, chemical and biological properties - waste collection and transfer stations - waste minimization and recycling of municipal waste, segregation of waste - status of technologies for generation of energy from waste treatment and disposal - aerobic composting, incineration - Land fill method of solid waste disposal land fill classification, types, methods and sitting consideration - environmental monitoring system for land fill gases.

Module 2: BIO & THERMO CHEMICAL CONVERSION **15 Hrs.**

Technologies for Waste to Energy - Energy generation from waste bio-chemical conversion: Sources of energy generation - anaerobic digestion of sewage and municipal waste - direct combustion of MSW-refuse derived solid fuel - Biogas production - land fill gas generation and utilization - thermo-chemical conversion: Sources of energy generation - gasification of waste using gasifies briquetting, utilization and advantages of briquetting - environmental benefits of bio-chemical and thermo- chemical conversion.

Module 3: E-WASTE MANAGEMENT **15 Hrs.**

E-waste in the global context - Growth of electrical and electronics industry in India - environmental concerns and health hazards - Recycling e-waste: A thriving economy of the unorganized sector -global trade in hazardous waste - impact of hazardous e-waste in India - Management of e-waste -legislation, government regulations on e-waste management - international experience, need for stringent health safeguards and environmental protection laws of India.

Total Hours:	**45 Hrs.**

Text Books:	
1.	Nicholas P Cheremisinoff, —Handbook of Solid Waste Management and Waste Minimization Technologies‖, An Imprint of Elsevier, New Delhi, 2016
2.	Metcalf and Eddy, “Wastewater Engineering Treatment and Reuse”, Tata McGraw Hill Publishers, New Delhi, 2010.
3.	AmalenduBagchi Design, —Construction and Monitoring of Landfills, John Wiley and Sons, New York, 2017
Reference Books:	
1.	C. S. Rao, —Environmental Pollution Control Engineering‖, Wiley Eastern Ltd. New Delhi, 2012
2.	Venugopal Rao P., “Textbook of Environmental Engineering”, Prentice Hall of India Pvt.Ltd, 2013
3.	Sofer, Samir S. (ed.), Zaborsky, R. (ed.), —Biomass Conversion Processes for Energy and Fuels, New York, Plenum Press, 2004
4.	Samuel, Integrated Solid Waste management: Engineering Principles and Management issues‖, New York, McGraw Hill, 2007
Web References:	
1.	http://www.teriin.org/projects/green/pdf/National-Waste.pdf
2.	https://www.e-waste Management: From waste to Resource Klaus Hieronymi, RamzyKahnat, Eric williams Tech. & Engg.-2013 (Publisher: Earthscan 2013
Online Resources:	
1.	https://www.mooc-list.com/course/ water-and-wastewater-treatment-engineering-physicochemical-technology-edx
2.	http://www.envfor.nic.in/

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C018.1 – C018.2	Apply	Assignment	20
C018.3	Analyze	Quiz	20
C018.4	Apply	Seminar	20
C018.5	Analyze	OCLE Report	20

Assessment based on Summative and End Semester Examination			
Bloom’s Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	

Remember	10	10	10
Understand	20	20	20
Apply	50	50	50
Analyse	20	20	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	**3**	**2**	**2**	**2**	**-**	**2**	**2**	**2**	**2**	**-**	**-**	**3**	**1**	**2**	**2**
2	**3**	**2**	**2**	**2**	**-**	**1**	**2**	**2**	**2**	**-**	**-**	**2**	**2**	**2**	**2**
3	**2**	**2**	**2**	**2**	**-**	**1**	**-**	**2**	**1**	**-**	**-**	**2**	**1**	**2**	**2**
4	**3**	**3**	**2**	**1**	**-**	**1**	**1**	**-**	**1**	**-**	**-**	**3**	**1**	**3**	**2**
5	**2**	**2**	**2**	**1**	**-**	**-**	**1**	**1**	**2**	**-**	**-**	**2**	**1**	**2**	**2**
Avg.	**2.6**	**2.2**	**2**	**1.6**	**-**	**1.25**	**1.5**	**1.75**	**1.6**	**-**	**-**	**2.4**	**1.2**	**2.2**	**2**

1	**Reasonably agreed**	**2**	**Moderately agreed**	**3**	**Strongly agreed**

Open Elective Courses

22CE001	DISASTER MANAGEMENT	3/0/0/3
Nature of Course	Theory	
Pre requisites	Nil	

Course Objectives:

1	To understand the knowledge of the disaster phenomenon, disaster schemes and its different contextual aspects, impacts and public health consequences.
2	To analyze the disaster management activities in India.
3	To apply disaster management in forecasting and warning of disasters.
4	To understand the recent trends in disaster management.

Course Outcomes:

Upon completion of the course, students shall have ability to

C001.1	Identify the disaster management schemes and components.	[AP]
C001.2	Analyze the potential effects of disasters and methods to deliver public health responses to avert these effects and as well risk and vulnerability in disaster management.	[AN]
C001.3	Construct the risk assessment to resolve the uncertainty and risk that occurs due to disaster.	[AP]
C001.4	Apply disaster management concepts in forecasting and warning of disasters and disaster management techniques in statistical seismology.	[AP]
C001.5	Examine and recent trends and emergency management systems in disaster management.	[AN]

Course Contents: Theory

Module 1: Dimensions of Disasters **15 Hrs.**

Dimensions of natural and anthropogenic disasters – Principles/Components of disaster management – Classification of Disasters - Organizational structure for disaster management –Disaster management schemes - Natural disasters and mitigation efforts: Flood control – Drought management – Cyclones – Land use planning - NBC threat and safety measures – Forest fires – Oil fires – Crisis in power Sector – Accidents in coal mines – Case Studies - Relationship between Disaster and Development.

Module 2: Disaster Management in India **15 Hrs.**

Disaster management in India - Disaster Management Act 2005 – DM Policy 2009 - Coastal Hazards - Assessing risk and vulnerability - Disaster preparedness – Disaster mitigation – Forecasting and warning of disasters - Role of panchayat raj, NGO's, paramedical forces, red cross society, news media and NDRF in Disaster management – Rehabilitation of victims - Operations Management(OM) – Risk assessment and disaster response – SWOT analysis based on design and formulation strategies – Insurance & risk management, Institution awareness and safety programs - Funding's for disaster management.

Module 3: Recent Trends in Disaster Management and Implementations **15 Hrs.**

Recent trends in disaster information provider – Electronic warning systems -Geo-Informatics - Psychological and social dimensions in disasters– Trauma and stress – Emotional intelligence -Applications in disaster management – Management of epidemics – Bio-Terrorism – Forecasting and Management of casualties - Emergency Management

Systems (EMS).	
Total Hours	**45 Hrs.**
Text Books:	
1	Srivastava A.K., “Text book of Disaster Management”, Scientific Publishers, New Delhi, 2021.
2	Sulphey M.M., “Disaster Management” PHI Learning Pvt. Ltd., New Delhi, 2017.
3	Kumar P., “Disaster Management”, Oak Bridge Publishers, Gurugram, Haryana, 2021.
Reference Books:	
1	Vaidyanathan S., “An Introduction to Disaster Management: Natural Disasters and Man Made Disasters”, Anitha Book Publishers, Chennai, 2020.
2	Mohan Kanda, “Disaster Management in India”, BSP Books Pvt. Ltd., Hyderabad, 2019.
3	Sunil R Hedge, “Disaster Management in India”, Notion Press Publishers, Chennai, 2021.
4	Arulsamy S., and Jeyadevi J., “Disaster Management”, Neelkamal Publications Pvt. Ltd., 2016.
Code of Practice:	
1	The Disaster Management Act 2005, Ministry of Law and Justice, New Delhi.
2	National Policy on Disaster Management 2009, National Disaster Management Authority, Ministry of Home Affairs, Government of India, New Delhi.
Web References:	
1	http://www.ndma.gov.in/
2	http://www.nidm.gov.in/
3	http://www.tnsdma.tn.gov.in/
Online Resources:	
1	https://nptel.ac.in/courses/124/107/124107010/
2	https://www.coursera.org/learn/disaster-preparedness
3	https://www.edx.org/course/natural-disasters

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)
Formative Assessment based on Capstone Model

Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)	FA (16%) [80 Marks]
C001.1	Apply	Technical Presentation	20
C001.2	Analyze	Assignment	20
C001.3	Apply	Technical Quiz	20
C001.4	Apply		
C001.5	Analyze	Case Study Report	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	20	20	20
Apply	40	40	40
Analyse	30	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	2	1	2	-	2	-	2	-	-	-	1	3	-	3
2	3	3	2	3	-	1	-	2	-	2	-	2	3	2	3
3	3	2	1	2	-	2	-	2	-	-	-	1	3	2	2
4	3	2	1	2	-	2	-	2	-	-	-	2	3	3	3
5	3	3	2	3	-	1	-	2	-	2	-	3	3	3	3
Avg.	2.8	2.4	1.4	2.4		1.6		2		2		1.8	3	2	2.8

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE002	ENGINEERING RISK AND UNCERTAINTY	3/0/0/3
Nature of Course	Theory and Application	
Pre requisites	Nil	

Course Objectives:

1.	To understand the feasibility of risk and uncertainty in engineering
2.	To identify risk and uncertainty in engineering projects
3.	To relate risk and uncertainty in decision making process
4.	To analyze, evaluate and manage risk and uncertainty in engineering projects

Course Outcomes:

Upon completion of the course, students shall have ability to

C002.1	Identify the risk and uncertainty in engineering projects	[AN]
C002.2	Analyze risk and uncertainty using existing methods and models	[AN]
C002.3	Assess the risk and uncertainty and make decisions in engineering	[AP]
C002.4	Mitigate risk using various methods and tools	[AN]
C002.5	Manage risk and uncertainty in engineering projects	[AP]

Course Contents:

Module 1: Concepts of Risk and Uncertainty **15 Hrs.**

Importance of Risk – Source and Types of risks in engineering - Quantifiable and Unquantifiable Risks – Types of Uncertainty – Measure of Uncertainty – Difference between Risk and Uncertainty - Risk analysis in Construction Projects – Quantitative and Qualitative Analysis – Probability Impact Matrix – Consequences of Ignoring Risk – Risk Registers - Risk priority number – Risk identification, Risk Acceptance Criteria

Module 2: Analysis of Risk and Uncertainty **15 Hrs.**

Mathematical Models - Stochastic and Statistical Methods – Preliminary Hazard Analysis (PHA) – Hazards and Operability Analysis (HAZOP) – Job Safety Analysis (JSA) – Failure Modes and Effects Analysis (FMEA) – Fault Tree Analysis (FTA) – Event Tree Analysis (ETA) - Decision Analysis - Cause-Consequence Analysis (CCA) – Probabilistic and Reliability Risk Assessment

Module 3: Management of Risk and Uncertainty **15 Hrs.**

Decision Making under Risk and Uncertainty - Concept of simulation – Monte Carlo Simulation - Use of Simulation in Risk Identification, Analysis and Mitigation – Risk Mitigation – Residual Risk – Coverage of Risk through Various Policies – Role of Insurance in Risk Management - Interlinking Risk Analysis and Risk Management – Optimization Criteria - Risk Analysis and Management for Projects (RAMP) – Cost Benefit Analysis – Environmental Health and Safety Risk Assessment

Total Hours:	**45 Hrs.**

Text Books:	
1.	Mohammad Modarres, Risk Analysis in Engineering - Techniques, Tools and Trends, Taylor & Francis Group, CRC Press, 2019
2.	Sergio E.Serrano, Engineering uncertainty and risk analysis, Hydro science Inc., 2011
3	Supreet Singh Bahga, Experimental Uncertainty Analysis – A textbook for Science and Engineering Students, White Falcon Publishing, 1 st edition, 2021
Reference Books:	
1.	John Bartlett, Project Risk Analysis and Management Guide, APM Publishing Limited, 2nd Edition, 2010
2.	Ehsan Goodarzi, Mina Ziaei and Lee Teang Shui, Introduction to risk and uncertainty in hydrosystem engineering, Springer, 2013
3	Mohammad Modarres, Mark P.Kaminskiy and VasiliyKrivitsov, Reliability Engineering and Risk Analysis, Taylor & Francis Group, CRC Press, 2017
4.	Ayyub B. M., Risk Analysis in Engineering and Economics, Chapman and Hall/CRC Press, 2014.
Online Resources:	
1.	https://www.ice.org.uk/getattachment/knowledge-and-resources/best-practice/design-risk-management/DRM-Guidance-Version-2-March-2020.pdf.aspx
2.	https://www.researchgate.net/publication/290883771_Risk_Assessment_Handbook
Web Resources:	
1.	https://ocw.mit.edu/courses/engineering-systems-division/esd-72-engineering-risk- benefit-analysis-spring-2007/index.htm
2.	https://www.pmi.org/learning/library/risk-analysis-project-management-7070
3.	https://www.guru99.com/risk-analysis-project-management.html

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C002.1	Apply	Technical Presentation	20
C002.2	Analyze	Assignment	20
C002.3	Apply	Technical Quiz	20
C002.4	Apply		
C002.5	Analyze	Case Study Report	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	20	20	20
Apply	40	40	40
Analyse	30	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	1	-	2	-	-	-	1	-	3	3	-	1
2	3	3	3	2	-	2	-	-	-	1	-	3	3	-	1
3	3	3	3	2	-	2	-	-	-	1	-	3	3	-	1
4	3	3	3	2	-	2	-	-	-	1	-	3	3	-	1
5	3	3	3	2	-	2	-	-	-	1	-	3	3	-	1
Avg.	3	2	2.8	1.8	-	2	-	-	-	1	-	3	3	-	1

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE003	Environmental Pollution and Global Challenges	3/0/0/3

Nature of Course	Theory Concepts
Pre requisites	-

Course Objectives:

1	To give students the knowledge of conception and significance of the variable factors causing deterioration of the environment.
2	To make students aware about significance of Environment and Human Health.
3	To brief the students community about biotechnological interventions and pollution control.
4	To prepare students involve in discussion of social, psychological, economic and political issues surrounding each of the global environmental issues.

Course Outcomes:

Upon completion of the course, students shall have ability to

C003.1	Monitor and measure the air, water and noise pollution levels in the environment.	[AP]
C003.2	Monitor and control of radioactive and thermal pollution from the sources.	[AN]
C003.3	Utilization of the latest scientific and mechanical technologies to control the environmental deterioration.	[AP]
C003.4	Understanding of biotechnological interventions and pollution control.	[U]
C003.5	Implementing the environmental legislation, regulations and other policy mechanisms to tackle global warming and climate change problems.	[AP]

Course Contents: Theory

Module 1: Air, Water and Soil Pollution **15 Hrs.**

Air Pollution - Pollution case studies – I Air Pollution and Industrial Disaster - Acid Rain - Photochemical Smog - Climate Change - Global Warming - Ozone depletion - Water Pollution - Marine Pollution - Soil Pollution - Pollution case studies – II Water and Soil Pollution - Noise Pollution - Nuclear Pollution - Nuclear accidents and holocaust - Thermal Pollution - Prevention of pollution - Radioactive Pollution: waste management and control - Case studies.

Module 2: Waste Managemet and SDG **15 Hrs.**

Biotechnology in Pollution control - Biodegradation and Bioremediation – Desertification - Solid waste Management - Wasteland reclamation - Biocides and heavy metals: Impact on Aquatic life - Concept of sustainable development - Environmental ethics - Environmental and Ethical issues of GMOs - Need for public awareness in Environmental Studies - Role of women and child in environmental protection - Role of Individuals in conservation of natural resources - Value Education - Case studies.

Module 3: Data Management and Environmental Modeling **15 Hrs.**

Human rights and the Environment - Environmental and Human Health – HIV/AIDS - Role of Information Technology in Environmental and human health - Resettlement and rehabilitation of people - its problems and concerns - Problems in enforcement of environmental legislation - Salient features of various legilsations: Water, Air, EPA acts, Biomedical waste, Noise pollution, Municipal solid wastes and Hazardous waste management and handling rules - Case studies.

	Total Hours	**45 Hrs.**
Text Books:		
1	McConnell, Robert and Abel, Daniel (2008) Environmental Issues: An Introduction to Sustainability. 3rd Edition Publisher Pearson – Prentice Hall.	
2	Wright, Richard and Boorse, Dorothy (2011) Environmental Science: Toward a Sustainable Future, 11th Edition Publisher Pearson.	
3	Hill, Marquita (2010) Understanding Environmental Pollution . Cambridge University Press; 3 edition (May 24, 2010).	
4	Kanagasabai, S. 2010. Text Book on Environmental Studies. PHI Learning.	
Reference Books:		
1	Bandh SA And Parray JA (2018) Environemntal Perspective sand Issues. Castillo Reference 1st Ed .	
2	Kaushak and Kaushak. 2016. Perspectives in Environmental Studies.	
3	Sharma, P. D. 2015. Ecology and Environment.	
4	Jaiswal, P.S.2007.Environmental Law. Pioneer Publications, Delhi.	
Web Reference:		
1	https://ncert.nic.in/textbook/pdf/lebo116.pdf	
2	https://www.sciencedirect.com/topics/earth-and-planetary-sciences/environmental-pollution	
3	https://www.frontiersin.org/articles/10.3389/fpubh.2020.00014/full	
Online Resources:		
1	https://onlinecourses.swayam2.ac.in/cec21_ge08/preview	
2	https://sebs.rutgers.edu/courses/035/11-035-268.php	
3	https://ral.ucar.edu/pressroom/features/air-pollution-a-global-problem	

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C003.1 - C003.5	Apply	MOOC Certifications	20
C003.1 - C003.5	Analyze	Technical Report	20
C003.1 - C003.5	Apply	Assignment	20

C003.1 - C003.5	Apply	Technical Quiz	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	20	20	20
Apply	40	40	40
Analyse	30	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3		2			2		2					1		1
2	3		2			2		1					1		1
3	3	2				3		3					1		
4	3	2				2		3						2	
5	3	2				2		3						2	1
Avg.	**3.0**	**2.0**	**2.0**	**-**	**-**	**2.2**	**-**	**2.4**	**-**	**-**	**-**	**-**	**1.0**	**2.0**	**1.0**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE004	PROJECT MANAGEMENT	3/0/0/3

Nature of Course	Theory Concept
Pre requisites	Nil

Course Objectives:

1	To study the various management techniques for successful completion of projects.
2	To understand the overview of project management
3	To study the effect of management for project organization, design process, and cost estimation.
4	To learn the Project life cycle, design of work breakdown systems, value engineering, equipment and material management.

Course Outcomes:

Upon completion of the course, students shall have ability to

C004.1	Apply the elementary concepts in project management and project life cycle.	[AP]
C004.2	Discuss the purpose of organization structure and role of managers	[U]
C004.3	Prepare an estimate of the project Cost and plan the cost budget.	[AN]
C004.4	Address the labor and material productivity in industries.	[AP]
C004.5	Apply the principles of planning and monitoring for projects and prepare a final project completion report	[AP]

Course Contents: Theory

Module 1: Introduction to Project Management **15 Hrs.**

Introduction to Project Management - Objectives of Project Management - Importance of Project Management- Types of Projects Project Management Life Cycle- Project Selection – Feasibility study: Types of feasibility Steps in feasibility study-Defining the project scope, Project scope checklist, Project priorities, Work Breakdown Structure (WBS), Integrating WBS with organization, coding the WBS for the information system.

Module 2: Project Cost Estimation & Resource Planning **15 Hrs.**

Various Types of Project Cost –Method of Structuring Project Cost – Clients' Estimate and Contractors Estimation of Project Cost – Type of Cost Estimates –Allocation of Joint Costs-Estimation of Operating Costs – Cost Indices and its Applications to Estimating – Cost Planning, Labour Productivity - Factors Affecting Job Productivity – Labour Estimation, Allocation and Control – Materials Estimation – Material Procurement and Delivery – Inventory Control .

Module 3: Project Planning, Monitoring and Project Completion **15 Hrs.**

Setting a baseline- Project management Information System – Indices to monitor progress-Importance of Contracts in projects- Teamwork in Project Management - Attributes of a good project team – Formation of effective teams – stages of team formation.– Stage-wise Completion - – Project Closure – Financial Closure – Contract Closure – Project Managers' Closure – Lessons Learnt from the Project evaluation- Project Auditing – Phases of project Audit- Project completion reports Guidelines for completion reports.

Total Hours	**45 Hrs.**

Text Books:	
1	K Nagarajan, "Project Management", New Age International Publishers, 2017.
2	Project Management by S Choudhury, Mc Graw Hill Education (India) Pvt. Ltd. New Delhi, 2016.
3	Project Management and Appraisal, Sitangshu Khatua, 2011.
Reference Books:	
1	Project Management by Pearson, 1st edition 2019.
2	Project Management: The Managerial Process (McGraw-Hill Series Operations and Decision Sciences), Edition 2014.
3	Prasanna Chandra, “Project Planning, Analysis, Selection, Implementation and review”, Tata McGraw Hill, 2010.
Web References:	
1	https://www.pmi.org/
2	https://www.projectmanager.com/
Online Resources:	
1	https://www.edx.org/course/project-management-of-engineering-projects prepari
2	https://www.coursera.org/specializations/project-management

Continuous Assessment				End Semester Examination	Total
Formative Assessment	Summative Assessment	Total	Total Continuous Assessment		
80	120	200	40	60	100

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C004.1	Apply	Quiz	20
C004.2	Understand	Assignment	20
C004.3	Analyze	Seminar presentation	20
C004.4	Analyze		
C004.5	Apply	Quiz	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	-	-	-
Understand	30	20	30
Apply	40	35	40
Analyse	30	45	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	1	-	-	-	-	-	2	2	1	3	1	1	3	-
2	2	2	-	-	-	-	1	2	2	1	3	1	1	2	-
3	2	3	2	2	-	-	-	1	2	1	3	1	2	3	1
4	2	3	1	3	-	-	1	1	2	1	3	1	2	3	-
5	2	3	2	2	-	-	1	1	2	1	3	1	2	3	1
Avg.	**2.2**	**2.4**	**1.6**	**1.4**	**-**	**-**	**1.0**	**1.4**	**2**	**1.0**	**3**	**1.0**	**1.6**	**2.8**	**1.0**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22CE006	RESEARCH METHODOLOGY AND IPR	3/0/0/3
Nature of Course	Theory	
Pre requisites	Nil	

Course Objectives:

1	To develop a research oriented approach among the students.
2	To acquaint students with fundamental of research methods.
3	To develop an understanding of various research design.
4	To understand the IPR and Patent act and rules in India among the students.

Course Outcomes:

Upon completion of the course, students shall have ability to

C006.1	Understand the basics and integral components of research design.	[U]
C006.2	Apply the concept of research design and developing scales for the real time research problems.	[AP]
C006.3	Analyze the real time research problem based on the guidelines of data collection, analysis and reporting.	[AN]
C006.4	Apply the research concepts in SPSS software.	[AP]
C006.5	Apply the guidelines of IPR and patent regulations in the real life problems.	[AP]

Course Contents: Theory

Module 1: Research Design **15 Hrs.**

The Hallmarks of Scientific Research – Building blocks of science in research – Concept of applied and basic research – Qualitative and quantitative research techniques Hypothesis development – Research Design: Purpose, Exploratory, Descriptive and Hypothesis testing – Laboratory and field experiments – Internal and external validity – Measurement of variables – Developing scales – Stability measures.

Module 2: Data Collection, Analysis and Reporting **15 Hrs.**

Interviewing, questionnaires, secondary sources of data collection – Guidelines for questionnaire design, electronic questionnaire design and surveys – Special data sources – Probabilistic and Non probabilistic samples – Data Analysis – Factor analysis - Cluster analysis – Discriminant analysis – Application of Statistical Software Package (SPSS) – Purpose of the written report – Basics of written report – Integral parts of a report.

Module 3: IPR and Patents **15 Hrs.**

Intellectual Property – Evolution and development of concept of IPR – Trade secrets – Utility models – IPR & Bio-diversity – Role of WIPO and WTO in IPR establishments – Right of Property – Common rules of IPR practices - Types and features of IPR agreement – Patents – Objectives and benefits of patent – Concept and features of patent - Types of patent application – Process e-filling – Examination of patent and grant of patent – Revocation – Licensing of related patents – Patent agents and registration of patent agents.

Total Hours	**45 Hrs.**

Text Books:	
1	John W. Creswell and David Creswell J., “Research Design – Qualitative, Quantitative and Mixed Methods Approaches”, SAGE Publications India Pvt. Ltd., 2018.
2	Uwe Flick., “Introducing Research Methodology: A Beginner’s guide to doing research project”, SAGE Publications India Pvt. Ltd., 2017.
3	Ramakrishna Chintakunta and Geethavani M., “A text book of Intellectual Property Rights”, Blue Hill Publications Pvt. Ltd., 2022.
Reference Books:	
1	Kothari C. R., and Gaurav Garg., “Research Methodology – Methods and Techniques”, New Age International Publishers, 2019.
2	Paneerselvam R., “Research Methodology”, Prentice Hall India Learning Pvt. Ltd., 2013.
3	Neeraj Pandey and Khushdeep Dharni., “Intellectual Property Rights”, PHI Learning, 2014.
4	Kankanala K. C., “Indian Patent Law & Practice”, Oxford India, 2012.
Code of Practice:	
1	The Patent Act, 1970, Intellectual Property Rights, Government of India.
2	The Patent Rules 2003, (Amendment rules 2021), Intellectual Property Rights, Government of India.
Web References:	
1	https://research.com/research/how-to-write-research-methodology
2	https://research-methodology.net/research-methodology/
3	https://ipindia.gov.in/rules-patents.htm
Online Resources:	
1	https://in.coursera.org/learn/research-methods
2	https://alison.com/course/essentials-of-research-methodology
3	https://onlinecourses.nptel.ac.in/noc22_ge08/preview

Continuous Assessment				**End Semester Examination**	**Total**
Formative Assessment	**Summative Assessment**	**Total**	**Total Continuous Assessment**		
80	**120**	**200**	**40**	**60**	**100**

Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative Assessment based on Capstone Model			
Course Outcome	**Bloom’s Level**	**Assessment Component (Choose and map components from the list - Quiz, Assignment, Case study, Seminar, Group Assignment)**	**FA (16%) [80 Marks]**
C006.1	Understand	Technical Presentation	20

C006.2	Apply	Individual Assignment	20
C006.3	Analyze	Technical Quiz	20
C006.4	Analyze		
C006.5	Apply	Case Study Report	20

Assessment based on Summative and End Semester Examination			
Bloom's Level	**Summative Assessment (24%) [120 Marks]**		**End Semester Examination (60%) [100 Marks]**
	CIA1 : [60 Marks]	**CIA2 : [60 Marks]**	
Remember	10	10	10
Understand	20	20	20
Apply	50	50	50
Analyse	20	20	20
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination						
Continuous Assessment (40%) [200 Marks]						**End Semester Examination (60%) [100 Marks]**
CA 1 : 100 Marks			**CA 2 : 100 Marks**			
SA 1 (60 Marks)	**FA 1 (40 Marks)**		**SA 2 (60 Marks)**	**FA 2 (40 Marks)**		
	Component - I (20 Marks)	**Component - II (20 Marks)**		**Component - I (20 Marks)**	**Component - II (20 Marks)**	

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	1	-	2	1	2	1	1	-	3	3	-	1
2	3	3	3	2	-	2	1	2	1	1	-	3	3	-	1
3	3	3	3	2	-	2	1	2	1	1	-	3	3	-	1
4	3	3	3	2	1	2	1	2	1	1	-	3	3	-	1
5	3	3	3	2	-	2	1	2	1	1	-	3	3	-	1
Avg.	3	2.8	1.8	1.8	1	2	1	2	1	1	-	3	3	-	1

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22EES102	Employability Enhancement Skills (2 Weeks Internship / Training)	0/0/0/2

Nature of Course	Training
Pre requisites	Nil

Course Objectives:

1.	To provide direct, firsthand experience with practical challenges pertaining to the field of Civil Engineering
2.	To provide firsthand insights into how Construction Management principles can be applied to execute engineering projects effectively
3.	To equip students with hands-on learning opportunities through real-world experiences on construction sites.
4.	To provide professionals with an added advantage in their respective fields.

Course Outcomes:
Upon completion of the course, students shall have ability to

C102.1	Enumerate key activities that are crucial in the construction industry.	[AN]
C102.2	Establish a problem-solving approach to address the identified issue	[AN]
C102.3	Acquire proficiency in effectively tackling field-related challenges and obstacles.	[AP]
C102.4	Obtain the ability to resolve challenges and issues encountered in the field proficiently.	[AP]
C102.5	Communicate the report to a targeted audience using both written and oral formats	[AP]

Course Contents:

The students individually undertake training in reputed engineering companies doing construction during the vacation for a specified duration of four weeks. At the end of the training, a detailed report on the work done should be submitted. The students will be evaluated through a viva-voce examination by a team of internal faculty.

Tentative Assessment Method & Levels (based on Revised Bloom's Taxonomy)

Summative assessment based on Report and Viva Voce Examination

Revised Bloom's Level	Training Report [40 marks]	Viva Voce Examination [60 marks]
Remember	10	10
Understand	20	20
Apply	40	40
Analyse	30	30
Evaluate	-	-
Create	-	-

Course Articulation Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	3	3	2	2	2	2	2	3	3	3	2	3	2	2	3
2	3	3	2	2	1	2	2	3	3	3	2	3	2	2	3

3	3	2	1	1	1	2	2	3	3	3	2	3	2	2	3
4	3	2	1	1	1	2	2	3	3	3	2	3	2	2	3
5	3	2	1	1	1	2	2	3	3	3	2	3	2	2	3
Avg	**3.0**	**2.3**	**1.3**	**1.3**	**1.2**	**2.0**	**2.0**	**3.0**	**3.0**	**3.0**	**2.0**	**3.0**	**2.0**	**2.0**	**3.0**
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

22EES101	Employability Enhancement Skills (2 Weeks Internship / Training)	0/0/0/2

Nature of Course	Training
Pre requisites	Nil

Course Objectives:

1.	To give a first-hand knowledge of practical problems related to Civil Engineering
2.	To offer firsthand knowledge of applications of Construction Management in carrying out engineering tasks.
3.	To train the students on real-time learning experiences in site.
4.	To offer an additional edge to their profession

Course Outcomes:
Upon completion of the course, students shall have ability to

C101.1	Identify critical activities in the Construction Industry	[AN]
C101.2	Develop the methodology to solve the identified problem	[AN]
C101.3	Develop skills in facing the problems experienced in the field.	[AP]
C101.4	Develop skills in solving the problems experienced in the field.	[AP]
C101.5	Present the report clearly to a specific audience in both the written and oral forms	[AP]

Course Contents:

The students individually undertake training in reputed engineering companies doing construction during the vacation for a specified duration of four weeks. At the end of the training, a detailed report on the work done should be submitted. The students will be evaluated through a viva-voce examination by a team of internal faculty.

Tentative Assessment Method & Levels (based on Revised Bloom's Taxonomy)

Summative assessment based on Report and Viva Voce Examination

Revised Bloom's Level	Training Report [40 marks]	Viva Voce Examination [60 marks]
Remember	10	10
Understand	20	20
Apply	40	40
Analyse	30	30
Evaluate	-	-
Create	-	-

Course Articulation Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	3	3	2	2	2	2	2	3	3	3	2	3	2	2	3
2	3	3	2	2	1	2	2	3	3	3	2	3	2	2	3
3	3	2	1	1	1	2	2	3	3	3	2	3	2	2	3

4	3	2	1	1	1	2	2	3	3	3	2	3	2	2	3
5	3	2	1	1	1	2	2	3	3	3	2	3	2	2	3
Avg	**3.0**	**2.3**	**1.3**	**1.3**	**1.2**	**2.0**	**2.0**	**3.0**	**3.0**	**3.0**	**2.0**	**3.0**	**2.0**	**2.0**	**3.0**
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

Mandatory Courses

22MC101	INDUCTION PROGRAMME (Common to all B.E / B.TECH/M.TECH)	1/0/0/0

Nature of Course	Induction Programme
Pre requisites	Nil

Course Objectives:

1	To have broad understanding of society and relationships
2	To nurture the character and 135abelin one's responsibility as an engineer, a citizen and a human being
3	To incorporate meta skills and values

Course Outcomes:

Upon completion of the course, students shall have ability to

C101.1	Explore academic interest and activities	[AP]
C101.2	Work for excellence	[AP]
C101.3	Promote bonding and give a broader view of life and character	[AP]

Course Contents: Theory

PHYSICAL ACTIVITY: Research over the past years has shown Yoga to have stress-relieving powers on students, paving the way for improved academic performance with the practice of asanas, meditation and breathing exercises. To prove these words Yoga classes has been planned in this module.(CO mapping: C101.1, C101.2, C101.3)

CREATIVE ARTS (students can select any one of their choice): Cultural development supports students to understand, feel comfortable with, value and appreciate the potential enrichment of cultural diversity. They should challenge discrimination, whether based on cultural or racial difference. Students should experience cultural traditions embedded in arts, crafts, language, literature, theatre, song, music, dance, sport, Science, technology and travel. Students should develop an appreciation of beauty both in experiencing artistic expression and by exploring their own creative powers. To inculcate those skills they are given a chance to exhibit their talents through painting, sculpture, pottery, music, dance, craft making and so on. .(CO mapping: C101.1, C101.2, C101.3)

UNIVERSAL HUMAN VALUES: Moral development involves supporting students to make considered choices around their behaviour and the values that provide a framework for how they choose to live. Moral development is also learning about society's values, understanding the reasons for them, how they are derived and change; and how disagreements are resolved. Students must consider the consequences of personal and societal decisions on the wider community – local and global- and on the environment and future generations. To acquire this the students are exposed to training to enhance their soft skills. .(CO mapping: C101.1, C101.2, C101.3)

LITERARY AND PROFICIENCY MODULES: Social development helps students to work effectively together, developing the inter-personal skills required to relate positively with their peers and people of all ages. Students must also understand how to participate productively in a diverse and plural society and learn about, and how to effectively engage

with societal institutions and processes. They should understand that a person may have different roles and responsibilities within society. To reach this the following aspects are given in the form of Reading, writing, speaking – debate, role play etc. Communication and computer skills. (CO mapping: C101.1, C101.2, C101.3)

LECTURES BY EMINENT PEOPLE: Teaching with Lectures. ... It is essential to see lectures as a means of helping students learn to think about the key concepts of a particular subject, rather than primarily as a means of transferring knowledge from instructor to student. During the induction period students will attend to Guest lectures by subject experts.(CO mapping: C101.1, C101.2, C101.3)

VISIT TO LOCAL AREAS: Traveling is in fact a way of learning to learn. You are out of your comfort zone and so you must learn to be able to adapt to a new learning environment in a very short time. It also helps in your overall learning as well. In the induction period students will be taken to different places near college to learn new things. Eg.Meditation centre/orphanage/Hospital.(CO mapping: C101.1, C101.2, C101.3)

FAMILIARIZATION TO DEPARTMENT/BRANCH INNOVATION: Hod's of different branches will present about their department followed by department visit to view various facilities available at their department, new innovations from students and faculties etc. .(CO mapping: C101.1, C101.2, C101.3)

Total Hours	**30 Hrs.**

Mapping of Course Outcomes (CO) with Programme Outcomes (PO)Programme Specific Outcomes (PSO)

Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1						3	3	3	3	3	3	3			1
2						3	3	3	3	3	3	3			1
3						3	3	3	3	3	3	3			1
Avg						3.0	3.0	3.0	3.0	3.0	3.0	3.0			1.0

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22MC102	ENVIRONMENTAL SCIENCES	2 /0 /0 /0
Nature of Course	Theory Concept	
Pre requisites	Basics in Environmental Studies	

Course Objectives:

1	To learn the integrated themes on various natural resources.
2	To gain knowledge on the type of pollution and its control methods.
3	To have an awareness about the current environmental issues and thesocial problems.

Course Outcomes:

Upon completion of the course, students shall have ability to

C102.1	Recall and play an important role in transferring a healthy environment for future generation.	[R]
C102.2	Illustrate the importance of natural resources and conservation of biodiversity.	[U]
C102.3	Interpret and analyze the impact of engineering solutions ina global and societal context.	[U]
C102.4	Apply the gained knowledge to overcome pollution problems.	[AP]
C102.5	Apply the gained knowledge in various environmentalissues and sustainable development.	[AP]

Course Contents: Theory

Natural Resources:

Introduction-Forest resources: Use and abuse, case study-Major activities in forest-Water resources-over utilization of water, dams-benefits and problems. Mineral resources-Use and exploitation, environmental effects of mining- case study–Food resources- World food problems, case study. Energy resources -Renewable and non-renewable energy sources Land resources- Soil erosion and desertification – Role of an individual in conservation of natural resources.

Environmental Pollutions:

Definition – causes, effects and control measures of: a. Air pollution - Acid rain - Greenhouse effect-Global warming- Ozone layer depletion – case study- Bhopal gas tragedy. Water pollution c. Soil pollution - Solid waste management-Recycling of plastics-Pyrolysis method- causes, effects and control measures of municipal solid wastes d. Noise pollution. e. Nuclear hazards-case study-Chernobyl nuclear disaster-Role of an individual in prevention of pollution.

Social issues and the Environment:

Sustainable development-water conservation, rain water harvesting, E-Waste Management – Environmental ethics: 12 Principles of green chemistry-Scheme of labelling of environmental friendly products (Eco mark) – Emission standards – ISO14001 standard.

Total Hours	**30 Hrs.**

Text Books:

1	Anubha Kaushik and C P Kaushik “Perspectives in Environmental Studies”4th Edition, New age International (P) Limited, Publisher Reprint 2014. New Delhi
2	Rajagopalan, R, “Environmental Studies-From Crisis to Cure”, OxfordUniversity Press 2015.
Reference Books:	
1	Tyler Miller, Jr., “Environmental Science”, Brooks/Cole a part of Cengage Learning, 2014.
2	William Cunningham and Mary Cunningham, “Environmental Science”, 13th Edition, McGraw Hill,2015.
3	Gilbert M. Masters, “Introduction to Environmental Engineering and Science”,Third Edition, Pearson Education, 2014.
Web References:	
1	http://nptel.ac.in/courses/104103020/20
2	http://nptel.ac.in/courses/120108002
3	http://nptel.ac.in/courses/122106030
4	http://nptel.ac.in/courses/120108004/
5	http://nptel.ac.in/courses/122102006/20
Online Resources:	
1	https://www.edx.org/course/subject/environmental-studies
2	www.environmentalscience.org

Assessment Methods & Levels (based on Bloom’s Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:50)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C102.1	Remember	Quiz	10
C102.2	Understand	Case study based on environmental aspect	20
C102.3	Understand	Class presentation	10
C102.4 & C102.5	Apply	Assignment	10

Summative assessment based on Continuous Assessment

Bloom’s Level	Continuous Assessment		
	CIA-I [0 marks]	CIA-II [0 marks]	Term End Assessment [50 marks]
Remember	-	-	30
Understand	-	-	40
Apply	-	-	30
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-

Mapping of Course Outcomes (CO) with Programme Outcomes (PO)Programme Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1	1	1	1		1							2	2
2	2	1	1	1	1		1							2	2
3	3	2	1	1	1		1							2	2
4	3	2	1	1	1		1							2	2
5	2	1	1	1	1		1							2	2
Avg	**2.5**	**1.5**	**1**	**1**	**1**		**1**							**2**	**2**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22MC103	Soft Skills (Department of CIVIL Engineering)	2/0/0/0
Nature of Course	Theory Concept	
Pre requisites	Technical Communication Skills	

Course Objectives:

1.	To develop the students competency level and their capabilities in language.
2.	To teach the students to be effective communicators in workplace and social environments.
3.	To create self confidence among the students and to resolve stress and conflict within themselves.
4.	To help the students to enhance their career skills by increasing their productivity and performances.
5.	To concentrate more on conversation skills, presentation skills, verbal ability, critical and creative thinking.

Course Outcomes:
Upon completion of the course, students shall have ability to

C103.1	Remember the principles of soft skills required for theirprofession.	[R]
C103.2	Understand the importance of Interpersonal communication skills among individuals, groups and cultures.	[U]
C103.3	Apply verbal and non verbal communication skills and also to apply good teamwork skills and leadership skills in corporate environment.	[AP]
C103.4	Analyse and apply creativity skills, critical thinking skills and problem solving skills in workplace.	[AP]
C103.5	Articulate oral and written messages in an appropriate and persuasive manner to suit specific purposes, audiences and contexts at work place.	[AP]

Course Contents:

Module 1: Professional Communication Skills **10 Hrs.**

Introduction to the Soft Skills, **Performance Evaluation 1** –Listening on TedX Shows- **Exercises on Listening Skills** -Speaking Skills - How to Start and Sustain a Conversation - **Speaking in Groups**- Understanding Self and Personal Branding, Attitude, Types of Attitude, Positive Attitude, Self Confidence and Self-Motivation – **Exercises on Personal Branding**. E mails –**Exercises on Email Writing**.

Module 2: Interview Skills **10 Hrs.**

Verbal Ability – Analogy – Classification - Odd One Out - Idioms and Phrases - Sentence Correction – **Exercises on Verbal Ability** - Writing Reports - Types of Reports - Strategies for Report Writing – **Exercises on Report Writing**- Developing Creativity- Critical Thinking and Problem Solving Skills-**Role Play on Critical Thinking**- Effective Resume along with Covering Letter- **Exercises**- Interviews- Facing Job Interviews – **Mock Interview**.

Module 3: Teamwork and Leadership Skills **10 Hrs.**

Impromptu Speaking- **Group Presentation** - Importance of Team Work - Developing Key Traits in Motivation, Persuasion, Negotiation and Leadership Skills- Being an Effective Team Player – **Group Activity**- Group Discussion –**Activity**- Making Effective Presentations- **Presentation Skills**.- **Performance Evaluation 2**

Total Hours: 30 Hrs.

Text Books:

1.	Business Communication for managers: An advanced approach, by Penrose, C engage learning.

2.	Professional Communication in Engineering. by H.E. Sales. Palgrave Macmillan 2009.
3.	Communication for professional engineers by W. P. Scott, Bertil Billing. Thomas Telford, 1998.
Reference Books:	
1.	Reason and professional ethics by Peter Davson-Galle. Ashgate Publishing, Ltd., 2009.
2.	Cross Cultural and Inter Cultural Communication. by William B. Gudykunst. Sage Publications India Pvt Ltd, New Delhi.2003.
3.	Corporate Communications: Theory and Practice. byJoepCornelissen. Sage Publications India Pvt Ltd, New Delhi.2004.
Web References:	
1	https://onlinecourses.nptel.ac.in/noc16_hs15/preview
2	https://www.getinternship.switchidea.com/NTAT/syllabus/Interpersonal-Communication.
3	https://smude.edu.in/smude/programs/bca/soft-skills.html
Online Resources:	
1	https://swayam.gov.in/course/4047-developing-soft-skills-and-personality
2	https://www.clearias.com/interpersonal-skills-including-communication-skills-for-csat/
3	https://www.bizlibrary.com/soft-skills-training/

Assessment Methods & Levels (based on Bloom's Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:50)

Course Outcome	Bloom's Level	Assessment Component	Marks
C103.1	Remember	Group Discussion	10
C103.2	Understand	Listening Skill	10
C103.3	Apply	Interview	10
C103.4 & C103.5	Apply	Formal Presentation	20

Summative assessment based on Continuous Assessment

Bloom's Level	Continuous Assessment		
	CIA-I [0 marks]	CIA-II [0 marks]	Term End Assessment [50 marks]
Remember	-	-	30
Understand	-	-	40
Apply	-	-	30
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-

Mapping of Course Outcomes (CO) with Programme Outcomes (PO)Programme Specific Outcomes (PSO)

	POs												PSOs		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1						1	1	2	2	3	2	2			1
2							1	1	3	3	2	2			1
3									2	3	2	2			1
4						1	1	1	2	3	3	2			1
5						1	1		2	3	2	2			1
Avg						**1**	**1**	**1.3**	**2.2**	**3**	**2**	**2**			**1**

1 Reasonably agreed 2 Moderately agreed 3 Strongly agreed

22MC104	MANAGEMENT ORGANIZATIONAL BEHAVIOUR	2/0/0/0

Nature of Course	Theory Concept
Pre requisites	Nil

Course Objectives:

1	The objective of the course is to provide basic knowledge about management to familiarize the students with the management principles and organizational behavior.
2	The course is designed to enable the students to adapt & apply theoretical concepts in business
3	To know about the role of manager in the area of management.
4	To create and implement team building strategies for organization building.

Course Outcomes:
Upon completion of the course, students shall have ability to

C104.1	Identify and understand different management principles techniques in business environment.	[AP]
C104.2	Apply management fundamentals and planning to solve organization problems and make effective decisions.	[AP]
C104.3	Understand and analyze the changes within an individual will change the group as well as the organization	[AN]
C104.4	Understand and analyze the leadership style and organization theories to create a productive environment to workforce.	[AN]
C104.5	Analyze the organizational climate and change management strategies and tactics	[AP]

Course Contents: Theory

Module 1: Fundamentals of Management, Planning and Decision Making 10 Hrs.

Introduction to Management- Concept and functions- Thought Managerial roles and styles- Principles of Management - Levels of Management- Theories of Management - Classical, Scientific, Administrative, Behavioral, Management Sciences Theories. Organizational planning - Vision, Mission and goals, Types of plans, steps in planning process, Approaches to planning, Planning in Dynamic Environment. Decision making process, types of decisions, decision making styles, Behavioral influences on decision making

Module 2: Individual, interpersonal and group behavior 10 Hrs.

Definition, need and importance of Organizational behavior Learning-Nature -Importance of Learning- Introduction and theories Motivation: Content and process theories-Leadership: Styles and Theories - Perception-Personality Attitudes- Definition, need and importance -Nature and scope-Importance of Groups and Teams- Role relationships and conflict-Group dynamics- Work values. Organization-Theories: Maslow's needs hierarchy theory ,two factor theory of motivation ,McGregor's theory, ERG theory ,MCClelland's needs theory, Valance theory

Module 3: Organizational Development 10 Hrs.

Organizational culture: Elements - Organizational climate Factors affecting organizational climate-Organizational Commitment, Organizational change- Importance- Stability Vs Change- Proactive Vs Reaction change- Change process Resistance to change- Managing changes- Managing International- Workforce Productivity-Alternative change management approaches and cultural contingencies - power to manage effectively; Empowerment and Participation strategies and tactics.

Total Hours	**30 Hrs.**

Text Books:	
1	Nelson, Quick, Khandelwal, —Organizational Behavior‖, 2nd edition, Cengage Learning, 2016.
2	Williams, Tripathy, —Principles of Management‖, Cengage Learning, 2016.
3	Aswathappa, K, —Organizational Behavior‖, 12th Edition, Himalaya Publication, 2016.
4	Stephen Robbins, Timothy A. Judge, —Organizational Behavior‖, 16th edition, Prentice Hall India Pvt. Ltd, 2014
Reference Books:	
1	Chandrani Singh, Aditi Khatri, —Principles and Practices of Management and Organizational Behavior ‖, Sage Publications, 2016
2	Richard L. Daft, —Understanding the Theory and Design of Organizations‖, 11th edition, Cengage Learning, 2013.
3	John M Ivancevich and Robert Konopaske, —Organizational Behavior and Management‖, McGraw-Hill Education, 2013
Web References:	
1	https://iedunote.com/fundamental-concepts-of-organizational-behavior
2	https://nscpolteksby.ac.id/ebook/
3	https://ebooks.lpude.in/management/mba/term_1/DMGT402_MANAGEMENT PRACTICES_AND_ORGANIZATIONAL_BEHAVIOUR.pdf
4	https://www.studocu.com/in/document/vellore-institute-of-technology/organizational - behaviour/lecture-notes/ob-notes/3208134/view
Online Resources:	
1	https://nptel.ac.in/syllabus/110105034/
2	https://nptel.ac.in/courses/110/105/110105033/

Assessment Methods & Levels (based on Blooms 'Taxonomy - Theory

Formative assessment based on Capstone Model (50 Marks)

Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz,	Marks
C104.1	Apply	Online Quiz	20
C104.2	Apply	Online course	20
C104.3 & C104.4	Analyze		
C104.5	Apply	Assignment	10

Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	**Continuous Assessment**		
	CIA 1 [0 Marks]	**CIA 2 [0 Marks]**	**Term End Assessment [50 marks]**
Remember	-	-	-
Understand	-	-	10
Apply	-	-	20
Analyse	-	-	20
Evaluate	-	-	-
Create	-	-	-

Mapping of Course Outcomes (CO) with Program Outcomes (PO) Program SpecificOutcomes (PSO)

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1					1	3		3	3	3	3	1			2
2					2	2		3	3	3	3	2			3
3					3	3		3	3	2	3	1			2
4					3	2		3	3	3	3	2			3
5					3	3		3	3	2	3	2			2
Avg					**2.4**	**2.6**		**3.0**	**3.0**	**2.6**	**3.0**	**1.6**			**2.4**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

22MC105	GENERAL APTITUDE	2/0/0/0

Nature of Course	Problem analytical
Pre requisites	Basic Mathematical calculations

Course Objectives:

1	To ensure that students learn to think critically about mathematical models for relationships between different quantities and use those models effectively to solve problems and reach conclusions about them.
2	To impart skills that enable students to effectively use and interpret data, formulas, and graphs in the workplace.
3	To instills confidence in facing technical aptitude questions interviewed by recruiters.

Course Outcomes:
Upon completion of the course, students shall have ability to

C105.1	To teach the basics of Quantitative Techniques in a graded manner.	[R]
C105.2	Understand the verbal and non-verbal nature of problems in reality and know the shortcut methods of solving it.	[U]
C105.3	Solve problems using their general mental ability.	[AP]
C105.4	To give intense focus on improving and increasing the ability of solving real problems.	[AP]
C105.5	Think critically about mathematical models for relating different quantities to reach conclusion.	[AP]

Course Contents: Theory

Module 1: Number Theory and Statistics **10 Hrs.**

Number Systems– HCF and LCM of Numbers – Decimal Fractions – Simplification – Square Root and Cube Root of a number — Surds and Indices — Problems on numbers — Percentage — Ratio and Proportion – Divisibility – Mixtures – Averages- Polynomials – Solving Equations and Inequalities –Discard‘s rule of signs — Problems on ages — Chain rule — Time and Work — Time and Distance — Problems on Trains – Problems on Boats and Streams- Measures of central tendency – Mean, Median and Mode — Variance and Standard deviation Logarithms — Profit and Loss — Simple Interest — Compound Interest.

Module 2: Logic and Decision Making **10 Hrs.**

Analogy – Classification – Series completion – Coding and Decoding – Blood Relations – Puzzle Test –Direction Sense test – Logical Venn Diagrams - Number Ranking and Time Sequence Test – Decision Making – Assertion and Reason– Inserting the missing one – Logical Sequence of words – Syllogisms.

Module 3: Reasoning **10 Hrs.**

Logic – Statement and Arguments – Statements and Assumptions – Statements and Course of Action – Statements and Conclusions – Deriving conclusions from passages – Functions – Different kinds of functions – Miscellaneous sets- Series – Analogy – Classifications – Analytical Reasoning – Problems on Cubes and Dice – Mirror Images – Water Images – Rule Detection.

Total Hours	**30 Hrs.**

Text Books:

1	Aggarwal R. S., Quantitative Aptitude‖ Revised Edition, S. Chand Publication.

2.	Abhijit Guha Quantitative Aptitude‖ 5th Edition, McGraw Hill Education.
Suggested Readings:	
1.	Edgar Thorpe —Mental Ability & Quantitative Aptitude‖ 3rd Edition, McGraw Hill Education.
Web Reference:	
1	https://www.wiziq.com/tutorial/815468-quantitative-aptitude-reasoning-data-interpretation- video-lectures
2	https://learningpundits.com/contest?referrer=harsh.cse15@nituk.ac.in
3	https://nptel.ac.in/courses/114106041/8
4	https://nptel.ac.in/courses/111103020/2
Online Resources:	
1	http://aptitudetraining.in/home/index.php
2	https://www.udemy.com/vedicmaths/
3	https://www.youtube.com/channel/UCtmn-DsF4BhPug-ff9LiDAA?disable_polymer=true

Assessment Methods & Levels (based on Blooms'Taxonomy) - Theory

Formative assessment based on Capstone Model (50 Marks)

Course Outcome	Bloom's Level	Assessment Component (Choose and map components from the list – Quiz, Assignment,Case study, Seminar, Group Assignment)	Marks
C105.1	Remember	Classroom or Online Quiz	10
C105.2 & C105.3	Understand	Formal presentation	10
C105.4, C105.5	Apply	Formal interview tests	20

Summative assessment based on Continuous and End Semester Examination

Bloom'sLevel	Continuous Assessment		
	CIA 1 [0 Marks]	CIA 2 [0 Marks]	Term End Assessment [50 marks]
Remember			-
Understand			10
Apply			20
Analyse			20
Evaluate			-
Create			

Course Articulation Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	3	3	1	-	-	-	-	-	-	-	-	-	-	-	-
2	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
3	3	3	1	-	-	-	-	-	-	-	-	-	-	-	-
4	3	2	1	-	-	-	-	-	-	-	-	-	2	-	-
5	3	3	1	-	-	-	-	-	-	-	-	-	2	-	-
Avg	**3**	**2.5**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

Value Added Courses

22VA130	EFFECTIVE COMMUNICATION SKILLS (MECH/MCT/AI&DS/CIVIL/CYBER)	0/0/0/2

Nature of Course	E (Theory skill based)
Pre-Requisites	Basics of English Language

Course Objectives:

1	To become self-confident individuals by mastering interpersonal skills, team management skills, and leadership skills.
2	To develop effective communication skills.
3	To train students to use the language with confidence and without committing errors.
4	To improve the fluency of the students when speaking English.
5	To focus on pronunciation, dialect, intonation, interaction, practice and communication.

Course Outcomes:
Upon completion of the course, students shall have ability to

C130.1	Remember correct usage of English grammar in speaking.	[U]
C130.2	Apply and improve their speaking ability in English both in terms of fluency and comprehensibility.	[AP]
C130.3	Understand and communicate effectively in personal and professional situations.	[U]
C130.4	Understand and analyzeoral presentations and receive feedback on their performance.	[U]
C130.5	Apply reading fluency skills through extensive reading.	[AP]

Course Contents:

Module I **10 Hrs.**

Pre-Test - Vocabulary Building- Connecting Phrases- Exercises and **Activities-Conversation Practices-** Greetings-exchanging ideas - Asking for information - questioning techniques / answering techniques - Getting people to do things - requesting/agreeing/refusing – **Activity Common Expressions** (Individual)- Talking about Favorites - Talk Show **Activity** - **Impromptu Speaking**- Personal Interest - Talking about Past Events and Future/Talking about Everyday Life (Family, Hobbies, Work, Travel and Current Events) – **Activity.**

Module II **10 Hrs.**

Listening- Trials of a Good Listener- Listening to Texts, Listening for Specific Purpose-**Activity**- **21st Century Skills**– Communication with Critical Thinking and Creativity-Role Play-**Activity**-**Personality Development**- Manners and Etiquettes. Building Confidence and Developing Presentation Skills-**Activity**- **Singing a Song (Group)** - **Activity**.

Module III **10 Hrs.**

Story Telling- Use of Charts and Graphs-**Activity -Persuasive Speech**- Handling Criticism-Justifying Opinions-Conflict-Resolution-Situational Role Play **Activity--News reading and Pronunciation**- **Activity** -**Satori**- Intuitive Approach-**Activity**-**Post Test.**

Total Hours: 30 Hrs.

Text Books:

1	English and Soft skills Orient Black Swan Publishers (S. P. Dhanavel) 2010
2	Remedial English Grammar. F.T. Wood. Macmillan.2007

3	On Writing Well. William Zinsser. Harper Resource Book. 2001
4	Dr Sumanth S, English for Engineers, Vijay Nicole Imprints Private Limited 2015.
Reference Books:	
1	Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
2	Busch, B., & Oakley, B. (2017). Emotional intelligence: why it matters and how to teach it. Retrieved from https://www.theguardian.com/teacher-network/2017/nov/03/emotional-intelligence-why-it-matters-and-how-to-teach-it.
3	Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
Web References:	
1	https://www.udemy.com/course/english-speaking-complete/
2	https://www.cambridgeenglish.org/exams-and-tests/linguaskill/
Online Resources:	
1	https://www.lingoda.com/en/linguaskill-from-cambridge/
2	https://www.icd.org.pk/linguaskill/

22VA101	BUILDING FUNCTION DESIGN USING AUTOCAD	0/0/0/1
Nature of Course	Theory Practical	
Pre requisites	Nil	

Course Objectives:

1	To be well versed with AutoCAD user interface.
2	To develop the hands-on experience with the AutoCAD UI needed to excel in the civil engineering industry.
3	To understand the basic and advanced techniques used in the development of 2D and 3D models.
4	To learn major CAD standards and practices used to create construction documents.

Course Outcomes:

Upon completion of the course, students shall have ability to

C101.1	Understand the AutoCAD user interface, tool bars and their functions.	[U]
C101.2	Apply the various commands, use drawing aids and get acquainted with layers.	[AP]
C101.3	Illustrate the various dimensioning tools and tool palettes in the 2D drawings.	[AP]
C101.4	Apply the concepts in preparing the 2D model of a residential building.	[AP]
C101.5	Demonstrate the 3D modeling and their features by design the 3D of a residential building.	[AP]

Course Contents: Theory

Module 1: AutoCAD User Interface and Basics **5 Hrs.**

Introduction to Engineering Drawing – Various types of engineering drawings used in AEC (Architecture, Engineering and Construction) Industry – Introduction to AutoCAD – Exploring GUI and Workspaces – User coordinate system - Basics, Viewing, Geometry, Layers, Properties, Modifying, Blocks, Layouts, Notes and Labels, Text, Dimensions, Hatch and its properties.

Module 2: Dimensioning and Detailing Drawings **5 Hrs.**

Dimensioning – True associative dimensions – Leaders and Dimension styles - Design center and tool palettes concept – Working with block and block attributes – Understanding external references and layout concept – Design and draft the layout of a residential building.

Module 3: 3D Modeling **5 Hrs.**

Introduction to 3D coordinate system – types of 3D models, 3D navigation and viewing tools – getting started with 3D Modeling – Visualization – Design the 3D model of a residential building using AutoCAD 3D.

Total Hours	**15 Hrs.**

Text Books:

1	James A Leach and Shawna Lockhart, “AutoCAD 2022 Instructor”, SDC Publications, 2022.
2	Jaiprakash Pandey and Yasser Shoukry., “Practical Autodesk, AutoCAD 2023 and AutoCAD LT 2023”, Packt Publishing, 2nd Edition, 2022.

3	AutoCAD (Civil & Architecture) Exercise Book, Cad desk publisher, 2019.
Suggested Readings:	
1	Azhar Wahab, “A Handbook on AutoCAD tools Practice”, Notion Press, 2020.
2	Sunil K Pandey, “Learn AutoCAD in a easy way”, S.K. Kataria & Sons, 2019.
3	Chitawadegi M. V., and Bhavikatti S. S., “Building Planning and Drawing”, Dream Tech Press, 2019.
4	Atish B Mane, “Learning AutoCAD”, PBD Publishers, 2016.
Web References:	
1	https://www.autodesk.com/certification/learning-pathways/autocad-design-drafting
2	https://www.autodesk.in/campaigns/autocad-tutorials
3	https://skill-lync.com/civil-engineering-courses/autocad-essentials-civil-engineer
Online Resources:	
1	https://www.coursera.org/learn/autodesk-autocad-design-drafting
2	https://www.udemy.com/course/autocad-for-civil-engineers/
3	https://www.autodesk.com/certification/all-certifications/autocad-design-drafting-professional

21VA102	TOTAL STATION AND GPS SURVEYING	0/0/0/1
Nature of Course	Theory Practical	
Prerequisites	Surveying and Geomatics	

Course Objectives:

1.	To introduce the working principles of modern surveying instruments
2.	To introduce the principles of various surveying methods and applications to Civil Engineering Projects
3.	The students can be exposed to the modern surveying methods
4.	The functioning various types total station and GPS equipment and their applications

Course Outcomes:
Upon completion of the course, students shall have the ability to

C102.1	Understand the working of Total Station equipment and solve thesurveying problems.	[U]
C102.2	Analyze the working principle of Total station & GPS, its components,signal structure of GPS and error sources	[AN]
C102.3	Distinguish the advantages of electronic surveying over conventionalsurveying methods	[AP]
C102.4	Apply the concepts of various techniques available for surveying andmapping with total station and GPS	[AP]
C102.5	Apply the concepts of GPS and data processing in various types ofcivil engineering works	[AP]
C102.6	Interpret the data with modern software tools for analyzing the resultsobtained from the instruments	[AP]

Course Contents:

Module 1: Fundamentals of Total Station & GPS **5 Hrs.**

Total Station: Advantages –working principle –Field procedure - Different segments -satellite configuration -Orbit determination and representation -Task of control segment -Hand Held and Geodetic receivers -data processing -Traversing and triangulation

Module 2: EDM Measurement principles and techniques **5 Hrs.**

Methods of Measuring Distance, Basic Principles of Total Station, Electro-optical system and Microwave system: Sources of Error, Infrared and Laser Total Station instruments, Care and maintenance of Total Station instruments

Module 3: GPS Data Processing and Techniques **5 Hrs.**

GPS observables - code and carrier phase observation - linear combination and derived observables - downloading the data RINEX Format – Differential data processing – softwaremodules -Concepts of rapid, static and kinematic methods-applications

Total Hours:	**15 Hrs.**

Text Books:

1.	Punmia B.C., –Surveying‖ — –Vols. — I, II & III‖, Laxmi publications, New Delhi2016
2.	Kanetkar T.P, Kulkarni S.V., —Surveying and Levelling‖, Vols. I and II, Standard publishers Distributors, New Delhi 2015.

3.	Anji Reddy M., Remote Sensing and Geographical Information System, B.S. Publications, 2012
Suggested Readings:	
1.	Purushothamaraj.P, —Surveying –I & II‖ Laxmi Publications, 2012.
2.	James M.Anderson and Edward M. Mikhali, —Surveying, Theory and Practice‖, 7th Edition, McGraw Hill, 2017
3.	Satheesh Gopi, Rasathishkumar, N.Madhu, —Advanced Surveying, Total Station GPS andRemote sensing‖ Pearson education, 2017.
4.	Arora K.R., —Surveying Vol I & II‖, Standard book house, 2015
Web References:	
1.	http://www.textofvideo.nptel.iitm.ac.in/105107121/lec3.pdf
2.	https://books.google.co.in/books?id=dF3oDzQ6KZgC&printsec=frontcover&dq=inauthor:%22C+Venkatramaiah%22&hl=en&sa=X&ved=0ahUKEwi3gfG_5eneAhXRdCsKHQZHBh0Q6AEILTAB#v=onepage&q&f=false
3.	http://www.textofvideo.nptel.iitm.ac.in/105107121/lec3.pdf
Online Resources:	
1.	http://www.nptel.ac.in/courses/105107122
2.	http://www.nptel.ac.in/courses/105104101

22VA103	ARC GIS FOR CIVIL ENGINEERS	0/0/0/1

Nature of Course	Theory Practical
Prerequisites	Nil

Course Objectives:

1.	Insights of general overview about the essential GIS concepts and about al the basic skills needed in handling ArcGIS
2.	Learn about GIS key tools in an appropriate and professional way, usage of vector and raster data information in order to develop different operations and spatial analysis.
3.	Skill to overcome all possible difficulties which you may encounter in the execution of GIS projects, and their solutions through practical exercises.
4.	Gain experience in data preparation, layout development, map creation and high quality products delivery

Course Outcomes:

Upon completion of the course, students shall have the ability to

C103.1	Understand the basic components involved in ArcGIS techniques	[U]
C103.2	Illustrate the Geo-referencing and map projection system and its application in GIS	[AP]
C103.3	Apply the concepts of data analysis and data models involved in GIS	[AP]
C103.4	Interpret the spatial data with Arcgis for creating and organizing layers.	[AP]
C103.5	Identify field applications of GIS in various resource management	[AP]
C101.6	Analyze the concepts involved in GIS by using 3D visualization techniques.	[AP]

Course Contents:

Module 1: Fundamentals of ArcGIS **5 Hrs.**

Introduction to GIS and GPS - Resolution and its types - Digital Image Processing - Spatial data model - Database management Systems (DBMS) - Geo Database (GDB) - Geo-referencing and its types - ArcMap.

Module 2: Data integration and layering **5 Hrs.**

Geographic coordinate systems - Projected coordinate systems, accessing and evaluation of GIS data - Layers and data, importing data into the geodatabase – Managing and organizing map layers

Module 3: Data analysis and visualization **5 Hrs.**

Utilizing GIS database, Symbols and map visualization, Data visualization, working with tabular data - Creating and editing data - Labeling features - CAD data input to ArcGIS - Performing spatial analysis - Solving spatial problems

Total Hours:	**15 Hrs**

Text Books:

1.	Lo, C.P. and Yeung, Albert K.W., Concepts and Techniques of Geographic Information Systems, Pearson, 2016.
2.	Wilpen L. Gorr, Kristen S. Kurland, GIS Tutorial for ArcGIS Pro 2.6, Esri Press, 2020.
3.	Michael Law, Amy Collins, Getting to Know ArcGIS Desktop 10.8, Esri Press, 2021.
Suggested Readings:	
1.	Kang-tsung Chang, Introduction to Geographic Information Systems: 9th Edition, 9781259929649, McGraw-Hill Education, 2018.
2.	Paul Bolstad, GIS Fundamentals, XanEdu Publishing Inc.,2016.
3.	Anji Reddy.M, Text book of Remote sensing and GIS, B.S.Bublications., 2019.
4.	David Smith, Nathan Strout, Christian Harder, Steve Moore, Tim Ormsby and Thomas Balstrm, Understanding GIS: An ArcGIS Pro Project Workbook, Esri Press, 2018.
Web References:	
1.	https://www.arcgis.com/index.html
2.	https://www.esri.com/en-us/arcgis/about-arcgis/overview
3.	https://libguides.utk.edu/gistraining/arcgis
Online Resources:	
1.	ArcGIS Level 1: GIS & ArcMap, ArcCatalog, ArcGlobe, ArcScene by Udemy.
2.	https://mgimond.github.io/ArcGIS_tutorials/index.html
3.	https://gis.harvard.edu/arcgis-desktop-and-server-tutorials

22VA105	Project Management Using Primavera	0/0/0/1

Nature of Course	Theory Practical
Prerequisites	Nil

Course Objectives:

1.	To understand the relationships and constraints between activities
2.	To define the roles and resources for various activities
3.	To create organization and work breakdown structure of a project
4.	To maintain project documents library and manage multiple projects

Course Outcomes:
Upon completion of the course, students shall have the ability to

C105.1	Understand the fundamental principles of project management	[U]
C105.2	Construct relationship between activities and maintain the project sequence	[AP]
C105.3	Compute the roles and resources for each activity of a project	[AP]
C105.4	Analyze the resource availability and cost involved in a project	[AN]
C105.5	Analyze the risk involved in time and cost and demonstrate the report performance and documentation	[AN]

Course Contents:

Module 1: Planning and Scheduling of construction projects **5 Hrs.**

Introduction, Primavera P6, EPS, OBS, creating a project, Project dates, Calendar and types, WBS, Activity types and codes, Logical relationships, Types of relationships, Feeding activity information to execution team, Scheduling, Constraints and types.

Module 2: Resource and Cost Management **5 Hrs.**

Resource types, Maximum units of time, Resource price revision, assigning resources to activities, Roles, Resource leveling and smoothing, Activity costs, Budgeted and Actual cost of activities, Project Budgets, Cost comparison analysis, Budget revisions

Module 3: Monitoring and Controlling of Projects **5 Hrs.**

Baseline and actual schedule, Progress Update, Delay Impact analysis, Earned value analysis, S Curve Analysis, Project threshold, Project Tracking, Visualizer tool, Reports, Global and Project reports, Report Editor, Cost reports, Schedule reports, Client reports.

Total Hours:	**15 Hrs**

Text Books:

1	Paul Harris , Planning and Control using Oracle Primavera P6 version, Eastwood Harris Pty Ltd, 2015.
2	P. Vinayagam and A. Vimala, Planning and Managing Projects with PRIMAVERA (P6) Project Planner. I K International Publishing House, 2016.

3	Daniel Williams, Oracle Primavera P6 Version 8: Project and Portfolio Management Paperback, Packt Publishing Limited, 2012.
Suggested Readings:	
1	P. Sham, Exploring Oracle Primavera P6 R8.4, Cadcim Technologies, 2012.
2	Stephen Kelly, Oracle Primavera Contract Management, Business Intelligence Publisher Edition v14, Packt Publishing, 2012.
3	Dibyaranjan Maharana, Primavera P6 Professional Project Management Paperback, Create space Independent Publishing Platform, 2017.
4	Mary Jane Beaufrand, Primavera, 2009.
Web References:	
1	https://learn.oracle.com/ols/course/primavera-p6-project-management/53065/92446/154779
2	https://education.oracle.com/oracle-cloud-learning-subscriptions
3	https://www.linkedin.com/learning/primavera-p6-essential-training
Online Resources:	
1	https://www.coursera.org/lecture/construction-scheduling/primavera-p6-overview- 7cC78
2	https://www.edx.org/learn/project-management
3	https://www.schedulereader.com/blog/top-15-books-to-learn-primavera-p6/

22VA106	3D BUILDING MODELING USING REVIT ARCHITECTURE	0/0/0/1
Nature of Course	Theory Practical	
Pre-requisite	Engineering Graphics, Architectural Planning and Building Drawing	

Course Objectives:

1.	To understand the building information modelling methodology and its benefits
2.	To learn and get familiar with 3D design and drawing of a building in Autodesk Revit Architecture
3.	To create full 3D architectural project models and set them up in working drawings.
4.	To know data inputs (including CAD) and produce federated project deliverables

Course Outcomes:
Upon completion of the course, students shall have ability to

C106.1	Understand the concepts and benefits of Building Information Modelling	[U]
C106.2	Apply fundamental concepts and features of Autodesk Revit Architecture	[AP]
C106.3	Apply parametric 3D design tools to start designing projects	[AP]
C106.4	Develop higher-quality, more accurate architectural designs	[AP]
C106.5	Demonstrate various Annotation techniques and Rendering tools.	[AP]

Course Contents:

Module 1: Fundamentals of Revit Architecture **5 Hrs.**
Building Information Modelling for architectural, - Revit Architecture user interface - Common modification tools - Viewing the model, Controlling Object Visibility - Elevation and Section Views - 3D Views - Perspective view - Adding and Modifying Levels.

Module 2: Projects and Families **5 Hrs.**
Creating Project Templates - Walls and Curtain walls, Floors and Roofs, Stairs and Railings, Process for creating a staircase by sketch, Creating the generic railing - Adding Families: Creating families, loading families, placing families, Editing families in project.

Module 3: Annotation, Documentation and Output **5 Hrs.**
Temporary Dimensions - Permanent Dimensions – 3D Text - Creating Legends - Working with Schedules - Sheets and Title blocks - Print setup - Setting for exporting content - Process of exporting views to CAD formats.

Total Hours:	**15 Hrs.**

Suggested Readings

1	Elise Moss “Autodesk Revit 2021 Architecture Basics”, SDC Publications, 2020

2	Munir Hamad “Autodesk Revit 2020 Architecture”, Stylus Publishing, LLC, 2019
3	Douglas R. Seidler “Revit Architecture 2020 for Designers”, Bloomsbury Academic, 2019
4	Autodesk, Inc. “Revit Architecture 2011 user’s guide”, Autodesk, Inc. 2011
Web References:	
1.	https://images.autodesk.com/adsk/files/revit_architecture_2011_user_guide_en.pdf
2.	http://www-classes.usc.edu/engr/ce/107/revit_guide.pdf
Online Resources:	
1.	https://www.autodesk.com/products/revit/overview?term=1-YEAR&tab=subscription
2.	https://www.autodesk.in/products/revit/overview?term=1-YEAR&tab=subscription