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

DEPARTMENT OF CIVIL ENGINEERING

BE CIVIL ENGINEERING

CURRICULUM AND SYLLABI

REGULATION 2020

(2021-2025 BATCH)

SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY

An Autonomous Institution affiliated to Anna University, Chennai

Kuniamuthur, Coimbatore - 641 008

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REGULATION 2020 (2021-2025 BATCH)

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 2020
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.**
THEORY							
1.	21CE101	Introduction to Civil Engineering	3/0/0	3	3	60/40	ESC
THEORY CUM PRACTICAL							
2.	21MA101	Engineering Mathematics I	2/1/2	5	4	50/50	BSC
3.	21CH101	Engineering Chemistry	3/0/3	6	4.5	50/50	BSC
4.	21CS111	Problem Solving Using C Programming	3/0/2	5	4	50/50	ESC
5	21EN101	Technical Communication Skills	2/0/2	4	3	50/50	HSMC
PRACTICAL							
6	21ME111	Engineering Graphics	1/0/3	4	2.5	40/60	ESC
MANDATORY COURSE							
7.	21MC101	Mandatory Course I	3 WEEKS		0	0/100	MC
		Total	**14/1/12**	**27**	**21**	**700**	

SEMESTER II							
SL. No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs./wk.**	**C**	**Ext./Int.**	**Cat.**
THEORY CUM PRACTICAL							
1.	21CE201	Architectural Planning and Building Drawing	3/0/2	5	4	50/50	ESC
2.	21MA201	Engineering Mathematics II	2/1/2	5	4	50/50	BSC
3.	21PH201	Applied Physics	3/0/3	6	4.5	50/50	BSC
4.	21EE111	Basics of Electrical and Electronics Engineering	3/0/2	5	4	50/50	ESC
PRACTICAL							
5.	21CS211	Python for Engineers Laboratory	1/0/3	4	2.5	40/60	ESC
6.	21ME103	Engineering Practices Laboratory	0/0/3	3	1.5	40/60	ESC
MANDATORY COURSE							
7.	21MC102	Mandatory Course II	2/0/0	2	0	0/100	MC
		Total	**14/1/15**	**30**	**20.5**	**700**	

SEMESTER III							
SL. No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs./wk.**	**C**	**Ext./Int.**	**Cat.**
THEORY							
1.	21ME201	Engineering Mechanics	3/1/0	4	4	60 /40	ESC
2.	21GE201	Universal Human Values	3/0/0	3	3	60/40	HSMC
3.	21MA301	Engineering Mathematics III	3/1/0	4	4	60/40	BSC
THEORY CUM PRACTICAL							
4.	21CE301	Construction Materials and Techniques	3/0/2	5	4	50/50	PCC
5.	21CE302	Fluid Mechanics and Hydraulic Machinery	3/0/2	5	4	50/50	PCC
6.	21CE303	Surveying and Geomatics	3/0/2	5	4	50/50	PCC
MANDATORY COURSE							
7.	21MC104	Mandatory Course III	2/0/0	2	0	0/100	MC
		Total	**20/2/6**	**28**	**23**	**700**	

SEMESTER IV							
SL. No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs./wk.**	**C**	**Ext./Int.**	**Cat.**
THEORY							
1.	21CE401	Mechanics of Solids	3/0/0	3	3	60/40	PCC
2.	21MA401	Probability and Numerical Methods	3/1/0	4	4	60/40	BSC
THEORY CUM PRACTICAL							
3.	21CE402	Engineering Geology and Concrete Technology	3/0/2	5	4	50/50	PCC
4.	21CE403	Environmental Engineering	3/0/2	5	4	50/50	PCC
5.	21CE404	Geotechnical Engineering	3/0/2	5	4	50/50	PCC
6.	21CE405	Transportation Engineering	3/0/2	5	4	50/50	PCC
MANDATORY COURSE							
7.	21MC103	Mandatory Course IV	2/0/0	2	-	0/100	MC
		Total	**29/1/8**	**29**	**23**	**700**	

SEMESTER V							
SL. No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs./wk.**	**C**	**Ext./Int.**	**Cat.**
THEORY							
1.	21xxxxx	Open Elective I	3/0/0	3	3	60/40	OEC
2.	21CE0xx	Emerging Elective I	3/0/0	3	3	60/40	EEC
3.	21CE9xx	Professional Elective I	3/0/0	3	3	60/40	PEC
THEORY CUM PRACTICAL							
3.	21CE501	Construction Planning and Management	3/0/3	6	4.5	50/50	HSMC
5.	21CE502	Design of Reinforced Concrete Structures	3/0/3	6	4.5	50/50	PCC
6.	21CE503	Mechanics of Materials	3/0/3	6	4.5	50/50	PCC
MANDATORY COURSE							
7.	21MC105	Mandatory Course V	2/0/0	2	-	0/100	MC
		Total	**20/0/9**	**29**	**22.5**	**700**	

SEMESTER VI							
SL. No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs./wk.**	**C**	**Ext./Int.**	**Cat.**
THEORY							
1.	21xxxxx	Open Elective II	3/0/0	3	3	60/40	OEC
2.	21CE0xx	Emerging Elective II	3/0/0	3	3	60/40	EEC
3.	21CE9xx	Professional Elective II	3/0/0	3	3	60/40	PEC
THEORY CUM PRACTICAL							
4.	21CE601	Construction Cost Estimation and Valuation	3/0/3	6	4.5	50/50	PCC
5.	21CE602	Design of Steel Structures	3/0/3	6	4.5	50/50	PCC
6.	21CE603	Structural Analysis	3/0/2	5	4	50/50	PCC
EMPLOYABILITY ENHANCEMENT SKILLS							
7.	21EES01	Employability Enhancement Skills (Industry Internship / Training - 4 weeks)			2	40/60	EES
		Total	**18/0/8**	**26**	**24**	**700**	

SEMESTER VII							
SL. No.	Course Code	Course	L/T/P	Contact hrs./wk.	C	Ext./Int.	Cat.
THEORY							
1.	21CE0xx	Emerging Elective III	3/0/0	3	3	60/40	EEC
2.	21CE0xx	Emerging Elective IV	3/0/0	3	3	60/40	EEC
3.	21CE9xx	Professional Elective III	3/0/0	3	3	60/40	PEC
4.	21CE9xx	Professional Elective IV	3/0/0	3	3	60/40	PEC
5.	21CE9xx	Professional Elective V	3/0/0	3	3	60/40	PEC
6.	21CE9xx	Professional Elective VI	3/0/0	3	3	60/40	PEC
PROJECT WORK							
6.	21CE701	Design Comprehensive Project	0/0/2	2	1	40/60	PROJ
		Total	**18/0/2**	**20**	**19**	**700**	

SEMESTER VIII							
SL. No.	Course Code	Course	L/T/P	Contact hrs./wk.	C	Ext./Int.	Cat.
PROJECT WORK							
1.	21CE801	Project Work	0/0/24	24	12	40/60	PROJ
		Total	**0/0/24**	**24**	**12**	**100**	

COURSES DISTRIBUTION - SPECIALIZATION

SL. No.	Stream	Courses								Total
		I	II	III	IV	V	VI	VII	VIII	
1.	Structural Engineering	-	-	-	1	2+2	1+2	0+6	-	4+10
2.	Environmental and Water Resource Engineering	-	-	1	1	0+2	0+2	0+6	-	2+10
3.	Construction Engineering and Management	-	1	1	-	1+2	2+2	0+6	-	5+10
4.	Geotechnical and Transportation Engineering	-	-	1	2	0+2	0+2	0+6	-	3+10
5.	Basic Civil Engineering Courses	2	1	1	1	-	-	-	-	5
6.	Science and Humanities	4	4	2	1	-	-	-	-	11
7.	Open Elective / Mandatory Courses	1	1	1	1	2	1	-	-	7
8.	Project / Internship	-	-	-	-	-	1	1	1	3
	Total	**7**	**7**	**7**	**7**	**5+2**	**5+2**	**1+6**	**1**	**40+10**

COURSES DISTRIBUTION - SUMMARY

SL. No.	Stream	Courses/Semester								Total	%
		I	II	III	IV	V	VI	VII	VIII		
1.	Theory	1	-	3	2	3	3	6	-	16	32
2.	Practical	1	2	-	-	-	-	-	-	3	6
3.	Theory cum Practical	4	4	3	4	3	3	-	-	23	46
4.	Project Work / EES	-	-	-	-	-	1	1	1	3	6
5.	Mandatory Course	1	1	1	1	1	-	-	-	5	10
	Total	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**1**	**50**	**100**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

SL. No.	Stream	Credits/Semester								C	%
		I	II	III	IV	V	VI	VII	VIII		
1.	Humanities & Social Sciences Including Management (HSMC)	3	-	3	-	4.5		-	-	10.5	6.4
2.	Basic Sciences (BSC)	8.5	8.5	4	4	-	-	-	-	25	15.1
3.	Engg. Sciences (ESC)	9.5	12	4	-	-	-	-	-	25.5	15.5
4.	Professional Core (PCC)	-	-	12	19	9	13	-	-	53	32.1
5.	Professional Electives (PEC)	-	-	-	-	3	3	12	-	18	10.9
6.	Open Electives (OEC) / Emerging Elective Courses (EEC)	-	-	-	-	6	6	6	-	18	10.9
7.	Project Work (PROJ) / (EES)	-	-	-	-	-	2	1	12	15	9.1
8.	Mandatory Course (MC)	Non-credit								0	0
	Total	**21**	**20.5**	**23**	**23**	**22.5**	**24**	**19**	**12**	**165**	**100**

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAMME

SL. No.	Course Work - Subject Area	AICTE Suggested Breakdown of Credits	SKCET Credits
1.	Humanities and Social Sciences including Management courses	**12***	10.5
2.	Basic Science courses	**25***	25
3.	Engineering Science courses including Workshop, Drawing, Basics of Electrical / Mechanical / Computer etc.	**24***	25.5
4.	Professional core courses	**48***	53
5.	Professional Electives courses relevant to the chosen specialization / branch	**18***	18
6.	Open Subjects - Electives from other technical and / or emerging subjects	**18***	18
7.	Project Work, Seminar and / or Internship in Industry or elsewhere.	**15***	15
8.	Mandatory Courses	**Non-credit**	**Non-credit**
Total		**160***	165
**Minor Variations is allowed as per need of the respective disciplines*			

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT (10.5 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	21EN101	Technical Communication skills	2/0/2	4	3	HSMC
2.	21GE201	Universal Human Values	3/0/0	3	3	HSMC
3	21CE501	Construction Planning and Management	3/0/3	6	4.5	HSMC

BASIC SCIENCE COURSES (25 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	21MA101	Engineering Mathematics I	2/1/2	5	4	BSC
2.	21CH101	Engineering Chemistry	3/0/3	6	4.5	BSC
3.	21MA201	Engineering Mathematics II	2/1/2	5	4	BSC
4.	21PH201	Applied Physics	3/0/3	6	4.5	BSC
5.	21MA301	Engineering Mathematics III	3/1/0	4	4	BSC
6.	21MA401	Probability and Numerical Methods	3/1/0	4	4	BSC

ENGINEERING SCIENCE COURSES (25.5 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	21CE101	Introduction to Civil Engineering	3/0/0	3	3	ESC
2.	21CS111	Problem Solving using C Programming	3/0/2	5	4	ESC
3.	21ME111	Engineering Graphics	1/0/3	4	2.5	ESC
4.	21EE111	Basics of Electrical and Electronics Engineering	3/0/2	5	4	ESC
5.	21CS211	Python for Engineers Laboratory	1/0/3	4	2.5	ESC
6.	21ME103	Engineering Practices Laboratory	0/0/3	3	1.5	ESC
7.	21ME201	Engineering Mechanics	3/1/0	4	4	ESC
8.	21CE201	Architectural Planning and Building Drawing	3/0/2	5	4	ESC

PROFESSIONAL CORE COURSES (53 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	21CE301	Construction Materials and Techniques	3/0/2	5	4	PCC
2.	21CE302	Fluid Mechanics and Hydraulic Machinery	3/0/2	5	4	PCC
3.	21CE303	Surveying and Geomatics	3/0/2	5	4	PCC
4.	21CE401	Mechanics of Solids	3/0/0	3	3	PCC
5.	21CE402	Engineering Geology and Concrete Technology	3/0/2	5	4	PCC
6.	21CE403	Environmental Engineering	3/0/2	5	4	PCC

7.	21CE404	Geotechnical Engineering	3/0/2	5	4	PCC
8.	21CE405	Transportation Engineering	3/0/2	5	4	PCC
9.	21CE502	Design of Reinforced Concrete Structures	3/0/3	6	4.5	PCC
10.	21CE503	Mechanics of Materials	3/0/3	6	4.5	PCC
11.	21CE601	Construction Cost Estimation and Valuation	3/0/3	6	4.5	PCC
12.	21CE602	Design of Steel Structures	3/0/3	6	4.5	PCC
13.	21CE603	Structural Analysis	3/0/2	5	4	PCC

PROFESSIONAL ELECTIVE COURSES (18 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
Elective Stream I: Structural and Foundation Engineering						
1.	21CE901	Damage Detection and Rehabilitation of Concrete Structures	3/0/0	3	3	PEC
2.	21CE902	Design of Substructures	3/0/0	3	3	PEC
3.	21CE903	Disaster Resistant Structures	3/0/0	3	3	PEC
4.	21CE904	Green Building Technology	3/0/0	3	3	PEC
5.	21CE905	Ground Improvement and Land Reclamation Methods	3/0/0	3	3	PEC
6.	21CE906	Prefabricated Structures	3/0/0	3	3	PEC
7.	21CE907	Prestressed Concrete Structures	3/0/0	3	3	PEC
8.	21CE908	Tall Structures	3/0/0	3	3	PEC
9.	21CE909	Valuation of Civil Engineering Structures	3/0/0	3	3	PEC
Elective Stream II: Environmental and Water Resource Engineering						
1.	21CE910	Air and Noise Pollution Management	3/0/0	3	3	PEC
2.	21CE911	Ecological Engineering	3/0/0	3	3	PEC
3.	21CE912	Environmental Hazard, Risk Assessment and Management	3/0/0	3	3	PEC
4.	21CE913	GIS for Environmental Engineering	3/0/0	3	3	PEC
5.	21CE914	Industrial Waste Treatment and Disposal	3/0/0	3	3	PEC
6.	21CE915	Irrigation Engineering	3/0/0	3	3	PEC
7.	21CE916	Occupational Hazards and Industrial Safety	3/0/0	3	3	PEC
8.	21CE917	Renewable and Sustainable Energy	3/0/0	3	3	PEC
9.	21CE918	Surface Water Hydrology	3/0/0	3	3	PEC
Elective Stream III: Infrastructural Engineering and Management						
1.	21CE919	Intelligent Transportation Systems	3/0/0	3	3	PEC
2.	21CE920	Construction Methods and Equipment Management	3/0/0	3	3	PEC
3.	21CE921	Disaster Management Planning and Mitigation	3/0/0	3	3	PEC

4.	21CE922	Infrastructure Asset Management and Financing	3/0/0	3	3	PEC
5.	21CE923	Pavement construction and management	3/0/0	3	3	PEC
6.	21CE924	Project Safety Management	3/0/0	3	3	PEC
7.	21CE925	Sustainable Building Materials	3/0/0	3	3	PEC
8.	21CE926	Traffic Engineering and Management	3/0/0	3	3	PEC
9.	21CE927	Transport and Environment	3/0/0	3	3	PEC

EMERGING ELECTIVE COURSES (12 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	21CE007	Building Services and Management	3/0/0	3	3	EEC
2.	21CE008	Clean Energy Production	3/0/0	3	3	EEC
3.	21CE009	Financing and Costing Management for Civil Engineers	3/0/0	3	3	EEC
4.	21CE010	Instrumentation and Sensor Technologies for Civil Engineering Applications	3/0/0	3	3	EEC
5.	21CE011	Lean startup Management	3/0/0	3	3	EEC
6.	21CE012	Metro Rail Engineering	3/0/0	3	3	EEC
7.	21CE013	Pre-Engineered Industrial Structures	3/0/0	3	3	EEC
8.	21CE014	Risk and Reliability Analysis of Civil Infrastructure Systems	3/0/0	3	3	EEC
9.	21CE015	Rural water supply and Onsite Sanitation Systems	3/0/0	3	3	EEC
10.	21CE016	Contaminated site assessment and Remediation	3/0/0	3	3	EEC
11.	21CE017	Smart City Planning and Development	3/0/0	3	3	EEC
12.	21CE018	Smart Materials and Structures	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.	21CE001	Disaster Management	3/0/0	3	3	OEC
2.	21CE002	Engineering Risk and Uncertainty	3/0/0	3	3	OEC
3.	21CE003	Environmental Impact Assessment and Life Cycle Analysis	3/0/0	3	3	OEC
4.	21CE004	Geographical Information System	3/0/0	3	3	OEC
5.	21CE005	Industrial Pollution control and Prevention Techniques	3/0/0	3	3	OEC
6.	21CE006	Sustainability and Infrastructure	3/0/0	3	3	OEC

PROJECT WORK (13 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	21CE701	Design Comprehensive Project	0/0/2	2	1	PROJ
2.	21CE801	Project Work	0/0/24	24	12	PROJ

EMPLOYABILITY ENHANCEMENT SKILLS (2 Credits)

SL. No.	Course Code	Course Title	Duration	C	Cat.
1.	21EES01	Employability Enhancement Skills (Industry Internship / Training)	4 Weeks	2	EES

MANDATORY COURSES (Non-credit)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	21MC101	Induction Programme	3 WEEKS		0	MC
2.	21MC102	Environmental Sciences	2/0/0	2	0	MC
3.	21MC103	Soft Skills	2/0/0	2	0	MC
4.	21MC104	Management Organizational Behaviour	2/0/0	2	0	MC
5.	21MC105	General Aptitude	2/0/0	2	0	MC

VALUE ADDED COURSES

SL. No.	Course Code	Course Title
1.	21VA101	Arc GIS
2.	21VA102	Auto CAD- 2D for Civil Engineers
3.	21VA103	Construction Planning and Management Using Primavera
4.	21VA104	3D Design and Drafting Using Revit Architecture
5.	21VA105	Structural Analysis and Design Using STAAD.Pro
6.	21VA106	Total Station and GPS Surveying

SEMESTER WISE CREDIT DISTRIBUTION: -

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	21	20.5	23	23	22.5	24	19	12	165

Total Credits: 165

L : Lecture
T : Tutorial
P : Practical
C : Credit
HSMC : Humanities and Social Sciences including Management
Cat. : Category
MC : Mandatory Course
BSC : Basic Science Courses
ESC : Engineering Science Courses
OEC : Open Elective Courses
EEC : Emerging Elective Courses
EES : Employability Enhancement Skills
PROJ : Project Work
PCC : Professional Core Courses
PEC : Professional Elective Courses

SEMESTER 1

21CE101	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 motivate the student to pursue a career in one of the many areas of Civil Engineering with deep interest and keenness
3	To give basic knowledge about the applications and qualities standards of building materials
4	To expose the students to the various avenues available for doing creative and innovative work in this field by showcasing the many monuments and inspiring projects of public utility

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 their functions	[U]
C101.4	Classify the types of masonry and types of flooring	[U]
C101.5	Illustrate the traditional and latest technologies in environmentalengineering	[U]
C101.6	Discuss the fundamental principles in transportation engineering	[UP]

Course Contents: Theory

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

Scope of Civil Engineering - Functions of a Civil Engineer - Relevance of Civil Engineering in the overall infrastructural development of the country — Definition, types and classification of structures: buildings, bridges, dams, roads, railways, runways, tunnels, towers, chimneys, retaining walls, water tanks, cooling towers and silos - Fundamentals of Town Planning and Smart cities — Definition, types, applications and qualities standards of building materials: Stones, M-sand, bricks, blocks, cement, concrete, structural steel, high tensile steel bar, chemicals, timber, plywood, aluminum, GI sheet, PVC, UPVC, CPVC, recycling of construction & demolition wastes.

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

Definition, types and classification of buildings - Selection of site - Components of a building and their types and functions: foundation, basement, wall, column, RC members, Pre-stress concrete members, beams, slab, floor, roof, staircase, lintel, truss & damp proof course - Fixing of room dimensions as per NBC - Importance of analysis and design - Highlighting typical available software systems - Setting out of a building - Construction sequences of building – Types of Stone masonry: Ashlar and rubble – Types of Brick masonry bonds -- Types and constructions of flooring - Definition: Maintenances, Repairs & Rehabilitation - Basics of corrosion phenomena.

Module 3: Infrastructure Engineering **15 Hrs.**

Basic fundamentals and broad outline for the following topics:

Multi-purpose reservoir projects – Water treatment plant - Water supply systems - Irrigation systems – Rain water harvesting - Effluent treatment systems - Hydro power projects - Solid waste management. Building Energy Efficiency - Cross sectional elements in national highway – Water bound macadam road - flexible and rigid pavement - Intelligent Transport Systems - Permanent way and functions of its elements - Metro rail project - Ports & Harbors and other marine structures – Site selection for airport project-structural elements in airport.

	Total Hours	**45 Hrs.**
Text Books:		
1	Bhavikatti. S.S., Basic Civil Engineering, New Age International Publishers, 2018.	
2	Mau S. T. and Sami Maalouf, Introduction to Civil Engineering: A Student's Guide to Academic and Professional Success Cognella academic publishing, 2014	
3	Punmia B.C. Ashok kumar jain and Arun kumar jain, Building constructions Laxmi Publicaions (P) LTD, 2016	
4	Valdengrave Okumu, An Introduction to Civil Engineering, Create space Independent Publishers, 2014.	
5	Anurag Kandya Elements Of Civil Engineering Charotar Publishing House Pvt. Limited, 2015	
Suggested Readings:		
1	Anil Kumar P.P., Introduction to Smart Cities, Pearson Education, 2019	
2	Patil, B.S.(1974), Legal Aspects of Building and Engineering Contract	
3	Purushothama Raj P Building Construction Materials and Techniques, Pearson Education India,2017	
4	The National Building Code, Bureau of Indian Standards, 2017.	
5	Wadhera, Intellectual Property Rights, Universal Law Publishing Co, 2004.	
Web References:		
1	https://www.indianconcreteinstitute.org/	
2	https://geology.com/	
Online Resources:		
1	https://nptel.ac.in/courses/105102088	
2	https://onlinecourses.swayam2.ac.in/nou20_cs14/	

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 & C101.3	Understand	Online Quiz	20
C101.2	Apply	Group assignment	20
C101.4 & C101.5	Understand	Group assignment	20
C101.6	Understand	Announced test	20

<table>
<tr><th colspan="4">Assessment based on Summative and End Semester Examination</th></tr>
<tr><th rowspan="2">Bloom's Level</th><th colspan="2">Summative Assessment (24%)
[120 Marks]</th><th rowspan="2">End Semester Examination (60%)
[100 Marks]</th></tr>
<tr><th>CIA1 : [60 Marks]</th><th>CIA2 : [60 Marks]</th></tr>
<tr><td>Remember</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Understand</td><td>50</td><td>60</td><td>60</td></tr>
<tr><td>Apply</td><td>50</td><td>40</td><td>40</td></tr>
<tr><td>Analyse</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Evaluate</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Create</td><td>-</td><td>-</td><td>-</td></tr>
</table>

<table>
<tr><th colspan="7">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><th colspan="6">Continuous Assessment (40%)
[200 Marks]</th><th rowspan="4">End Semester Examination (60%)
[100 Marks]</th></tr>
<tr><th colspan="3">CA 1 : 100 Marks</th><th colspan="3">CA 2 : 100 Marks</th></tr>
<tr><th rowspan="2">SA 1
(60 Marks)</th><th colspan="2">FA 1 (40 Marks)</th><th rowspan="2">SA 2
(60 Marks)</th><th colspan="2">FA 2 (40 Marks)</th></tr>
<tr><th>Component - I
(20 Marks)</th><th>Component - II
(20 Marks)</th><th>Component - I
(20 Marks)</th><th>Component - II
(20 Marks)</th></tr>
</table>

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2					2	2	2				2	3		
2	2					2	2	2				2	3		
3	2					2	2	2				2	3		
4	2					2	2	2				2	3		
5	2					2	2	2				2	3		
6	2					2	2	2				2	3		
Avg	**2**					**2**	**2**	**2**				**2**	**3**		
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed				

21MA101	ENGINEERING MATHEMATICS I (COMMON TO MECH,MCT,CIVIL,ECE,EEE,CSE,IT,AIDS)	2/1/2/4
Nature of Course	Problem analytical	
Pre requisites	Concept of Differentiation and matrices	

Course Objectives:

1	To develop the skill to use matrix algebra techniques that is needed by engineers for practical applications.
2	To know about system of linear equations and its solution set and how to write down the coefficient matrix and augmented matrix of a linear system
3	To familiarize with functions of several variables applicable in many branches of engineering.
4	To find the solution of ordinary differential equations as most of the engineering problems are characterized in this form.

Course Outcomes:

Upon completion of the course, students shall have ability to

C101.1	Recall the concepts of matrices, ordinary and partial derivatives.	[R]
C101.2	Express square matrix in the diagonal form.	[U]
C101.3	Solve systems of linear equations numerically and to find inverse matrices.	[AP]
C101.4	Apply numerical techniques effectively to analyse and visualize data to solve basic engineering-related problems.	[AP]
C101.5	Find the extreme values of the given functions to solve the engineering problems.	[AP]
C101.6	Find the solution of second and higher order differential equations connected with electric circuits and simple harmonic motion.	[AP]

Course Contents: Theory

Module 1: Matrices **15 Hrs.**

Definition - Types of matrices - Characteristic equation - Eigenvalues and eigenvectors of a real matrices and their properties (statement only) - Cayley-Hamilton theorem (statement only) - Verification and application to find inverse and powers of real matrices - Orthogonal transformation of a real symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by Orthogonal transformation.

Module 2: Solution of Equations and Eigen value Problems **15 Hrs.**

Newton-Raphson method - Fixed point iteration method - Gauss-Elimination method - Gauss-Jordan method - Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method – Eigen value of a matrix by Power method and Jacobi method.

Module 3: Calculus **15 Hrs.**

Concepts of limits and continuity - Functions of several variables - Total derivatives - Differentiation of implicit functions - Jacobians - Taylor series expansion - Maxima and Minima - Method of Lagrangian multipliers - Ordinary differential equations - Higher order linear differential equations with constant coefficients -Euler Cauchy's equations - Applications of ODE: Solving electrical circuits and simple harmonic motion.

Total Hours	**45 Hrs**

Laboratory Course Content:

S. No	List of Experiments	CO	BT

		Mapping	
1	Entering row vector, column vector, accessing blocks of elements in MATLAB.	C101.1	[U]
2	Entering matrices, to locate matrix elements and Correcting any entry through indexing in MATLAB.	C101.1	[U]
3	First and second derivative of single variable functions using MATLAB.	C101.1	[AP]
4	Eigenvalues and eigenvectors of a matrix using MATLAB.	C101.2	[AP]
5	Sum, product, transpose, inverse, determinant and rank of a matrices using MATLAB.	C101.3	[AP]
6	System of linear equations in MATLAB using Gaussian elimination.	C101.3	[AP]
7	System of linear equations in MATLAB using matrix inverse method.	C101.3	[AP]
8	System of linear equations in MATLAB using linsolve.	C101.4	[AP]
9	Maxima and Minima of a function using MATLAB.	C101.5	[AP]
10	Higher Order Equations of constant coefficients using MATLAB.	C101.6	[AP]
		Total Hours	**30 Hrs.**

Text Books:	
1	G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry, 14th Edition,Pearson,Reprint,2018
2	Kreyszig. E, Advanced Engineering Mathematics, Tenth Edition, John Wiley and Sons (Asia) Limited, Singapore 2018.
3	Grewal. B.S, Higher Engineering Mathematics, 43rd edition, Khanna Publications, Delhi, 2018.
Suggested Readings:	
1	Veerarajan. T, Engineering Mathematics I, Tata McGraw-Hill Publishing Company Ltd., NewDelhi, 2018.
2	Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, 4th edition,2012.
3	N.P. Bali and Dr. Manish Goyal, A Text book of Engineering Mathematics, 9th edition, Laxmi publications ltd, 2014.
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
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		
C101.4	Understand	Online Quiz-II	20
C101.5	Apply	Assignment-II	20
C101.6	Understand		

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	35	35	35
Apply	45	45	45
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	-	-	-

<table>
<tr><th colspan="9">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><td colspan="8">Continuous Assessment (50%)</td><td>End Semester Examination (50%)</td></tr>
<tr><td colspan="3">CA 1
(100 Marks)</td><td colspan="3">CA 2
(100 Marks)</td><td colspan="2">Practical Exam
(100 Marks)</td><td rowspan="3">Theory Examination (35%)
Practical Examination (15%)</td></tr>
<tr><td rowspan="2">SA 1
(60M)</td><td colspan="2">FA 1</td><td rowspan="2">SA 2
(60M)</td><td colspan="2">FA 2</td><td rowspan="2">FA
(75M)</td><td rowspan="2">SA
(25M)</td></tr>
<tr><td>Component-I
(20 Marks)</td><td>Component-II
(20 Marks)</td><td>Component-I
(20 Marks)</td><td>Component-II
(20 Marks)</td></tr>
</table>

Course Articulation Matrix :

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2		1							1			
2	3	2	2	1	1							1			
3	3	3	2		1							1			
4	3	2	2		1							1			
5	3	2	2	1	1							1			
6	3	2	2	1	1							1			
Avg	**3**	**2**	**2**	**1**	**1**							**1**			
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

21CH101	**ENGINEERING CHEMISTRY** **(Common to all I Year B.E. / B.Tech)**	**3/0/3/4.5**
Nature of Course	Theory skill based	
Pre requisites	NIL	

Course Objectives:

1	To make the students conversant with water treatment, boiler feed water techniques.
2	To learn the effect of corrosion in materials and the methods for prevention of corrosion.
3	To understand the principles and applications of electrochemistry and to learn electro analytical methods.
4	To understand the basic concepts, synthesis, and applications of nonmaterial's.
5	To explore the synthesis and properties of important engineering plastics, energy sources and drug molecules.
6	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 requirements of water treatment procedures and boiler feed water for industries.	[R]
C101.2	Apply the various corrosion control techniques in real time industrial environments.	[AP]
C101.3	Understand the principle and working of reference electrodes and conductivity meters as an analyzer.	[U]
C101.4	Understand the basic concepts and applications of Nano chemistry.	[U]
C101.5	Use the knowledge of polymers, various energy sources and storage devices in engineering field.	[AP]
C101.6	Understand the principle and working of certain analytical techniques, and synthesis of some common drug molecules.	[U]

Course Contents: Theory

Module 1: Water chemistry and Corrosion **15 Hrs**

Water treatment-characteristics of water-hardness-types and estimation by EDTA method with numerical problems. Boiler feed water-requirements-disadvantages of hard water. Domestic water treatment-disinfection methods (chlorination, Ozonation, UV treatment)-demineralization process- desalination-reverse osmosis. Corrosion-types-mechanism of dry and wet corrosion-galvanic corrosion- differential aeration corrosion-protective coatings-electroplating of gold-electroless plating of nickel.

Module 2: Electrochemistry and Energy sources **15 Hrs.**

Electrochemical cells-electrolytic cell-reversible and irreversible cells - Free energy and emf, cell potentials, Nernst equation and applications. Oxidation and reduction potentials-standard hydrogen electrode, saturated calomel electrode, glass electrode - pH measurement. Nanochemistry - Basics- Comparison of molecules, nanomaterials and bulk materials; Types – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: Electrochemical deposition and electro spinning. Applications of nanomaterials in science and technology. Energy Sources - Fuel cells (H_2-O_2). Storage Devices-Batteries - Alkaline-Lead acid, Nickel cadmium and Lithium-ion batteries.

Module 3: Polymer chemistry, Spectroscopic techniques and Synthesis of drug molecules 15 Hrs.

Introduction-monomers and polymers-classification of polymers-Polymerization-types. Mechanism of addition polymerization (free radical mechanism). Plastics-classification-preparation, properties and uses of Nylon 6,6, Nylon 6, PVC, Bakelite and PET. Moulding methods- moulding of plastics for Car parts, bottle caps (Injection moulding), Pipes, Hoses (Extrusion moulding), Mobile Phone Cases, Battery Trays (Compression moulding) and PET bottles (Blow moulding). Spectroscopy-Beer Lambert‘s law, principle, instrumentation, and applications of Electronic spectroscopy (UV-visible), Vibrational and rotational spectroscopy (IR) and Flame emission spectroscopy (FES). Synthesis of a commonly used drug molecule-Asprin, p-nitroaniline from acetanilide.

Field work:

Industrial visit- Water treatment plant / Sewage treatment plant / Reverse osmosis plant

Total Hours	**45 Hrs**

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Estimation of hardness of water by EDTA method	C101.1	[E]
2	Estimation of alkalinity of water sample	C101.1	[E]
3	Determination of chloride content in bleaching powder	C101.1	[E]
4	Estimation of dissolved oxygen in water	C101.2	[E]
5	Potentiometry- determination of redox potentials and emf‘s	C101.2	[E]
6	Corrosion rate of mild steel in acid medium	C101.2	[E]
7	Electroplating of nickel over copper	C101.2	[E]
8	Conductometric titration-mixture of acids vs NaOH	C101.3	[E]
9	Determination of strength of strong acid by pH metry	C101.3	[E]
10	Synthesis of Nylon 66	C101.5	[E]
11	Spectrophotometry-Estimation of iron in water	C101.6	[E]
12	Separation of mixture of amino acids by thin layer chromatography	C101.6	[E]
		Total Hours:	**45 Hrs.**

Understanding the concepts by simple Demonstrations/Experiments:

1	To observe the hardness of given water sample by soap solution test
2	To view the colour of the different medium of given water sample using litmus paper test
3	To detect the chlorine content in tap water using simple chemical method
4	To know the presence of dissolved oxygen in given water sample using glucose by redoxprinciple
5	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 & CompanyLtd., New Delhi 2015.
2	Jain P. C. & Monica Jain., Engineering Chemistry‖, 16th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.
3	Fundamentals of Molecular Spectroscopy, 4th Edition by C. N. Banwell Publishing McGraw-HillBook Company (P) Ltd, England, 1994.
4	Physical Chemistry, 11th Edition by P. W. Atkins Publishing Oxford University Press (P) Ltd, United Kingdom, 2018.
5	Nanochemistry, 2nd Edition by K. Klabunde, G. Sergeev Springer Publisher, 2013.
6	N.Krishna Murthy, Vallinayagam D.,‖Engineering Chemistry‖ 3rd Edition by PHI Learning PvtLtd.,2014
7	Sunita Rattan, A Text Book of Engineering Chemistry, Student Edition by SK Kataria Publishers, 2013.
8	R.V.Gadag, A.Nithyananda Shetty Engineering Chemistry‖ 3rd Edition PHI Learning Pvt Ltd.,2014.
Suggested Readings:	
1	Shikha Agarwal., Engineering Chemistry and Applications‖, Cambridge University press, 2016.
2	Liliya.,Bazylak., 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	Perez, Nestor Electro chemistry and Corrosion Science. Springer, 2016.
6	Introduction to Nano: basics to Nano science and Nanotechnology, by Sengupta, Amretashis, Sarkar, Chandan Kumar, Springer Publisher, 2015.
7	Ghazi A.Karim. Fuels, Energy and the Environment, CRC Press, Taylor and Francis group,2012.
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	nptel.ac.in/courses/105104102/hardness.htm
2	https://ocw.mit.edu/courses/chemistry
3	nptel.ac.in/courses/105106112/1_introduction/5_corrosion.pdf
4	https://alison.com - Spectroscopic technique, Colorimetry

5	https://ocw.mit.edu/courses/chemistry
6	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		
C101.4	Understand	Online Quiz-II	20
C101.5,	Apply	Assignment-II	20
C101.6	Understand		

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	35	35	35
Apply	45	45	45
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	-	-	-
Understand	20	20	20
Apply	30	30	30
Analyse	25	25	25
Evaluate	25	25	25
Create	-	-	-

<table>
<tr><th colspan="10">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><th colspan="9">Continuous Assessment (50%)</th><th>End Semester Examination (50%)</th></tr>
<tr><th colspan="3">CA 1
(100 Marks)</th><th colspan="3">CA 2
(100 Marks)</th><th colspan="2">Practical Exam
(100 Marks)</th><th rowspan="3" colspan="2">Theory Examination (25%)
Practical Examination (25%)</th></tr>
<tr><th rowspan="2">SA 1
(60M)</th><th colspan="2">FA 1</th><th rowspan="2">SA 2
(60M)</th><th colspan="2">FA 2</th><th rowspan="2">FA
(75M)</th><th rowspan="2">SA
(25M)</th></tr>
<tr><th>Component-I
(20 Marks)</th><th>Component-II
(20 Marks)</th><th>Component-I
(20 Marks)</th><th>Component-II
(20 Marks)</th></tr>
</table>

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2		1							1			
2	3	2	2	1	1							1			
3	3	3	2		1							1			
4	3	2	2		1							1			
5	3	2	2	1	1							1			
6	3	2	2	1	1							1			
Avg	3	2	2	1	1							1			
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

21CS111	PROBLEM SOLVING USING C PROGRAMMING	3/0/2/4
Nature of Course	Theory Programming	
Pre requisites	Nil	

Course Objectives:

1	To understand problem solving using structured programming language
2	To gain knowledge about the control structures in C.
3	To develop logics and write C programs using arrays
4	To gain familiarity in inbuilt functions, structures and unions in C.
5	Apply concept and techniques for implementation in respective domain

Course Outcomes:

Upon completion of the course, students shall have ability to

C111.1	Apply problem solving techniques to solve real world problems	[AP]
C111.2	Understand C fundamental constructs and control structures	[U]
C111.3	Use the concept of pointers and arrays in designing programs	[AP]
C111.4	Design C programs using the concepts of strings and functions	[C]
C111.5	Develop programs using structures and Unions in C	[AP]
C111.6	Apply the suitable programming concept for the given computational problem	[AP]

Course Contents: Theory

Module 1: Problem Solving Techniques and C Fundamentals **15 Hrs.**

Problem Solving Techniques: Algorithm, Pseudo-code and Flowchart. Creative Thinking andProblem solving skills in everyday life. Understanding Compiler and interpreter. ProgramDevelopment Life Cycle. C Fundamentals: Structure of C program, Character Set – Identifiers and Keywords – Data Types – Constants - Variables and Arrays – Declarations -Operators and Expressions –Precedence of operators and associatively. Data input and output - Preparing and running a Complete C Program

Module 2: Control Structures, Arrays, Strings **15 Hrs.**

Control Structures: Branching: if-else- Looping – while - do while – for - Nes ted controlstructures - switch – break – continue – comma - goto. Arrays - Defining an array -Processing an array - Multi dimensional arrays - Strings: Defining a string - Null character -initialization of strings - reading and writing a string - processing the string

Module 3: Pointers, Functions, Structures and Unions: **15 Hrs.**

Pointers: fundamentals – Pointer Declaration & Usage – Dynamic Memory Allocation. Functions: Defining a Function – Accessing a function – Function Prototype Functions -Pointer to Function - Functions Returning Pointers. - Pointers and Strings - Passing arguments to a function - Recursion. Structures and Unions: The Type Definition (type def) – Enumerated types - Structure - Type Definition - Initialization - Accessing Structures -
Unions.

Total Hours	**45 Hrs**

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Formulate simple algorithm and flowchart using Raptor Tool for simple and complex problem	C111.1	[AP}
2	Program to process data types, format input and output and to evaluate an expression	C111.2	[AP]
3	Program using decision making statements	C111.2	[AP]
4	Program using looping statements	C111.2	[AP]
5	Program using single and two dimensional arrays	C111.3	[AP]
6	Program with Strings	C111.4	[AP]
7	Program using Pointers.	C111.3	[AP]
8	Program using Recursion	C111.5	[AP]
9	Program using structures	C111.5	[AP]
10	Branch specific application program	C111.6	[AP]
		Total Hours:	**30 Hrs.**

Text Books:

1	Sprankle M, Problem Solving and Programming Concepts. 9th Edition, Pearson Education, New Delhi, 2013
2	Yashavant Kanetkar, Let Us C. 16th Edition, BPB Publication, 2017.
3	Byron, S. Gottfreid, Programming with C. McGraw Hill, Schaum's outlines, 4thEdition, 2018.
4	Reema Thareja Computer Fundamentals and Programming in C, 2nd edition, OXFORD publications, 2016
5	Brian W. Kernighan, Dennis Ritchie, The C Programming Language. 2nd EditionPearson Publications, 2015

Suggested Readings:

1	Yashavant Kanetkar, 101 Challenges in C Programming. Edition, BPB Publication,2017
2	Herbert Schildt, The Complete Reference C. 4th Edition , McGraw Hill , 2015
3	Venugopal K R and Sudeep R.Prasad , Mastering C. 2nd Edition, McGraw Hill,2017
4	Jeri.R Hanly, and Elliot B Koffman, Problem solving and programming Design in C, 8th Edition, Pearson 2016

Web References:

1	http://raptor.martincarlisle.com/

Online Resources:	
1	https://nptel.ac.in/courses/106/104/106104128/
2	https://nptel.ac.in/courses/106/105/106105171/
3	https://www.coursera.org/specializations/c-programming

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]**
C111.1 & C111.3	Understand	Online Quiz	10
C111.2	Apply	Group assignment	30
C111.4 & C111.5	Understand	Group assignment	10
C111.6	Understand	Announced test	30

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	30	30	20
Understand	50	50	40
Apply	20	20	40
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	20	20	20
Understand	20	20	20
Apply	40	40	40
Analyse	20	20	20
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)			

Course Articulation Matrix															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3						2	1		2	2		
2	3	3	3						2	1		2	2		
3	3	3	3						2	1		2	2		
4	3	3	3						2	1		2	2		
5	3	3	3						2	1		2	2		
6	3	3	3						2	1		2	2	1	1
Avg	**3**	**3**	**3**						**2**	**1**		**2**	**2**	**1**	**1**
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

21EN101	TECHNICAL COMMUNICATION SKILLS (MECH/MCT/IT/CIVIL/CSE)	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 effective communication skills
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	Recall language skills for technical communication.	[U]
C101.2	Apply communication skills in corporate environment.	[AP]
C101.3	Understand and communicate effectively in personal and professional situation.	[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]
C101.6	Apply language skills with ease in academic and real-life situations.	[AP]

Course Contents: Theory

Module 1: Listening and Speaking **10 Hrs.**

Introduction to Effective Communication- Basics of English Language - Importance of LSRW Skills - Self Introduction - Introducing Others **- Listening** to Short Conversations or Monologues - Listening to Speeches / Talks - Listening and Responding -- Longer Listening Tasks -Recognise Functions **Speaking**- Speaking about Giving Directions / Instruction - Talk about Preferences-Agree and Disagree - Giving Opinions - Speaking Practices by Giving Examples, Reasons and Additional Information-Short Talk on Business Topics- Non Verbal Communication- Presentation using Digital Tools- Effectiveness of Narration-Leadership, Conflict and Persuasion.

Module 2: Reading **10 Hrs.**

Reading Short Texts - Skimming and Scanning - Comparing Facts and Figures - Reading and Understanding Specific Information in a Text - Cloze Reading -Identifying Reasons and Consequences Through Reading Practices - Comprehension - Collocations.

Module 3: Grammar and Writing **10 Hrs.**

Parts of Speech- Tenses – Subject Verb Agreement - Sentence Structures - Connectives - Modal Verbs - Question Formation - If Conditionals- Active and Passive - Impersonal Passive Voice - Vocabulary Building - Business Vocabulary -- Synonyms, Antonyms – British and American Words - One Word Substitution- Identifying Common Errors.

Writing Formal Letters (Accepting and Declining Invitations) - Writing Business Letters (Calling for Quotation, Seeking Clarification, Placing an Order and Complaint Letter) - Email Writing – Memo - Circular - Agenda and Minutes of the Meeting - Job Application Letter - Resume Writing - Paragraph Writing – Proof Reading and Editing--Technical Instructions and Recommendations- Jumbled Sentences - Technical Definitions - Report Phrases - Report Writing - Technical Proposal - Transcoding (Bar Chart, Flow Chart).			
		Total Hours	**30 Hrs.**
Laboratory Course Content:			
S. No	**List of Experiments**	**CO Mapping**	**BT**
1	Listening Comprehension	C101.1	[E]
2	Pronunciation, Intonation, Stress and Rhythm	C101.3	[E]
3	Situational Dialogues	C101.6	[E]
4	Formal Presentation	C101.2	[E]
5	Group Discussion	C101.2	[E]
6	Interview Skills- Online and Offline	C101.6	[E]
		Total Hours:	**30 Hrs.**

Text Books:	
1	Practical English Usage. Michael Swan. OUP. 1995.
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.
Suggested Readings:	
1	Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
2	Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
3	Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
Web References:	
1	http://www.academiccourses.com/Courses/English/Business-English
2	https://**steptest**.in
Online Resources:	
1	https://www.coursera.org/specializations/business-english
2	http://www.academiccourses.com/Courses/English/Business-English
3	https://scoop.eduncle.com/one-word-substitution-list

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	-	-	-

<table>
<tr><th colspan="10">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><td colspan="9">Continuous Assessment (50%)</td><td>End Semester Examination (50%)</td></tr>
<tr><td colspan="3">CA 1
(100 Marks)</td><td colspan="3">CA 2
(100 Marks)</td><td colspan="2">Practical Exam
(100 Marks)</td><td rowspan="3" colspan="2">Theory Examination (25%)
Practical Examination (25%)</td></tr>
<tr><td rowspan="2">SA 1
(60M)</td><td colspan="2">FA 1</td><td rowspan="2">SA 2
(60M)</td><td colspan="2">FA 2</td><td rowspan="2">FA
(75M)</td><td rowspan="2">SA
(25M)</td></tr>
<tr><td>Component-I
(20 Marks)</td><td>Component-II
(20 Marks)</td><td>Component-I
(20 Marks)</td><td>Component-II
(20 Marks)</td></tr>
</table>

Course Articulation Matrix : Theory

CO	PO												PSO		
	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			

21ME111	ENGINEERING GRAPHICS	1/0/3/2.5
Nature of Course	Practical application	
Pre requisites	Basic Drawing and Computer Knowledge	

Course Objectives:

1	To know the method to construct the conic curves used in engineering applications.
2	To develop an understanding of Isometric to orthographic views and vice versa.
3	To learn the basic projection of straight lines and plane surfaces.
4	To develop the imagination of solids inclined to one reference plane.
5	To know the development of surfaces used in various fields.

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

C111.1	Understand the basic concepts of Engineering Graphics.	[U]
C111.2	Sketch isometric, orthographic projections and projection of lines and planes	[AP]
C111.3	Develop lateral surfaces of solids including prisms and pyramids	[AP]
C111.4	Construct projections of lines, planes, solids and isometric views using modeling software.	[A]

Course Contents: Theory

Conic curves and special curves – Isometric projections, Isometric to orthographic projection-Orthographic to Isometric projection-Projection of lines and plane surfaces-Projection of solids-Development of surfaces-Introduction to perspective projection.

Laboratory Component:

S. No	List of Experiments	CO Mapping	BT
1	Introduction to drafting software.	C111.1	[U]
2	Construction of conic curves (Ellipse, Parabola and Hyperbola)	C111.1	[U]
3	Construction of special curves (Cycloid and Involutes)	C111.1	[U]
4	Isometric to orthographic projections - manual sketches	C111.2	[AP]
5	Isometric to orthographic projections - software sketches	C111.4	[A]
6	Projection of lines - inclined to HP, VP and Both HP & VP	C111.4	[A]
7	Projection of plane surfaces (Hexagon, Pentagon and circle) - inclined to any one of the principle planes	C111.4	[A]
8	Projection of solids (Prism and Pyramid) - inclined to HP	C111.3	[AP]
9	Projection of solids (Cone and Cylinder) - inclined to VP	C111.3	[AP]
10	Development of surfaces (Prism, Pyramid, Cone and Cylinder)	C111.4	[A]
11	Introduction to perspective projection	C111.2	[U]
		Total Hours	**45 Hrs.**

Suggested Readings:	
1	Bhatt N.D. and Panchal V.M., Engineering Drawing‖, Charotar Publishing House, 50th Edition,2014.
2	K. V. Natarajan, A Text Book of Engineering Graphics", Dhanalakshmi Publishers, 2018.
3	Gopalakrishna K.R., Engineering Drawing‖ (Vol. I&II combined), Subhas Stores, Bangalore,2011.
4	Venugopal K. and Prabhu Raja V., Engineering Graphics‖, New Age International (P)Limited, 2013.
Web References:	
1	http://nptel.ac.in/courses/112102101/
2	www.solidworks.com

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

Course Articulation Matrix															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	2	2				2	2	3		2	2	2		
2	2	2	2				2	2	3		2	2	2		
3	2	2	2				2	2	3		2	2	2		
4	2	2	2				2	2	3		2	2	2		
Avg	2	2	2				2	2	3		2	2	2		

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

SEMESTER 2

21CE201	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 siteand climate.
4.	To understand the building rules, Bye laws and Building Information Modeling (BIM).

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

C201.1	Apply the components and elements of an architectural design.	[AP]
C201.2	Relate spatial relationship and spatial organization principles.	[AP]
C201.3	Incorporate principles of architecture and circulation in the design.	[AP]
C201.4	Perform climate responsive designs and its various components – passive design strategy.	[AP]
C201.5	Design in terms with building Bye laws, National Building Code andtheir significance.	[AP]
C201.6	Discuss the Building Information Modeling concepts and its significance.	[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, Spatialorganization 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 Modeling **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 Modeling - Concepts -Advantages - Drawing based process vs BIM process- 3D Simulations- 4D Scheduling- 5D Costing- 6D Sustainability-7D Facility and Asset Management- Design Coordination - BIM software's -Case studies

Total Hours	**45 Hrs.**

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

C201.1	Design a single storied residential space for a given client set and drafts its sectional and elevation views.	[AN]
C201.2	Design a hospital building with all amenities and draft its sectional and elevation views.	[AN]
C201.3	Design a school building with all amenities and draft its sectional and elevation views.	[AN]
C201.4	Design a factory building with North Light roof truss & G+1 commercial building and draft its sectional and elevation views.	[AN]
C201.5	Render a 3D model of residential building, school and hospital building using Revit software Package.	[AN]
C201.6	Understand the 4D (Scheduling) , 5D (Costing), Clash detection and Automation in BIM.	[U]

Laboratory course contents:

S. No	List of Experiments	CO Mapping	BT
1.	Planning and drafting the plan, section & elevation of a single storied residential building.	C201.1	[AN]
2.	Planning and drafting the section, elevation of a G+1 hospital building	C201.2	[AN]
3.	Planning, drafting the section and elevation of a schoolbuilding	C201.3	[AN]
4.	Planning and drafting the section, elevation of a factory building with north Light Roof truss	C201.4	[AN]
5.	Planning and drafting the section elevation of a G+1commercial complex building.	C201.4	[AN]
6	Hands on Overview to Building Information Modelling (BIM)	C201.6	[U]
7.	Hands-on 3D Modeling of a single storied residential building. (Autodesk Revit Architecture).	C201.5	[AN]
8.	Hands-on 3D Modeling of a factory building with north LightRoof truss (Autodesk Revit Architecture).	C201.5	[AN]
9.	Hands-on 3D Modeling of a school building (Autodesk Revit Architecture)	C201.5	[AN]
10.	Hands-on Overview to 4D (BIM)- Simulation of a residential building.	C201.6	[U]
11.	Hands-on Overview to 5D (BIM) - cost estimating of a residential building.	C201.6	[U]
12.	Hands-on Overview to Clash detection (Navis works) and Visual Programming environment for automation (DynamoStudio)	C201.6	[U]
		Total hours	**45 Hrs**

Text Books:	
1	Simon Unwin, Analysing Architecture, Routledge; 4th edition, 2014
2	Koenigsberger O.H et.al.,Manual of Tropical Housing and Building – Part I - Climate design, Orient Longman, Madras, India, 2010.
3	Kale C.M, Patki S.Y. Building Drawing with an Integrated to Built Environment, Mc-Graw Hill Education, fifth reprint edition 2013.
Suggested Readings:	
1	Julius Panero, Martin Zelnik, Human Dimension and Interior Space: A Source Book of Design Reference Standards‖, 2012.
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, 2017
3	Ricard Hyde, Climate Responsive Design: A Study of Buildings in Moderate and Hot Humid Climates. Taylor & Francis; 1 edition, 2015
4	National Building Code of India, SP7 (Group 1) Bureau of Indian Standards, New Delhi, 2016.
Web References:	
1	http://www.civilengineeringx.com/building-design-and-construction-handbook
2	https://www.thebalancesmb.com/designing-climate-responsive-architecture-3157812
Online Resources:	
1	http://char.txa.cornell.edu/language/principl/principl.htm
2	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]
C201.1 - C201.2	Understand	Online Quiz	10
C201.3	Apply	Group assignment -1	30
C201.4 - C201.5	Understand	Group assignment -2	10
C201.6	Understand	Seminar	30

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	10	10
Understand	30	20	20
Apply	50	70	70
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	-	-	-
Understand	30	30	30
Apply	40	40	40
Analyse	30	30	30
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

<table>
<tr><th colspan="10">Continuous Assessment (50%)</th><th>End Semester Examination (50%)</th></tr>
<tr><th colspan="3">CA 1
(100 Marks)</th><th colspan="3">CA 2
(100 Marks)</th><th colspan="2">Practical Exam
(100 Marks)</th><th colspan="2"></th><th rowspan="3">Theory Examination (25%)
Practical Examination (25%)</th></tr>
<tr><th rowspan="2">SA 1
(60M)</th><th colspan="2">FA 1</th><th rowspan="2">SA 2
(60M)</th><th colspan="2">FA 2</th><th rowspan="2">FA
(75M)</th><th rowspan="2">SA
(25M)</th><th colspan="2" rowspan="2"></th></tr>
<tr><th>Component-I
(20 Marks)</th><th>Component-II
(20 Marks)</th><th>Component-I
(20 Marks)</th><th>Component-II
(20 Marks)</th></tr>
</table>

Course Articulation Matrix : Theory

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	1	1							3		
2	3	3	2	2	3	2							1		
3	3	3	3	3	3	3							3		
4	3	3	3	3	3	3							3		
5	3	3	3	3	3	3							3		
6	3	3	3	3	3	3							3		
Avg	**3**	**3**	**3**	**3**	**3**	**2**							**3**		
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

Course Articulation Matrix : Laboratory

CO	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
6	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			

21MA201	ENGINEERING MATHEMATICS II (COMMON TO MECH,MCT,CIVIL,ECE,EEE,CSE,IT,AIDS)	2/1/2/4

Nature of Course	Problem analytical
Pre requisites	Concepts of Differentiation and Integration.

Course Objectives:

1	To gain knowledge in integrals, which are needed in engineering applications.
2	To develop logical thinking and analytical skills in evaluating multiple integrals.
3	To acquaint with the concepts of vector calculus needed for problems in all engineeringdisciplines.
4	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	Determine the area and volume by applying the techniques of double and triple integrals.	[R]
C201.2	Finding the values of integrals through different numerical methods.	[U]
C201.3	Differentiate and integrate vector-valued functions to solve real world applications.	[AP]
C201.4	Calculate grad, div, curl and use Gauss, Stokes and Greens theorem to simplify the calculations of integrals.	[AP]
C201.5	Apply Laplace transform techniques in system modeling, digital signal processing, process control, solving boundary value problems.	[AP]
C201.6	Apply Laplace transform methods for solving linear differential equations.	[AP]

Course Contents: Theory

Module 1: INTEGRAL CALCULUS **15 Hrs.**

Definite integrals: Evaluation of definite integrals using Bernoulli‘s formula -Multiple Integrals: Double integration in Cartesian coordinates – Area as double integral -Change of order of Integration – Triple integration in Cartesian co-ordinates -Volume as triple integral – Beta and Gamma functions – Relation between Beta and Gamma Functions – Evaluation of Integrals using Beta and Gamma Functions - Numerical integration: Trapezoidal rule and Simpson‘s rule for single and double integrals.

Module 2: VECTOR CALCULUS **15 Hrs.**

Vector differential operator – Gradient of a scalar point function - Directional derivatives – Divergence and Curl of a vector point function – Irrotational and solenoidal vector fields – Simple problems – Vector integration – Green‘s theorem in a plane, Gauss divergence theorem and Stoke‘s theorem (theorems statements only) – Simple applications involving cubes and rectangular parallelepipeds.

Module 3: LAPLACE TRANSFORM **15 Hrs.**

Convergence of Laplace transform – Transform of some standard functions – Unit step function – Unit Impulse function – Properties – Initial and final value theorem – Inverse Laplace transform – Partial fraction method – Convolution theorem – Application of Laplace transform for solving second order Ordinary differential equation.

Total hours	**45 Hrs.**

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT

1	Double integrals evaluation in cartesian coordinates using MATLAB.	C201.1	[AP]
2	Triple integral calculations using MATLAB in cartesian and cylindrical coordinates.	C201.1	[AP]
3	Double integral evaluation in MATLAB by Trapezoidal rule.	C201.2	[AP]
4	Evaluation of gradient, curl and divergence in MATLAB.	C201.3	[AP]
5	Line integral over a vector field using MATLAB	C201.3	[AP]
6	Applying Green's theorem to solve integrals in MATLAB.	C201.4	[AP]
7	Relation between Laplace transform of function and its derivative using MATLAB.	C201.5	[AP]
8	Laplace transform of Dirac delta and Heaviside functions in MATLAB.	C201.5	[AP]
9	Solving Differential Equations in MATLAB using Laplace Transform.	C201.5	[AP]
10	Inverse Laplace Transform of symbolic expressions using MATLAB.	C201.6	[AP]
		Total Hours	**30 Hrs.**

Text Books:

1	G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 14thEdition, Pearson,Reprint,2018.
2	Kreyszig. E, Advanced Engineering Mathematics. Tenth Edition, John Wiley and Sons (Asia) Limited, Singapore 2018.
3	Grewal. B.S, Higher Engineering Mathematics. 43rd edition, Khanna Publications, Delhi,2014.

Suggested Readings:

1	Veerarajan. T, Engineering Mathematics II‖,Tata McGraw-Hill Publishing Company Ltd., NewDelhi, 2018.
2	Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, 4th edition,2012.
3	N.P.Bali and Dr.Manish Goyal,A Text book of Engineering Mathematics. 9th edition, Laxmi publications ltd, 2014.

Web References:

1	http://nptel.ac.in/video.php?subjectId=122107037
2	http://nptel.ac.in/courses/122107036/
3	http://nptel.ac.in/video.php?subjectId=117102060

Online Resources:

1	https://www.coursera.org/learn/pre-calculus
2	https://www.coursera.org/learn/linearalgebra1
3	https://alison.com/courses/Advanced-Mathematics-1
4	https://www.edx.org/course/algebra-lineal-mexicox-acf-0903-1x.

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	Remember	Quiz	20
C201.2	Understand	Seminar	20
C201.3 – C201.6	Apply	Tutorial	20
C201.3 – C201.6	Apply	Assignment	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	40	40	40
Apply	50	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	10	10
Understand	30	30	30
Apply	60	60	60
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

<table>
<tr><th colspan="10">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><td colspan="9">Continuous Assessment (50%)</td><td>End Semester Examination (50%)</td></tr>
<tr><td colspan="3">CA 1
(100 Marks)</td><td colspan="3">CA 2
(100 Marks)</td><td colspan="2">Practical Exam
(100 Marks)</td><td rowspan="3">Theory Examination (35%)
Practical Examination (15%)</td></tr>
<tr><td rowspan="2">SA 1
(60M)</td><td colspan="2">FA 1</td><td rowspan="2">SA 2
(60M)</td><td colspan="2">FA 2</td><td rowspan="2">FA
(75M)</td><td rowspan="2">SA
(25M)</td></tr>
<tr><td>Component-I
(20 Marks)</td><td>Component-II
(20 Marks)</td><td>Component-I
(20 Marks)</td><td>Component-II
(20 Marks)</td></tr>
</table>

Course Articulation Matrix : Theory															
CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	1										1		
2	2	2	2										2		
3	3	3	3										3		
4	2	2	2										1		
5	2	2	2										2		
6	2	2	2										1		
Avg	2	2	2										2.7		
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

21PH201	**APPLIED PHYSICS (Common to Mech. MCT and Civil)**	3/0/3/4.5
Nature of Course	Theory skill based	
Pre requisites	Nil	

Course Objectives:

1	To learn the basic concepts of physics needed for all branches of engineering
2	To enable the students to understand the basics of properties of matter, harmonic oscillator,quantum mechanics and crystallography.
3	To familiarize the principles of various instrument and laser.

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

C201.1	Describe the bending behavior beams, analyze the expression foryoung's modulus and working of torsional pendulum.	[U]
C201.2	Identify the various parameters that are measurable in differentinstruments.	[U]
C201.3	Discuss the physical characteristics of oscillation and the basic principle of laser.	[U]
C201.4	Understand the central concepts and principles in quantum mechanics, such as the Schrödinger equation, the wave function and its statistical interpretation.	[U]
C201.5	Estimate the Atomic packing and acquire the basic knowledge about Crystal Lattice, Unit cell, Crystal defects and classify the solids based on band theory.	[AP]
C201.6	Apply the gained knowledge to solve the problems related to their fieldof study.	[AP]

Course Contents: Theory

Module 1: Properties of Matter and Instrumentations: 15 Hrs.

Properties of matter: elasticity – Plasticity – Types of stress and strain – Hooke‘s law, stress-strain diagram - Poisson‘s ratio – Types of moduli of elasticity, relation between three moduli of elasticity – Factors affecting elasticity - Bending moment of a body: neutral surface and neutral plane, derivation of expression for bending moment of a beam with circular and rectangular cross section, cantilever, I- beam - Derivation of expression for Young‘s modulus – Torsion of cylinder: expression for couple perunit twist of a solid cylinder (derivation), torsional pendulum, expression for period of oscillation.

Instrumentations: dial gauge - Piezo electric strain gauge - Load cell: pneumatic load cell and hydraulic load cell - Pirani gauge - Optical microscope: Scanning electron microscope (SEM), transmission electron microscope (TEM) - Types of errors: gross error, systematic error and random error.

Module 2: 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 decay in a damped harmonic oscillator.

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: Neodymium laser, CO_2 and semiconductor laser (heterojunction) – Thermal effect – Qualitative industrial applications of lasers: welding, drilling and cutting.

Module 3: 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 - Crystal imperfections: point, line burger vector – Basic concepts of band theory and classification of materials into conductor, semiconductor and insulator

		Total Hours	**45 Hrs**

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Young's modulus of the material - Non-Uniform bending method.	C201.1	[U]
2	Moment of Inertia of disc and rigidity modulus of a wire - Torsional pendulum.	C201.1	[U]
3	Projectile motion – Simulation lab.	C201.2	[U]
4	Frequency of transverse and longitudinal wave modes - Melde's experiment.	C201.3	[U]
5	Simple harmonic motion- Simulation lab.	C201.3	[U]
6	Determination of laser and optical fiber parameters.	C201.3	[U]
7	Determination of Planck's Constant.	C201.4	[U]
8	Determination of Stefan's Constant.	C201.4	[U]
9	Determination of lattice constant of cubic crystal structure.	C201.5	[U]
10	Determination of band gap of semiconductor.	C201.5	[U]
Life Skill Experiments			
1	Determination of pressure required to shut off the fuel pump nozzle.	[E]	[U]
2	Determination of capacitance required to shut off the circuit in a circuit breaker.	[E]	[U]
3	Determination of earth, neutral and phase line in a circuit.	[E]	[U]
		Total Hours	**45 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.

Suggested Readings:

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 PhysicsVol. Ⅲ: The New Millennium Edition.2015

Web References:

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]
C201.1	Understand	Online Quiz - I	20
C201.2	Understand	Assignment - I	20
C201.3	Understand	Online Quiz - II	20
C201.4	Understand	Assignment - II	20
C201.5	Apply		
C201.6	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	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 (25%) [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 (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)			

Course Articulation Matrix															
CO	PO												PSO		
	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			
6	3	2	1	1								1			
Avg	3	2	1	1								1			
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

21EE111	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING (COMMON TO CSE, MECH, CIVIL AND IT)	3/0/2/4

Nature of Course	Theory analytical
Pre requisites	Nil

Course Objectives:

1	To equip students with a basic understanding of Electrical circuits
2	To learn the working principle of transformers
3	To understand the DC and AC Machine 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.
5	To equip students with an ability to understand basics of analog and digital electronics.

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

C111.1	Analyze the concepts in ac circuit and dc circuits.	[A]
C111.2	Understand the working principle of single phase and three phase transformers.	[U]
C111.3	Understand the working principle of DC and AC machines.	[U]
C111.4	Utilize the basic components for electrical installations.	[AP]
C111.5	Understand the basic concepts of Analog and Digital Electronics.	[U]

Course Contents: Theory

Module 1: DC Circuits and AC Circuits **20 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, Nodal Analysis Superposition, The venin Theorem, Maximum power transfer theorem and Norton Theorem. 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, RC, RLC combinations (series and parallel). Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 2: Electrical Machines and Installations **15 Hrs**

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections (Qualitative only). Construction and working principle of DC motor. Construction and working principle of Synchronous motor and three phase Induction motor. Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthling. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption.

Module 3: Basics of Analog and Digital Electronics **10 Hrs**

Semiconductor, PN junction diode, Zener diode, rectifier- Half wave, full wave and Bridge rectifier, Introduction to Number system, basic Boolean laws, reduction of Boolean expressions and implementation with logic gates.

Total Hours **45 Hrs**

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Familiarization of Electrical Elements, Sources, Measuring Devices and Verification of ohm's law	C111.1	[U]

2	Estimation of voltage and current by KVL and KCL in Electric Circuits	C111.1	[AP]
3	Determination of mesh current and node voltage by Mesh andNodal Analysis	C111.1	[AP]
4	Application of Superposition theorems, thevenin‘s and maximum power transfer theorem in electrical circuits	C111.1	[AP]
5	Measurement of three phase power	C111.2	[A]
6	Demonstration of cut-out sections of machines: dc machine (Commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winding - slip ring arrangement) and single-phase induction machine	C111.3	[U]
7	Load test on dc shunt motor.	C111.3	[AP]
8	Demonstration of components of LT Switch Gears	C111.4	[U]
9	Construction of bridge rectifier with and without filters	C111.5	[U]
10	Verification of logic gates.	C111.5	[U]
		Total Hours:	**30 Hrs**

Text Books:

1	Fitzgerald. A.E., Charles KingselyJr, Stephen D.Umans, ‚Electric Machinery‘, Tata McGraw Hill, 6th edition 2015.
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 GrawHill, 2013.
5	M. Morris Mano, ‚Digital Logic and Computer Design‘, Prentice Hall of India, 6th edition, 2017

Suggested Readings:

1	Charles A.Gross, Thaddeus A.Roppel, Fundamentals of Electrical Engineering. CRC press, 2012.
2	D. C. Kulshreshtha, Basic Electrical Engineering‖, McGraw Hill, 5th edition 2012,
3	Theodore F. Bogart, Jeffery S. Beasley and Guilermo Rico, ‚Electronic Devices and Circuits‘, Pearson Education,6th edition, 2019.

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	https://www.edx.org/course/electricity-magnetism-part-1-ricex-phys102-1x-1
2	https://www.mooc-list.com/course/fundamentals-electrical-engineering-coursera
3	https://nptel.ac.in/course.php

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]
C111.1	Analyze	Assignment	20
C111.2	Understand	Tutorial	20
C111.3	Understand	Quiz	20
C111.4	Apply	Simulation	20
C111.5	Understand		

Assessment based on Summative and End Semester Examination - Theory

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

<table>
<tr><th colspan="11">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><th colspan="10">Continuous Assessment (50%)</th><th>End Semester Examination (50%)</th></tr>
<tr><th colspan="3">CA 1
(100 Marks)</th><th colspan="3">CA 2
(100 Marks)</th><th colspan="2">Practical Exam
(100 Marks)</th><th rowspan="3">Theory Examination
(35%)
Practical Examination
(15%)</th></tr>
<tr><th rowspan="2">SA 1
(60M)</th><th colspan="2">FA 1</th><th rowspan="2">SA 2
(60M)</th><th colspan="2">FA 2</th><th rowspan="2">FA
(75M)</th><th rowspan="2">SA
(25M)</th></tr>
<tr><th>Component-I
(20 Marks)</th><th>Component-II
(20 Marks)</th><th>Component-I
(20 Marks)</th><th>Component-II
(20 Marks)</th></tr>
</table>

<table>
<tr><th colspan="16">Course Articulation Matrix</th></tr>
<tr><th rowspan="2">CO</th><th colspan="12">PO</th><th colspan="3">PSO</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>1</th><th>2</th><th>3</th></tr>
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<tr><td>Avg</td><td>3</td><td>2</td><td>2</td><td>2</td><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td><td>3</td><td>3</td><td></td></tr>
<tr><td>1</td><td colspan="4">Reasonably agreed</td><td>2</td><td colspan="5">Moderately agreed</td><td>3</td><td colspan="4">Strongly agreed</td></tr>
</table>

<table>
<tr><td>21CS211</td><td colspan="2">PYTHON FOR ENGINEERS LABORATORY</td><td>1/0/3/2.5</td></tr>
<tr><td>Nature of Course</td><td colspan="3">Theory analytical</td></tr>
<tr><td>Pre requisites</td><td colspan="3">Nil</td></tr>
<tr><td colspan="4">Course Objectives:</td></tr>
<tr><td>1</td><td colspan="3">Interpret the use of procedural statements like assignments, conditional statements, loops and function calls.</td></tr>
<tr><td>2</td><td colspan="3">Infer the supported data structures like lists, dictionaries and tuples in Python.</td></tr>
<tr><td>3</td><td colspan="3">Improve problem solving skills using strings, and functions</td></tr>
<tr><td>4</td><td colspan="3">Describe the need for Object-oriented programming concepts in Python..</td></tr>
<tr><td colspan="4">Course Outcomes:
Upon completion of the course, students shall have ability to</td></tr>
<tr><td>C211.1</td><td colspan="2">Structure simple Python programs for solving problems.</td><td>[U]</td></tr>
<tr><td>C211.2</td><td colspan="2">Describe the Python language syntax including control statements, loops and functions to write programs for a wide variety problem in mathematics, science, and games.</td><td>[U]</td></tr>
<tr><td>C211.3</td><td colspan="2">Examine the core data structures like lists, dictionaries, tuples and sets in Python to store, process and sort the data.</td><td>[AP]</td></tr>
<tr><td>C211.4</td><td colspan="2">Interpret the concepts of Object-oriented programming as used in Python using encapsulation, polymorphism and inheritance.</td><td>[AP]</td></tr>
<tr><td>C211.5</td><td colspan="2">Identify the external modules for creating and writing data to excel files and inspect the file operations to navigate the file systems.</td><td>[AP]</td></tr>
<tr><td colspan="4">Course Contents: Theory</td></tr>
<tr><td colspan="4">Introduction to Python: 15 Hrs.
Interpreter And Interactive Mode; Values and Data Types, Variables, Expressions, Statements, Operators, Conditionals: Boolean Values and Operators, Conditional (If), Alternative (If-Else), Chained Conditional (If-Elif-Else); Iteration: While, For, Break, Continue, Pass Functions: Function Definition, parameters and arguments, Recursion. Strings: String Slices, String Functions and Methods Lists: List Operations, List Slices, List Methods, List Loop Tuples: Tuple Assignment and Methods Dictionaries: Operations and Methods, Set in Python Files: Text Files, Reading and Writing Files, Command Line Arguments.</td></tr>
<tr><td colspan="4">Laboratory course contents : Write Python programs for the following</td></tr>
<tr><td colspan="4">Laboratory Course Content:</td></tr>
<tr><td>S. No</td><td>List of Experiments</td><td>CO Mapping</td><td>BT</td></tr>
<tr><td>1</td><td>Commands in interactive mode</td><td>C211.1</td><td>[U]</td></tr>
<tr><td>2</td><td>Programs using operators</td><td>C211.2</td><td>[AP]</td></tr>
<tr><td>3</td><td>Programs using I/O Operations</td><td>C211.2</td><td>[AP]</td></tr>
<tr><td>4</td><td>Programs using control structures</td><td>C211.3</td><td>[AP]</td></tr>
<tr><td>5</td><td>Programs using break, continue and pass statements</td><td>C211.3</td><td>[AP]</td></tr>
<tr><td>6</td><td>Programs using loops</td><td>C211.4</td><td>[AP]</td></tr>
<tr><td>7</td><td>Programs using functions</td><td>C211.4</td><td>[AP]</td></tr>
<tr><td>8</td><td>Programs using recursive functions</td><td>C211.4</td><td>[AP]</td></tr>
</table>

9	Programs using Strings	C211.4	[AP]
10	Programs using Lists	C211.4	[AP]
11	Programs using Tuples	C211.4	[AP]
12	Programs using Dictionary	C211.4	[AP]
13	Programs using Sets	C211.5	[AP]
14	Programs using Files	C211.5	[AP]
15	Programs using Command line arguments	C211.5	[AP]
		Total Hours:	**60 Hrs**
Text Books:			
1	John V. Guttag., Introduction to computation and programming using python: with applications to understanding data, PHI Publisher, 2016		
2	Beginning Python: From Novice to Professional, Magnus Lie Hetland. Edition, 2005		
3	Allen B. Downey, Think Python: How to Think Like a Computer Scientist", 2ndedition,Updated for Python 3, Shroff /O'Reilly Publishers, 2016		
4	Guido van Rossum and Fred L. Drake Jr, An Introduction to Python- Revised and updated for Python 3.2, Network Theory Ltd., 2011.		
Suggested Readings:			
1	Robert Sedgwick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python:An Inter-disciplinary Approach‖, Pearson India Education Services Pvt. Ltd.,2016.		
2	Timothy A. Budd, Exploring Python, Mc-Graw Hill Education (India) Private Ltd.,,2015.		
3	John V Guttag, Introduction to Computation and Programming Using Python",Revised and expanded Edition, MIT Press , 2013		
Web References:			
1	https://www.wileyindia.com/introduction-to-computer-science-using-python.html		
2	https://www.programiz.com/python-programming		
3	https://www.fullstackpython.com/best-python-resources		
4	https://www.tutorialspoint.com/python/		
5	https://www.geeksforgeeks.org/python-programming-language/		
Online Resources:			
1	http://nptel.ac.in/courses/106106145/		
2	https://www.codecademy.com/learn/learn-python		

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

Course Articulation Matrix															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	3	2				2			2	3	3	1
2	3	3	3	2	2							2	3	3	
3	3	3	3	2	2								2	2	
4	3	3	3	2	2										
5	3	3	3	2	2										
6															
Avg	**3**	**3**	**3**	**2**	**2**				**2**			**2**	**3**	**3**	**1**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21ME103	ENGINEERING PRACTICES LABORATORY	0/0/3/1.5
Nature of Course	Practical application	
Pre requisites	Nil	

Course Objectives:

1	To learn the use of basic hand tools and to know the need for safety in work place and to gain hands on experience in Carpentry, Sheet metal, Plumbing, Welding and Foundry.
2	To learn about basic electrical devices, meters and electronics devices and to gain knowledge about the fundamentals of various electrical and electronic gadgets their working and trouble shooting.

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

C103.1	Identify and solve the basic engineering problems at home and inworkplace.	[AP]
C103.2	Develop the surfaces and make simple components like tray and funnel.	[AP]
C103.3	Make simple metal joints using welding equipment and wooden jointsusing carpentry tools.	[AP]
C103.4	Prepare pipe connections and sand moulds.	[AP]
C103.5	Understand the fundamentals of hot forging and injection moulding	[U]
C103.6	Examine and troubleshoot electrical and electronic circuits	[A]

Course Contents: Theory

GROUP A (CIVIL & MECHANICAL)

Manufacturing Methods -Sheet metal operations - Welding - arc welding, gas welding,Study of TIG & MIG welding. Study of foundry, Demonstration of Smithy and Injection moulding - Carpentry work using power tools - Plumbing components and pipelines

Laboratory Component:

S. No	List of Experiments	CO Mapping	BT
1	Preparation of butt joints and lap joints using arc welding	C103.3	[AP]
2	Sheet metal Forming and Bending, Model making - Trays and funnels.	C103.2	[AP]
3	Preparation of wooden joints by sawing, planning and cutting.	C103.3	[AP]
4	Making basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings.	C103.4	[AP]
5	Demonstration of foundry operations like mould preparation for solid and split piece pattern.	C103.4	[U]
6	Demonstration of Smithy operations	C103.5	[AP]
7	Demonstration of assembly of pump / Demonstration of Injection moulding	C103.1	[AP]

GROUP B (ELECTRICAL AND ELECTRONICS ENGINEERING)

Basic Circuit Elements: Resistor, inductor, capacitor. Introduction to measuring equipments: Moving iron meter, moving coil meter, Wattmeter, Energy meter, CRO, Multi-meter. Digital logic circuits, PCB design, fuse, relay, circuit breaker, wire, Earthing, fan, fluorescent lamp, iron box, mixer grinder, study of FM radio and mobile phone.

Laboratory Component:

1	Study and identification of electronic components with	C103.6	[U]

	specification.		
2	Testing of CRO and Electronic components using Multimeter.	C103.6	[A]
3	Generation and measurement of signals using CRO.	C103.6	[A]
4	Familiarization of digital basic gate IC's.	C103.6	[AP]
5	Soldering practice-components devices and circuits- usinggeneral purpose PCB.	C103.6	[AP]
6	Demonstration of meters and electrical components.	C103.6	[AP]
7	Safety precautions with electrical components.	C103.6	[AP]
8	Residential house wiring.	C103.6	[A]
9	Measurement of power and energy.	C103.6	[A]
10	Trouble shooting of electrical equipments.	C103.6	[A]
		Total Hours:	**45 Hrs**

Suggested Readings:

1	Serope Kalpakjian and Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Education, Inc. 2009 (Second Indian Reprint).
2	Hajra Choudhury, Elements of Workshop Technology, Vol. I & II, Media Promotors Pvt Ltd.,2014.
3	Suyambazhagan S, ‗Engineering practices' PHI Learning private limited, New Delhi,2012.
4	D. P. Kothari and I. J. Nagrath, ―Basic Electrical Engineering, Tata McGraw Hill, 2010.
5	E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

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	40	40	40
Evaluate	-	-	-
Create	-	-	-

Course Articulation Matrix															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3			3										
2	3	2			2									3	
3	3	2			2									3	
4	3	2			2									3	
5	3	2			2									3	
6	3	2			2									3	
Avg	**3**	**2**			**2**									**3**	

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

SEMESTER 3

21ME201	**ENGINEERING MECHANICS** (COMMON TO CIVIL AND MECH)	**3/1/0/4**

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 behavior of particles and rigid bodies under motion.

Course Outcomes:

Upon completion of the course, students shall have ability to

C201.1	Define and illustrate the basic concepts of force system	[U]
C201.2	Calculate the resultant force, moment and geometrical properties of 2D, 3D objects	[AP]
C201.3	Analyse the resistance force of particles and objects for Impending Motion	[A]
C201.4	Determine the displacement, velocity and acceleration of particles and objects.	[AP]
C201.5	Determine the Dynamic forces exerted in various mechanisms of planar motion	[AP]

Course Contents: Theory

Module 1: Equilibrium of Particles and Rigid Bodies **20 Hrs**

Force Systems – Basic concepts, System of Forces, Coplanar Concurrent Forces, Resolution and addition of forces, resultant of several concurrent forces, Forces in space, Particle equilibrium in 2D and 3D. Moment of Forces and its Application; Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems - Equations of equilibrium of rigid bodies in 2D and 3D. Beams and frames - types of supports, loads and reactions.

Module 2: Centre of Gravity, Moment of Inertia and Friction **20 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, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere.

Friction: Types of friction, Limiting friction, Laws of friction – Static and Dynamic Friction; simple contact friction, ladder friction – wedge friction.

Module 3: Dynamics of Particles and rigid bodies **20 Hrs**

Kinematics of Particles: Basic terms, general principles in dynamics; Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates); Relative motion.

Kinetics of Particles: Newton's 2nd law (rectangular, path, and polar coordinates). D'Alembert's principle and its applications; Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique). Method of Virtual Work - Work of a Force, Potential Energy, Potential Energy and Equilibrium. Kinetics of rigid bodies: rigid body translation, rotation and general plane motion.

Total Hours	**60 Hrs.**

Text Books:

1	Beer, Johnston, Cornwell, Self, Mazurek and Sanghi, Vector Mechanics for Engineers - Statics and Dynamics, 12th Edition, McGraw Hill Education, New Delhi, 2019.
2	Dhiman A.K, Dhiman P, Kulshreshtha D.C, Engineering Mechanics-Statics and Dynamics, McGraw Hill Education, 2017

Suggested Readings:

1	Rajasekaran S and Sankarasubramanian G, Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., New Delhi, 2009.
2	Meriam JL, Craige and Bolton, Engineering Mechanics statics and dynamics, John Willey and Son‘s publication 9th edition, 2018
3	Kumar DS, Engineering Mechanics, S.K.Kataria and Sons Publications, 2013.
4	Irving H. Shames, Engineering Mechanics - Statics and Dynamics, Pearson Education Asia Pvt. Ltd., 2005.
5	Kottiswaran N, Engineering Mechanics - Statics and Dynamics, Sri Balaji Publications, 2018.
6	Timoshenko.S, ¯Engineering Mechanics‖, McGraw Hill Education, 2008.

Web References:

1	http://nptel.ac.in/courses/122104015/
2	http://nptel.ac.in/courses/112103109/

Online Resources:

1	https://ocw.mit.edu/courses

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)

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	Objective type Quiz	20
C201.2	Apply	Assignment	20
C201.3	Analyze	Assignment	20
C201.4 & C201.5	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	-	-	-

<table>
<tr><th colspan="7">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><th colspan="6">Continuous Assessment (40%)
[200 Marks]</th><th rowspan="4">End Semester Examination (60%)
[100 Marks]</th></tr>
<tr><th colspan="3">CA 1 : 100 Marks</th><th colspan="3">CA 2 : 100 Marks</th></tr>
<tr><th rowspan="2">SA 1
60 Marks)</th><th colspan="2">FA 1 (40 Marks)</th><th rowspan="2">SA 2
(60 Marks)</th><th colspan="2">FA 2 (40 Marks)</th></tr>
<tr><th>Component - I
(20 Marks)</th><th>Component - II
(20 Marks)</th><th>Component - I
(20 Marks)</th><th>Component - II
(20 Marks)</th></tr>
</table>

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	-	1	2									2	-	
2	3	2	2	3									3	1	
3	3	3	3	3									3	-	
4	3	2	3	3									3	1	
5	3	2	2	3									3	1	1
Avg	**3**	**2.2**	**2.2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**1**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21GE201	**UNIVERSAL HUMAN VALUES** (COMMON TO ALL BRANCHES)	3/0/0/3

Nature of Course	Theory Concept
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 withNature

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 mind.	[U]
C201.2	Apply responsibilities towards their commitments (human values, human relationship and human society).	[U]
C201.3	Apply what they have learn to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.	[AP]
C201.4	Analyze ethical and un ethical practices, and formulate strategies to actualize a harmonious environment wherever they work.	[AP]
C201.5	Understand the harmony in nature and existence, and workout mutually on fulfilling participation in nature.	[AN]

Course Contents: Theory

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

Purpose and motivation for the course. Self-Exploration–Its content and process; ‗Natural Acceptance and Experiential Validation- as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Understanding human being as a co-existence of the sentient ‗I‘and the ‗Material Body‘. Understanding the needs of Self (‗I‘) and ‗Body‘- happiness and physical Facility. Understanding the Body as an instrument of ‗I‘ (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: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail-Programs to ensure Sanyam and Health.		
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-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and Competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all- pervasive space. Holistic perception of harmony at all levels of existence.		
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: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for the above production systems. Case studies of typical holistic technologies, management models and eco-friendly production systems. Strategy for transition from the present state to Universal Human Order: a. Individual level: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations. Sum up.		
	Total Hours	**45 Hrs.**
Text Books:		
1	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, ExcelBooks, New Delhi, 2010	
2	Rajni Setia, Priyanka Sharma, ¯ Human Values‖, Genius Publication, Jaipur,2019.	
Suggested Readings:		
1	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.	
2	The Story of My Experiments with Truth - by Mohandas Karamchand 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	

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)

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)	

Course Articulation Matrix

CO	PO												PSO		
	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	2	-	-	-	-	-	-
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

21MA301	ENGINEERING MATHEMATICS III MECH/MCT/CIVIL	3/1/0/4
Nature of Course	J (Problem analytical)	
Pre requisites	Concepts of basic differentiation and Integration	

Course Objectives:

1	To understand the different possible forms of Fourier series and the frequently needed practical harmonic analysis that an engineer may have to make from discrete data.
2	To acquaint the student with transform techniques which are used in variety of engineeringfields.
3	To study the concept of mathematical formulation of certain practical problems in terms of partial differential equations and solving for physical interpretation.
4	To find the numerical solution for partial differential equations.

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

C301.1	Recall the basic integration concepts and partial derivatives	[R]
C301.2	Interpret Fourier series solutions to the engineering problems	[U]
C301.3	Apply continuous transforms techniques to evaluate definite integrals	[AP]
C301.4	Apply the Z transform techniques in discrete sequences	[AP]
C301.5	Apply analytical methods to solve the partial differential equations	[AP]
C301.6	Apply numerical methods to solve wave and heat equation with boundary conditions	[AP]

Course Contents: Theory

Module 1: Fourier Series **20 Hrs**

Dirichlet's conditions - General Fourier Series - Odd and Even Functions - Half range sine series and cosine series - Parseval's Identity - Harmonic analysis.

Module 2: Fourier Transform and Z Transform **20 Hrs**

Fourier Transform: Complex form of Fourier Transforms – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Self reciprocal - Convolution theorem and Parseval's Identity (Statement only) – Evaluation of integrals using Parseval's Identity. **Z- Transform**: Convergence of Z transform **-** Z-transform of Standard functions **-** Properties – Initial and Final value Theorem **-** Inverse Z- transform - Convolution theorem (Statement only) - Partial fraction method - Formation of difference equations - Solution of difference equations using Z-transform Techniques.

Module3:Partial Differentia Equations **20 Hrs**

Introduction to PDE- Formation of PDE by eliminating arbitrary constants and arbitrary functions - Solving PDE by Lagrange's linear equations - Linear homogeneous partial differential equations of second and higher order with constant coefficients-Classifications - Numerical Solution to Partial differential Equation - Elliptic equations - Laplace equation - Liebmann's Iteration Process -Poisson equation - Parabolic Equation (one dimensional heat equation) - Bender-Schmidt's Difference Scheme - Crank-Nicholson's Difference Scheme - Hyperbolic Equation (one dimensional wave equation).

Total Hours	**60 Hrs.**

Text Books:

1	Erwin E Kreyszig., Advanced Engineering Mathematics‖,John Wiley and Sons (Asia) Limited, Hoboken,2020.

2	Grewal. B.S, Higher Engineering Mathematics‖, 44th edition, Khanna Publications, Delhi,2018.
3	Jain M.K. Iyengar, K & Jain R.K., Numerical Methods for Scientific and Engineering Computation, New Age International (P) Ltd, Publishers,6th edition, 2016.
Suggested Readings:	
1	Veerarajan. T, Transforms and Partial differential equations, 3rd edition, Tata McGraw-Hill Publishing Company Ltd., reprint, 2016.
2	N.P.Bali . A Text book of Engineering Mathematics Sem-III/IV‖ 13th edition, Laxmi Publications Ltd, 2017.
3	Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, 4th edition, 2016.
4	P. Kandasamy, K. Thilagavathy and K. Gunavathy, Numerical Methods‖,S.Chand Co. Ltd., New Delhi, 2015.
5	Holly Moore, MATLAB for Engineers‖ Fifth Edition - Pearson Publications, 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**	**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	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

<table>
<tr><td colspan="6">Continuous Assessment (40%)
[200 Marks]</td><td rowspan="4">End Semester Examination (60%)
[100 Marks]</td></tr>
<tr><td colspan="3">CA 1 : 100 Marks</td><td colspan="3">CA 2 : 100 Marks</td></tr>
<tr><td rowspan="2">SA 1 (60 Marks)</td><td colspan="2">FA 1 (40 Marks)</td><td rowspan="2">SA 2 (60 Marks)</td><td colspan="2">FA 2 (40 Marks)</td></tr>
<tr><td>Component - I (20 Marks)</td><td>Component - II (20 Marks)</td><td>Component - I (20 Marks)</td><td>Component - II (20 Marks)</td></tr>
</table>

Course Articulation Matrix

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

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE301	CONSTRUCTION MATERIALS AND TECHNIQUES	3/0/2/4

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

C301.1	Explain the properties and applications of various building materialsand their appropriate suitability for a given scenario.	[AP]
C301.2	Demonstrate the manufacturing process of buildings materials and role of admixtures in the concrete mixture.	[AP]
C301.3	Illustrate the characteristics and applications of alternate and decorative construction materials used in various construction works.	[AP]
C301.4	Illustrate the characteristics and applications of protective and special materials used in various construction works.	[AP]
C301.5	Identify and describe the significance of modern machineries and technologies for construction activities.	[AP]
C301.6	Select appropriate techniques and tools 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: Alternate, Decorative, Protective and Special Materials **15 Hrs.**

Alternate materials: Engineered wood, Bamboo, Sustainable particle boards, Veneer, Foam, Eco- friendly materials - Decorative materials: Panels of laminates, Paints, Varnishes, Distempers, Glass, Ceramics, Plaster, Fabric, Paper - Protective materials: Sealants for joints, Fiber glass reinforced plastic, Carbon fiber, Thermal insulation - Special materials: Composite materials and types, Applications of laminar composites

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

Machineries for: Earthmoving, Dewatering, Concrete mixing, Transporting & placing of materials, 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**

Laboratory Course Content:

S. No	List of Experiments	CO	BT

		Mapping	
1	Determine the general quality of bricks and building blocks (Drop test, Dimension test, Warpage test)	C301.1	[AN]
2	Estimate the Water absorption and Efflorescence of bricks and building blocks	C301.1	[AN]
3	Assess the compression strength of bricks and building blocks	C301.1	[AN]
4	Determination of tensile strength of steel rods	C301.2	[AN]
5	Evaluate the double shear strength of steel rods	C301.2	[AN]
6	Estimate the torsion strength of steel rods	C301.2	[AN]
7	Determine the impact strength of steel bar	C301.3	[AN]
8	Determine the hardness of metal specimens	C301.3	[AN]
9	Assess the fineness and soundness properties of cement	C301.4	[AN]
10	Estimate the consistency and setting time of cement	C301.4	[AN]
11	Determination of compression strength of cement	C301.5	[AN]
12	3D Printing in building construction (study experiment)	C301.6	[U]
		Total Hours	**30 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	Rangwala.S.C, Engineering Materials, Charotar Publishing House, New Delhi 2015.
4	Carlos Balaguer, Robotics and automation in construction‖, Springer ed., 2008.
Suggested Readings:	
1	Rajput.R.K, Engineering Materials. S. Chand & Company Ltd., 2014.
2	Duggal.S.K, Building Materials, New Age International (P) Ltd., Publishers, 2012
3	Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C.," Construction Planning, Equipmentand 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
IS 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.
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	http://www.iaacblog.com/programs/robot-assisted-interior/
4	https://www.sciencedirect.com/science/article/pii/S2352710219300889
5	https://construction-robotics.eu/journal/
6	https://wingtra.com/drone-mapping-applications/drones-in-construction-and-infrastructure/

7	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

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 & C201.3	Understand	Online Quiz	20
C201.2	Apply	Group assignment	20
C201.4 & C201.5	Understand	Seminar	20
C201.6	Understand	Group assignment	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	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 (15%) [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 (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)**				

Course Articulation Matrix : Theory															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	-	-	3	-	-	-	-	-	-	-	-	3	-	-
2	3	-	3	-	-	-	-	-	-	-	-	-	-	1	-
3	2	3	-	-	2	1	2	-	-	-	1	-	3	2	-
4	2	3	-	-	2	1	2	-	-	-	1	-	3	2	-
5	2	2	1	1	3	-	1	2	-	-	2	-	1	3	1
6	2	-	1	1	3	-	1	2	-	-	2	-	1	3	1
Avg	**2.3**	**2.7**	**1.7**	**1.7**	**2.5**	**1.0**	**1.5**	**2.0**	**-**	**-**	**1.5**	**-**	**2.2**	**2.2**	**1.0**
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			
Course Articulation Matrix : Laboratory															
1	1	3	-	3	1	-	-	2	-	-	-	3	2	2	2
2	2	3	-	-	2	-	-	2	-	-	-	3	2	2	2
3	2	3	-	-	2	-	-	2	-	-	-	3	2	2	2
4	2	3	-	-	2	-	-	2	-	-	-	3	2	2	2
5	2	3	-	-	2	-	-	2	-	-	-	3	2	2	2
6	2	2	-	-	3	-	-	2	-	-	-	3	2	2	2
Avg	**1.8**	**2.8**	**-**	**3.0**	**2.0**	**-**	**-**	**2.0**	**-**	**-**	**-**	**3.0**	**2.0**	**2.0**	**2.0**
1		Reasonably agreed			2	Moderately agreed			3			Strongly agreed			

21CE302	FLUID MECHANICS AND HYDRAULIC MACHINERY	3/0/2/4
Nature of Course	Theory Application	
Pre requisites	Nil	

Course Objectives:

1	To study the concepts of fluid mechanics
2	To understand the closed conduit flow in different flow condition and the open channel flowtypes
3	To understand the application of Dimensional analysis in similitude and model study.
4	To study the concepts of hydraulic machines and the basics of Computational Fluid Dynamics for Civil Engineering Problems

Course Outcomes:

Upon completion of the course, students shall have ability to

C302.1	Understand the broad principles of fluid statics, kinematics and dynamics	[U]
C302.2	Calculate major and minor losses in flow through pipes	[AN]
C302.3	Apply the knowledge of fluid mechanics in addressing problems in open channels flow.	[AP]
C302.4	Apply the principle of dimensional analysis and model analysis in hydraulic engineering problems	[AP]
C302.5	Design and Study the performance of hydraulic machineries (Pumps & Turbines)	[AN]
C302.6	Apply the basics of Computational Fluid Dynamics in solving pipe flow	[AP]

Course Contents: Theory

Module I: Fluid Mechanics (Fluid Statics, Kinematics & Dynamics) 15 Hrs.

Properties of fluids-Fluid Statics-Pascal‘s Law, Pressure Measurement, Buoyancy and Flotation, Hydrostatic force on plane and curved surface-Fluid Kinematics-Classification of Flow, Continuity equation, Stream and Velocity Function-Fluid Dynamics-Bernoulli‘s equations, Laminar and Turbulent Flow-Closed Conduit Flow-major and minor losses-Concept of boundary Layer and boundary layer thickness.

Module II: Applied Hydraulics 15 Hrs.

Open Channel Flow-Types of Flow, Discharge measurement, Most Economical Section, Gradually Varied Flow, Rapidly Varied Flow-Energy-depth relationships, specific energy, critical flow, hydraulic jump, uniform flow, Energy dissipation-Water surface profile-Dimensional analysis-Rayleigh‗s method and Buckingham‗s p theorem-Hydraulic models – Geometric, kinematic and dynamic similarities - dimensionless numbers - model and prototype relations.

Module III: Hydraulic Machines and Computational Fluid Dynamics 15 Hrs.

Turbines-Reaction and Impulse Turbines (Pelton, Francis and Kaplan Turbine)- Hydrodynamic force of jet-Pumps-Centrifugal Pumps, Reciprocating Pumps-working principle Velocity diagram, Work done and Efficiency- Computational Fluid Dynamics-Basic equations of fluid dynamics, Grid generation, Introduction to in-viscid incompressible flow, Boundary layer flow as applicable to C.F.D. Hydro informatics: Concept of hydro informatics -scope of internet and web based modeling in Civil Engineering Problems

Total Hours	**45 Hrs**

Course Outcomes : Laboratory

Upon completion of the Laboratory, students shall have ability to

C302.1	Measure the flow in pipe section using orifice meter and venturi meter	[AP]
C302.2	Measure the discharge in channels using notches and impact of jet	[AP]
C302.3	Determine the major and minor losses in pipes	[AP]
C302.4	Study the performance of different types of pumps	[AP]
C302.5	Study the performance of different types of hydraulic turbines	[AP]
C302.6	Model the pipe flow using CFD	[AP]

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Flow Measurement in pipe using Venturi meter	C302.1	[AP]
2	Flow Measurement in pipe using Orifice meter	C302.1	[AP]
3	Flow measurement in open channel using notches.	C302.2	[AP]
4	Study of impact of jet on vanes	C302.2	[AP]
5	Determination of frictional loss in pipes	C302.3	[AP]
6	Determination of minor losses in pipes	C302.3	[AP]
7	Performance test on reciprocating pump	C302.4	[AP]
8	Performance test on centrifugal & submersible pump	C302.4	[AP]
9	Performance test on impulse turbine (Pelton Turbine)	C302.5	[AP]
10	Performance test on reaction turbine (Francis Turbine)	C302.5	[AP]
11	Performance test on reaction turbine (Kaplan Turbine)	C302.5	[AP]
12	Modeling of a pipe flow using CFD software	C302.6	[AP]
		Total Hours	**30 Hrs**

Text Books:

1	Modi P N and Seth S.M, Hydraulics & Fluid Mechanics.Standard book house, New Delhi,2017.
2	Bansal R K, Fluid Mechanics and Hydraulic Machines, Laxmi Publications, New Delhi, 10th Edition 2018.
3	Versteeg, H. K.; Malalasekera, W.,An Introduction to Computational Fluid Dynamics‖, Pearson Publishers,2007

Suggested Readings:

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 and hydraulic 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 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& C302.2	Understand	Surprise Test	20
C302.3	Apply	Assignment	20
C302.4	Apply	Tutorial Problems	20
C302.5 & C302.6	Analyze	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	-	-	-
Understand	10	10	10
Apply	50	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	10	10	10
Understand	20	20	20

Apply	30	30	30
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 (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)**			

Course Articulation Matrix : Theory															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1		1			1			1	1	1	2	2	2
2	3	3	2	3			1			1	1	1	2	2	2
3	3	2	1	2			1			1	1	1	1	1	1
4	3	2	1	2			1			1	1	1	1	2	2
5	3	3	2	3	2		1			1	1	1	2	2	2
6	2	2	2	2	3		1			1	1	1	2	2	2
Avg	**2.7**	**2.2**	**1.6**	**2.2**	**2.5**		**1.0**			**1.0**	**1.0**	**1.0**	**1.7**	**1.8**	**1.8**
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			
Course Articulation Matrix : Laboratory															
1	3	2	2	1				1				2	2	2	2
2	3	2	2	1				1				2	2	2	2
3	3	2	2	1				2				2	1	1	1
4	3	2	2	2	2			2				2	1	2	2
5	3	2	2	2	2			2				1	2	2	2
6	3	2	2	2	3			2				1	2	2	2
Avg	**3.0**	**2.0**	**2.0**	**1.5**	**2.3**			**1.7**				**1.7**	**1.7**	**1.8**	**1.8**
1		Reasonably agreed			2	Moderately agreed				3		Strongly agreed			

21CE303	SURVEYING AND GEOMATICS	3/0/2/4
Nature of Course	Theory 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 introduce the concepts of software tools in modern surveying methods

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

C303.1	Apply the concepts of basic surveying in the measurement of area, volume and earthwork calculations	[AP]
C303.2	Apply the concepts of setting out of simple and compound curves using linear methods	[AP]
C303.3	Distinguish the advantages of modern surveying over conventionalsurveying methods	[AP]
C303.4	Analyze the working principle of Total station and its applications in modern surveying	[AN]
C303.5	Measure the depth of water bodies using modern surveying methods	[AN]
C303.6	Classify the concepts of photogrammetry and remote sensing techniques used in modern surveying methods	[AP]

Course Contents: Theory

Module 1: Classic surveying methods **15 Hrs.**

Definitions, Classifications - basic principles - methods of ranging - Errors in linear measurements and their corrections - Compass – types – bearing systems and conversions - errors and local attraction - levelling and applications –Methods - Fly, Check and Reciprocal levelling - curvature and refraction- Contouring - characteristics & Interpolating methods - Computations of cross sectional areas and volumes – Earthwork calculations - Mass haul diagrams - Curves - Simple, Compound and Reverse curves – Setting out in linear methods.

Module 2: Triangulation & Modern surveying methods **15 Hrs.**

Theodolite – surveying adjustments – Heights and Distances – Triangulation – instrument and accessories - satellite station - reduction to center – Signals and towers - 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 Electro-optical and Microwave system - Care and maintenance of Total Station instruments.

Module 3: Hydrographic and GPS surveying **15 Hrs.**

Hydrographic surveying - Tides - MSL - Sounding methods - Determination of depth and position using multi-beam sounder - 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.

Total Hours	**45 Hrs**

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

C303.1	Measure the Horizontal & Vertical angles and calculate the area of the given plot	[AN]

C303.2	Measure the difference in elevation between two inaccessible points	[AN]
C303.3	Plot the LS & CS view of the road surface using software tools	[AP]
C303.4	Prepare the contour map of the area using modern tools	[AP]
C303.5	Plot the curve between two points by various methods	[AP]
C303.6	Find out the Latitude & Longitude of the point using GPS	[AP]

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Computation of bearings and area by Compass Traversing	C303.1	[AP]
2	Measurement of Horizontal angles by Repetition, Reiterationand Vertical angles.	C303.2	[AP]
3	Determination of Elevation of an object single plane method. (Base accessible and in- accessible)	C303.2	[AP]
4	Determination of difference in elevation using Dumpy Level.	C303.2	[AP]
5	Profile leveling – Longitudinal & Cross-sectional plottingusing TERRA MODEL/EXCEL	C303.2	[AP]
6	Determination of Tachometric Constants.	C303.3	[AP]
7	Measurement of height and distance by tangential tachometry.	C303.3	[AP]
8	Preparation of Contour map by grid contouring method using SURFER 8.0.	C303.4	[AP]
9	Study of total station, measuring horizontal and verticalangles	C303.4	[AN]
10	Setting out of simple and Transition curve.	C303.5	[AP]
11	Determination of distances and elevation between twoinaccessible points using total station.	C303.6	[AN]
12	Traversing and area measurement using total station and its latitude and longitude observation using GPS.	C303.6	[AN]
		Total Hours	**30 Hrs**

Text Books:

1	Punmia B.C., Surveying‖ – Vols. – I, II & III‖, Laxmi publications, New Delhi 2016
2	N.N. Basak., Surveying and Levelling‖, McGraw Hill Edition, 2017
3	Anji Reddy M., Remote Sensing and Geographical Information System‖, B.S. Publications,2012

Suggested Readings:

1	Aylmer Johnson, Plane and Geodetic surveying, 4th edition, Crc Press, 2014
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 and Remote sensing,Pearson education, 2017.
4	Arora K.R., Surveying Vol I & II, Standard book house, 2019

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_5eneAhXRdCsKHQZHBh0Q6
	AEILTAB#v=onepage&q&f=false
Online Resources:	
1	http://www.nptel.ac.in/courses/105107122
2	http://www.nptel.ac.in/courses/105104101

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 - C303.2	AP	Online Quiz - 1	20
C303.3	AP	Group Assignment - 1	20
C303.4 - C303.5	AP	Online Quiz - 2	20
C303.6	AP	Group 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	-	-	-
Understand	20	10	10
Apply	40	40	40
Analyse	40	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	20	20	20
Analyse	60	60	60
Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

<table>
<tr><th colspan="9">Continuous Assessment (50%)</th><th>End Semester Examination (50%)</th></tr>
<tr><th colspan="3">CA 1
(100 Marks)</th><th colspan="3">CA 2
(100 Marks)</th><th colspan="2">Practical Exam
(100 Marks)</th><th rowspan="3">Theory Examination (35%)
Practical Examination (15%)</th></tr>
<tr><th rowspan="2">SA 1
(60M)</th><th colspan="2">FA 1</th><th rowspan="2">SA 2
(60M)</th><th colspan="2">FA 2</th><th rowspan="2">FA
(75M)</th><th rowspan="2">SA
(25M)</th></tr>
<tr><th>Component-I
(20 Marks)</th><th>Component-II
(20 Marks)</th><th>Component-I
(20 Marks)</th><th>Component-II
(20 Marks)</th></tr>
</table>

Course Articulation Matrix : Theory

CO	PO												PSO		
	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			2				3	3		2
5	3	3	3	3	3			2				3	3		2
6	2		2		3			1				3	3		2
Avg	**2.7**	**2.8**	**2.5**	**2.7**	**2.7**			**1.5**				**2.5**	**2.6**		**1.7**
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

Course Articulation Matrix : Laboratory

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		1			2				3	3		2
2	3	3	1		2			2				3	3		2
3	3	3	2		3			3				3	3		2
4	3	3	2	2	3			3				3	3		3
5	3	3	3	2	3			3				3	3		3
6	3	3	3	2	3			3				3	3		2
Avg	**3**	**3**	**2**	**2**	**2.5**			**2.6**				**3**	**3**		**2.3**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

SEMESTER 4

21CE401	MECHANICS OF SOLIDS		3/0/0/3
Nature of Course	Problem Analytical		
Pre requisites	Engineering Mechanics		
Course Objectives:			
1	To apply the fundamental concepts of stress, strain and deformation of solids and thin cylinders		
2	To compute and sketch the bending moment, shear force, stresses and deformations of beams.		
3	To analyse plane trusses using various methods.		
4	To compute the torsion on shafts and springs.		
Course Outcomes: **Upon completion of the course, students shall have ability to**			
C401.1	Apply the concept of stress and strain for brittle and ductile materials to compute the stresses and strains.		[AP]
C401.2	Analyse the composite bars, simple applications of strain energy principles and thin cylinders		[AP]
C401.3	Analyse the determinate beams for various load cases and construct bending moment and shear force diagrams.		[AN]
C401.4	Analyse the trusses for various load cases.		[AN]
C401.5	Apply the simple bending concept and various methods to compute the stresses, bending, slope and deformations in determinate beams.		[AN]
C401.6	Compute the bending and torsional deformation on shafts and springs.		[AN]
Course Contents: Theory			
Module 1: Simple Stresses, Strains and Thin cylinders — **15 Hrs.** Stresses in the Members of a Structure - types of stresses and strain - Hooke's Law - Stress-Strain relationship- True Stress and True Strain - Stress-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 - Strain Energy - Resilience - Gradual, sudden, impact and shock loadings - simple applications - Thin cylinders - under internal pressure - deformation of thin cylinders. **Module 2: Analysis of Beams and Trusses** — **15 Hrs.** Determinate structures – internal forces and moment in beams – relationships between loads, shear forces, and bending moments - Shear force and bending moment diagrams – cantilever, simply supported beams – with and without overhangs - Analysis of plane truss - stability and equilibrium of plane frames - analysis of forces in truss members - method of joints - method of sections - method of tension coefficient **Module 3: Bending, Slope and Deflection of beams, Torsion on shafts** — **15 Hrs.** Theory of simple bending - Determination of bending stresses - Section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections –Slope and deflection - Relationship between moment, Slope and deflection - Integration Method - Macaulay's Method - Moment-Area Method - Conjugate beam method - Torsion - Bending and Torsional Deformation of a Circular Shaft – power transmitted by shafts – Springs - stresses in helical springs - deflection of springs.			
		Total Hours	**45 Hrs.**
Text Books:			
1	Bansal R.K, Strength of Materials, Laxmi Publications Ltd, New Delhi, 2018.		

2	Rajput R K, A Textbook of Strength of Materials (Mechanics of Solids), 7e, S. Chand Publishing, 2018.
3	Beer, F.P., Johnston Jr., E.R., Dewolf, J.T. and Mazurek, D.F. Mechanics of Materials‖, 8e, McGraw-Hill, 2020.
Suggested Readings:	
1	William A. Nash, Strength of Materials, Tata McGraw-Hill Publishing Co. Ltd, New Delhi, 2010
2	Gambhir M.L. Fundamentals of Solid Mechanics‖, PHI Learning Private Ltd., New Delhi, 2010.
3	Rattan S.S, Strength of Material‖, Tata McGraw-Hill Publishing Co. Ltd, New Delhi, 2011
4	Timoshenko S., Strength of Materials - Part 1 and 2 D Van Nostrand Company, Inc. London,2002
Web References:	
1	http://www.nesoacademy.org/civil-engineering/mechanics of solids
2	http://web.mit.edu/emech/dontindex-build/
Online Resources:	
1	http://nptel.ac.in/course.php?disciplineId=105
2	http://nptel.iitk.ac.in/courses/Webcourse-contents/IITDelhi/Mechanics%20Of%20Solids/index.htm

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& C401.2	Analyse	Online Quiz/ Assignment	20
C401.3	Analyse	Online Quiz/ Assignment	20
C401.4	Analyse	Online Quiz/ Assignment	20
C401.5 & C401.6	Analyse	Online Quiz/ 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	30	10	10
Apply	30	30	30
Analyse	30	50	50
Evaluate	-	-	-
Create	-	-	-

<table>
<tr><th colspan="7">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><th colspan="6">Continuous Assessment (40%)
[200 Marks]</th><th rowspan="4">End Semester Examination (60%)
[100 Marks]</th></tr>
<tr><th colspan="3">CA 1 : 100 Marks</th><th colspan="3">CA 2 : 100 Marks</th></tr>
<tr><th rowspan="2">SA 1
(60 Marks)</th><th colspan="2">FA 1 (40 Marks)</th><th rowspan="2">SA 2
(60 Marks)</th><th colspan="2">FA 2 (40 Marks)</th></tr>
<tr><th>Component - I
(20 Marks)</th><th>Component - II
(20 Marks)</th><th>Component - I
(20 Marks)</th><th>Component - II
(20 Marks)</th></tr>
</table>

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	2	-	-	-	-	-	-	-	3	3	-	3
2	3	2	2	2	-	-	-	-	-	-	-	3	3	-	3
3	3	3	2	2	-	-	-	-	-	-	-	3	3	-	3
4	3	3	2	2	-	-	-	-	-	-	-	3	3	-	3
5	3	2	2	2	-	-	-	-	-	-	-	3	3	-	3
6	3	3	2	2	-	-	-	-	-	-	-	3	3	-	3
Avg	**3**	**2.5**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**3**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21MA401	PROBABILITY AND NUMERICAL METHODS MECH/MCT/CIVIL	3/1/0/4

Nature of Course	J (Problem Analytical)
Pre requisites	Concepts of Differentiation and Integration.

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

Course Outcomes:

Upon completion of the course, students shall have ability to

C401.1	Recall the concept of probability	[R]
C401.2	Understand to handle situations involving random variables and Standard distributions.	[U]
C401.3	Apply measures of central tendency to Analyze statistical data	[AP]
C401.4	Develop the inferences for engineering problems using testing of hypothesis.	[AP]
C401.5	Apply curve fitting to Fit a polynomial or special function curve for the given data.	[AP]
C401.6	Apply numerical methods to fit the polynomial.	[AP]

Course Contents: Theory

Module 1: Probability **20 Hrs**

Sample space, Axioms of Probability-Events-independent events-Conditional probability, Total Probability- Baye‘s Theorem (Statement only) - Simple Problems. One dimensional Random Variable-Probability mass function-Probability density function-Discrete random variable-Continuous Random Variable-Simple problems. Mathematical Expectations-Moments-Moment generating function-Properties-Standard distributions - Discrete distributions: Binomial - Poisson - Geometric - Continuous distribution: Uniform - Normal – Simple Problems.

Module 2: Statistics **20 Hrs**

Definition of Statistics - Applications - Data - Collection of Data: Internal and external data, Primary and secondary Data. Descriptive Statistics: Classification and tabulation of univariate data, Measures of central tendency: Mean Median and Mode. Measures of dispersion – Range, Variance and Standard deviation – Scatter diagram - Correlation (Karl Pearson‘s) - Rank correlation (Spearman‘s) - Linear regression. Testing of Hypothesis - Small Samples - Student‘s t -Test for single mean, difference of mean -F test - Chi square test for goodness of fit and independence of attributes.

Module 3: Numerical Methods **20 Hrs**

Curve Fitting-Empirical laws - Linear law - Laws reducible to Linear law- Method of group averages - straight line and parabola - Principle of Least squares - Fitting straight line, parabola and exponential curve - 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 differentiation - Newton‘s Forward and Backward differentiation formulas.

Total Hours	**60 Hrs.**

Text Books:

1	Peebles Jr. P.Z., Probability Random Variables and Random Signal Principles, TataMcGraw-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.
Suggested Readings:	
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.
3	Steven Chapra, Applied Numerical Methods with MATLAB for engineers and scientists‖, 4thedition, 2017.
Web References:	
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/
4	https://www.coursera.org/learn/probability-intro
Online Resources:	
1	http://nptel.ac.in/course.php?disciplineId=105
2	http://nptel.iitk.ac.in/courses/Webcourse-contents/IITDelhi/Mechanics%20Of%20Solids/index.htm

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	Remember	Quiz	20
C401.2	Understand	Seminar	20
C401.3-C401.6	Apply	Tutorial	20
C401.3-C401.6	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)	

Course Articulation Matrix															
CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	1	1	-	-	-	-	-	-	-	-	1	-	-
2	1	2	2	1	-	-	-	-	-	-	-	-	2	-	-
3	2	2	2	3	-	-	-	-	-	-	-	-	2	-	-
4	1	1	2	2	-	-	-	-	-	-	-	-	2	-	-
5	2	3	2	3	-	-	-	-	-	-	-	-	3	-	-
6	2	3	2	3	-	-	-	-	-	-	-	-	3	-	-
Avg	**1.7**	**2**	**1.8**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE402	Engineering Geology and Concrete Technology	3/0/2/4

Nature of Course	Theory Application
Pre requisites	Construction Materials and Techniques

Course Objectives:

1	To impart knowledge on structure of earth and
2	To enable the students to understand the concept of mix design.
3	To impart knowledge on properties and durability of concrete.
4	To impart knowledge on the special concretes.

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

C402.1	Understand about types of rocks, their distribution and uses.	[U]
C402.2	Enumerate the geological structure and seismology	[AN]
C402.3	Apply mix proportion principles to design a concrete mix by using IScode	[AN]
C402.4	Determine the properties of fresh and hardened concrete	[AN]
C402.5	Enumerate the durability properties of concrete	[AN]
C402.6	Apply the suitable special concrete based on the field requirement.	[AP]

Course Contents: Theory

Module 1: Engineering Geology **15 Hrs.**

Geology in civil engineering – Branches of geology – Structure of earth and its composition, weathering of rocks - Classification of rocks; Igneous, Sedimentary and Metamorphic rocks - Engineering properties of rocks (Granite, Basalt, Sandstone, Limestone, Schist, Gneiss, marble) - Attitude of beds - Study of structures; folds, faults and joints, relevance to civil engineering - Tectonic plate - Seismology - Seismic zones in India

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

Mix design: Introduction, concept of mix design – mix design methods – IS method of mix proportioning with admixtures - Manufacture of concrete; batching, mixing, transporting, placing, compaction, curing - Ready mix concrete - 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.

Module 3: Durability of Concrete and Special Concretes **15 Hrs.**

Durability of Concrete; Permeability, creep, sulphate attack, alkali aggregate reaction, chloride attack, carbonation - Concrete in marine environment - Corrosion of concrete - Corrosion of reinforcement - Micro structures of concrete - Non-d estructive test; Ultrasonic pulse velocity test, rebound hammer test - Types and properties of Special Concretes; Lightweight concrete, High strength concrete, High performance concrete, Fibre reinforced concrete, Polymer concrete, Geo-polymer concrete - Self compacting concrete, Vacuum dewatering concrete - Mass concrete - Nano concrete.

Total Hours	**45 Hrs**

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

C402.1	Design concrete mixes and apply statistical quality control Techniques	[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	Investigate the durability properties of concrete.	[AN]
C402.6	Examine the concrete qualities by applying NDT.	[AN]

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Design the Concrete mix proportioning – IS Method	C402.1	[AN]
2	Determine the workability by slump cone test	C402.2	[AP]
3	Determine the workability by compaction factor test	C402.2	[AP]
4	Determine the fresh concrete property by Vee-Bee consistometer test	C402.3	[AP]
5	Determine the fresh concrete property by flow table test	C402.3	[AP]
6	Determine the compressive strength of concrete	C402.4	[AP]
7	Determine the splitting tensile strength of concrete	C402.4	[AP]
8	Determine the modulus of rupture of concrete	C402.4	[AP]
9	Determine the modulus of elasticity of concrete	C402.4	[AP]
10	Determine the durability of concrete by test resistance against acid attack	C402.5	[AP]
11	Determine the surface hardness of concrete structures by rebound hammer test	C402.6	[AN]
12	Determine the quality of concrete structures by ultrasonic pulse velocity test	C402.6	[AN]
		Total Hours	**30 Hrs**

Text Books:

1	Parbin singh Engineering and General Geology, S.K. Kataria & Sons Publications, New Delhi,2019
2	Shetty, M.S., Jain, A.K., Concrete Technology, Theory and Practice, S. Chand and Company Ltd, New Delhi, 2018
3	Neville A.M. Concrete Technology, Pearson Education, New Delhi, 2019

Suggested Readings:

1	Varghese, P.C., Engineering Geology for Civil Engineering Prentice Hall of India Learning Private Limited, New Delhi, 2012.
2	Gambhir, M.L, Concrete Technology, McGraw Hill Publishing Company Ltd, New Delhi,2017
3	Santha Kumar A.R., ¯Concrete Technology, Oxford University Press, New Delhi, 2018.
4	Mehta, P.K., "Concrete: Microstructure, PropertiesandMaterials " 4th edition, Tata McGraw Hill Education Private Limited, 2017

IS Codes

1	IS10262-2009, Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 2009.
2	IS456-2000 Plain and Reinforced Concrete- Code of Practice, Bureau of Indian Standards, New Delhi, 2000.
3	SP: 23-1982, Handbook on concrete.

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]**
C402.1& C402.2	Understand	Online Quiz/ Assignment	20
C402.3	Understand	Seminar	20
C402.4	Apply	Online Quiz/ Assignment	20
C402.5 & C402.6	Apply	Seminar	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	-
Understand	10	10	20
Apply	30	40	30
Analyse	50	40	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	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

<table>
<tr><td colspan="9">Continuous Assessment (50%)</td><td>End Semester Examination (50%)</td></tr>
<tr><td colspan="3">CA 1
(100 Marks)</td><td colspan="3">CA 2
(100 Marks)</td><td colspan="2">Practical Exam
(100 Marks)</td><td rowspan="3">Theory Examination (35%)
Practical Examination (15%)</td></tr>
<tr><td rowspan="2">SA 1
(60M)</td><td colspan="2">FA 1</td><td rowspan="2">SA 2
(60M)</td><td colspan="2">FA 2</td><td rowspan="2">FA
(75M)</td><td rowspan="2">SA
(25M)</td></tr>
<tr><td>Component-I
(20 Marks)</td><td>Component-II
(20 Marks)</td><td>Component-I
(20 Marks)</td><td>Component-II
(20 Marks)</td></tr>
</table>

Course Articulation Matrix : Theory															
CO	**PO**											**PSO**			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	-	-	1	-	-	-	-	-	-	-	1	2	-	2
2	3	1	-	1	2	-	-	-	-	-	-	1	2	-	2
3	3	2	3	3	-	-	1	-	-	-	-	2	2	-	2
4	3	2	-	3	-	-	-	-	-	-	-	2	2	-	2
5	3	2	-	3	3	-	-	-	-	-	-	2	2	-	2
6	3	1	1	-	2	-	1	-	-	-	-	2	2	-	2
Avg	**3**	**1.6**	**2**	**2.2**	**2.3**	**-**	**1**	**-**	**-**	**-**	**-**	**1.6**	**2**	**-**	**2**
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			
Course Articulation Matrix : Laboratory															
1	3	3	2	2	2	-	1	1	2	2	-	2	2	-	2
2	3	2	1	1	1	-	2	2	2	2	-	2	2	-	2
3	3	3	2	2	2	-	1	1	2	2	-	2	2	-	2
4	3	3	2	2	2	-	2	2	1	2	-	2	2	-	2
5	3	3	2	2	3	-	1	2	2	2	-	2	2	-	2
6	3	2	1	1	3	-	2	1	2	2	-	2	2	-	2
Avg	**3**	**2.6**	**1.6**	**1.6**	**2.1**	**-**	**1.5**	**1.5**	**1.8**	**2**	**-**	**2**	**2**	**-**	**2**
1		Reasonably agreed				2	Moderately agreed			3		Strongly agreed			

21CE403	ENVIRONMENTAL ENGINEERING	3/0/2/4

Nature of Course	Theory and Practical Application
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 evaluate the performance of water and wastewater treatment plants
3	To enable the students in designing water and waste water treatment plants for acommunity.
4	To study the various techniques for sludge disposal and disposal into land or water bodies.

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

C403.1	Cognize and assimilate the physical, chemical and biological characteristics of different sources of water	[AP]
C403.2	Estimate the water demand and design a good water distribution systemf or a town/city	[AP]
C403.3	Design an appropriate treatment system for the water available at the source	[AP]
C403.4	Design the necessary treatment units for the Wastewater collected fromt he town/city	[AP]
C403.5	Identify the suitable mode of disposal for the treated wastewater without endangering the environment	[AN]
C403.6	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: Sewage Disposal and Air 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

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

C403.1	Determine the quality of water based on its physical characteristic using the suitable experimental procedures	[AP]
C403.2	Calculate the type and quantum of chemical required for the removal of dissolved solid substances in water	[AP]
C403.3	Investigate the oxygen content in various forms in water	[AN]
C403.4	Determine the ionic concentration in water using sophisticatedanalytical methods	[AP]
C403.5	Determine the elemental concentration in water using sophisticatedanalytical methods	[AP]
C403.6	Investigate the ambient air quality characteristics and calculate the air quality index	[AN]

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Determination of pH, Turbidity and conductivity of the water and wastewater samples	C403.1	[AP]
2	Determination of Dissolved Oxygen presents in the water	C403.2	[AP]
3	Determination of Optimum Coagulant Dosage of the given water sample	C403.2	[AP]
4	Determination of Bio-chemical Oxygen Demand	C403.3	[AN]
5	Determination of Chemical Oxygen Demand	C403.3	[AN]
6	Determination of Iron / Fluorides presents in the given waste water sample	C403.4	[AP]
7	Determination of Sulphates presents in the given waste water sample	C403.4	[AP]
8	Determination of Ammonia presents in given wastewater sample	C403.4	[AP]
9	Determination of Sodium presents in the wastewater sample	C403.5	[AP]
10	Determination of Nitrates in the given wastewater sample	C403.5	[AP]
11	Modeling of Wastewater treatment plant using STEADY software	C403.5	[AP]
12	Determination of Air pollutant - Particulate Matter and Gaseous pollutant analysis	C403.6	[AN]
		Total Hours	30 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

Suggested Readings:

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,New Delhi, 2013.
4	Basak N.N, Environmental Engineering, McGraw Hill Education., 2017

IS Codes	
1	IS 10500:2012 Water Quality Standards, New Delhi, 2012
2	IS SP 26 – Handbook on Water supply and Drainage.
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/

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]**
C403.1 - C403.2	Apply	Assignment / Quiz	20
C403.3	Analyze	Online Quiz	20
C403.4 - C403.5	Apply	Group Assignment	20
C403.6	Analyze	Assignment	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	40	40	30
Apply	50	40	30
Analyse	-	10	30
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	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 (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)**				

Course Articulation Matrix : Theory															
CO	**PO**												**PSO**		
	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	2	2	2	1	1	-	1	1	2	-	-	2	1	2	2
6	3	3	3	-	1	2	2	1	1	-	-	3	2	3	2
Avg	**2.6**	**2.5**	**2.2**	**1.6**	**1**	**1.5**	**1.6**	**1.6**	**1.5**	**-**	**-**	**2.5**	**1.3**	**2.5**	**2.0**
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			
Course Articulation Matrix : Laboratory															
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	2	2	2	2	2	2	2	1	1	-	2	2	2	2	2
6	3	3	2	2	2	1	2	1	1	-	2	2	2	3	2
Avg	**2.5**	**2.2**	**2.0**	**2.0**	**2.0**	**1.7**	**2.0**	**1.0**	**1.0**	**-**	**1.7**	**1.7**	**1.7**	**2.5**	**2.0**
1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed										

21CE404	GEOTECHNICAL ENGINEERING	3/0/2/4
Nature of Course	Theory Application	
Pre requisites	Construction Materials and Techniques	

Course Objectives:

1	To study the fundamentals of soil mechanics and IS soil classification system.
2	To analyse the soil characteristics such as permeability, stress distribution andconsolidation, shear strength.
3	To study the various techniques for slope stability in soil.
4	To design the shallow and deep foundations, pressure distribution behind retaining walls.

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

C404.1	Examine the basic properties of soil and classify the soil according to ISsoil classification system.	[AN]
C404.2	Determine the permeability, effective stress distribution and consolidation characteristics of the soils.	[AN]
C404.3	Compute the shear strength of soils and analyze the different types of slopes, methods to improve its stability.	[AP]
C404.4	Examine the soil exploration program for determining the geotechnical parameters required for the design of foundations.	[AP]
C404.5	Estimate the bearing capacity of soils and settlement of foundations.	[AN]
C404.6	Determine pile and pile group efficiency, earth pressure theory and examine the forces acting on the well foundation.	[AN]

Course Contents: Theory

Module 1: Soil Classification and its Characteristics **15 Hrs.**

Soil Classification: Soil formation and soil types - Civil engineering problems related to soils - Natureof soil - basic definitions - Phase relationships - Determination of soil properties – Classification - Unified and Indian Soil classification system. Permeability: Darcy‘s law – Permeability (1D and 2D Flow) - Laboratory Methods – Field measurement of permeability - flow nets - uplift pressure – Piping, Capillarity and Seepage Force - Stress Distribution: Effective stress concept - Dry and saturated soils
- Stress distribution in soil media -Boussinesq‘s Analysis – Westergard‘s Analysis - Intensity of vertical stress using influence charts - Consolidation: measurement of compressibility - e-log p curves - Terzaghi‘s one dimensional consolidation theory – Time rate of consolidation and settlement.

Module 2: Shear Strength, Stability of Slopes and Soil Exploration Methods **15 Hrs.**

Shear Strength: Mechanism of shear resistance- Effective and total shear strength parameters – Mohr‘s circle - Mohr- Coulomb failure criterion - Measurement of shear strength - Direct shear test- Triaxial shear test - Unconfined compression strength test - Vane shear test - Shear strength of clay soil and sand. Stability of Slopes: Types of slopes - Stability of infinite slope - Stability of Finite slope - Total stress Analysis - Method of slices and Bishop‘s method - Use of Taylor‘s stability number - Slope failure mechanism - Effect of Tension cracks - Improving slope stability by Geo-synthetics. Soil Exploration: Methods - types of samplers - Field test - SPT, CPT, DCPT - Geophysical Investigation - Plate load test

Module 3: Bearing Capacity, Shallow and Deep Foundations **15 Hrs.**

Bearing Capacity-Types of shear failure - Terzaghi's and Meyerhoff‘s bearing capacity theories - effect of water table - IS code method – Settlement and its components - Shallow Foundation: Foundation Introduction - types, choice of foundations - proportioning of shallow foundation (no structural design)

- Deep Foundation: pile foundation, classification and selection - load carrying capacity, static and dynamic formulae - design of pile groups and its efficiency – pile under lateral loading - negative skin friction - under reamed piles - Rankine's earth pressure theory for active and passive status in both cohesive and cohesionless soils - Coulomb earth pressure theory - well foundation. types and different shapes of wells - components and forces acting - sinking of wells - tilts and shifts			
		Total Hours	**45 Hrs**

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

C404.1	Illustrate the soil behaviour and suitability of soil for structural purposeand its soil water movement.	[AP]
C404.2	Report the compaction state of the soil and classify the index propertiesof the fine-grained soil.	[AP]
C404.3	Calculate the permeability property of soil with different size to estimatethe seepage in earthen dams and embankments.	[AP]
C404.4	Apply the methods to report the soil strength and its suitability for structural foundation and its cohesive nature.	[AP]
C404.5	Relate the water content and density of soil and calculate the settlement of the soil due to pressure exerted by the super structure.	[AP]
C404.6	Report the strength parameters of the road and pavement, shearstrength of the undrained soil, bearing capacity of the soil.	[AP]

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Determination of Specific Gravity and Moisture content ofSoil.	C404.1	[AP]
2	Determination of Particle size distribution of cohesionless and cohesive soils	C404.1	[AP]
3	Determination of Atterberg's limits of C-Phi Soils.	C404.2	[AP]
4	Determination of relative density of cohesionless soils and Shrinkage factors of soil.	C404.2	[AP]
5	Determination of permeability characteristics of soil using falling head / Constant head permeability method	C404.3	[AP]
6	Determination of shear strength parameters of soil usingdirect shear method	C404.3	[AP]
7	Determine the unconfined compressive strength of clay.	C404.4	[AP]
8	Determination of maximum dry density of soil using standard proctor's compaction test	C404.4	[AP]
9	Determination of field density of soil by using sand replacement method / core cutter method	C404.5	[AP]
10	Determination of bearing capacity by Dynamic Cone penetration test	C404.6	[AP]
11	Determination of the sensitivity of cohesive soil by laboratory vane shear test	C404.6	[AP]
12	Determination of bearing capacity by standard penetrationtest	C404.6	[AP]
		Total Hours	**30 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 InternationalPvt. 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, NewDelhi, 2016.
3	Purushothama Raj P, Soil Mechanics and Foundation Engineering, Pearson EducationIndia, 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 ofIndian 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 IndianStandards, 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=PLbRMhDVUMngeiZjKPTPEFI1CByXmYX3Kv
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

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	10 0	200	50	50	10 0

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& C404.2	Analyze	Surprise Test	20
C404.3	Apply	Assignment	20
C404.4	Apply	Tutorial Problems	20
C404.5 & C404.6	Analyze	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	-	-	-
Understand	10	10	10
Apply	50	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	10	10	10
Understand	20	20	20
Apply	30	30	30
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 (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)			

Course Articulation Matrix : Theory															
CO	PO												PSO		
	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	-
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			
Course Articulation Matrix : Laboratory															
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
6	2	2	-	3	2	1	-	2	1	1	-	1	2	-	1
Avg	**2.2**	**2.0**	**2.0**	**3.0**	**2.2**	**1.5**	**-**	**2.0**	**1.0**	**1.0**	**-**	**1.0**	**2.0**	**1.0**	**1.0**
1		Reasonably agreed				2	Moderately agreed			3		Strongly agreed			

21CE405	TRANSPORTATION ENGINEERING	3/0/2/4

Nature of Course	Theory Application
Pre requisites	Surveying and Geomatics

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

C405.1	Understand and apply the basic concepts of highway planning.	[AP]
C405.2	Plan the various geometric elements for highway construction.	[AN]
C405.3	Outline and plan construction processes and alignment of railways.	[AN]
C405.4	Investigate the working procedures in railways.	[AP]
C405.5	Outline the airport components and services	[AP]
C405.6	Plan the airport layout and describe the visual aid 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 – 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 - Function Geometric Design of railway tracks, super elevation, cant deficiency and excess, negative super elevation. 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

Total Hours	**45 Hrs**

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

C405.1	Investigate the applicability of aggregates based on shape and density.	[AP]
C405.2	Determine and evaluate the strength parameters of aggregates.	[AN]
C405.3	Plan the vertical and horizontal alignment of pavements.	[AN]

C405.4	Plan the geometric deign of railway tracks.	[AN]
C405.5	Design the airport runway orientation	[AP]
C405.6	Examine the suitability of bitumen for usage in field.	[AP]

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Determination of specific gravity and water absorption of aggregates	C405.1	[AN]
2	Determination of flakiness and elongation index of aggregates	C405.1	[AN]
3	Determination of resistance offered by aggregate against gradual loading	C405.2	[AP]
4	Determination of resistance offered by aggregates against impact loading	C405.2	[AP]
5	Determination of resistance of aggregate against abrasion	C405.2	[AP]
6	Design of alignment of pavements using software package	C405.3	[AN]
7	Geometric design of railway tracks using software package	C405.4	[AN]
8	Design of airport runway orientation using wind rose diagram	C405.5	[AN]
9	Determination of Viscosity of bituminous binder	C405.6	[AP]
10	Determination of Ductility of bituminous binder	C405.6	[AP]
11	Determination of Softening point of bitumen	C405.6	[AP]
12	Determination of Penetration of bitumen (Penetration Test)	C405.6	[AP]
		Total Hours	**30 Hrs**

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, TataMcGraw 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]**
C405.1-C405.2	Apply	Online Quiz - 1	20
C405.3	Apply	Group assignment - 1	20
C405.4-C405.5	Apply	Online Quiz - 2	20
C405.6	Apply	Group 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	-	-	-

<table>
<tr><th colspan="11">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><th colspan="10">Continuous Assessment (50%)</th><th>End Semester Examination (50%)</th></tr>
<tr><th colspan="3">CA 1
(100 Marks)</th><th colspan="3">CA 2
(100 Marks)</th><th colspan="2">Practical Exam
(100 Marks)</th><th rowspan="3" colspan="3">Theory Examination (35%)
Practical Examination (15%)</th></tr>
<tr><th rowspan="2">SA 1
(60M)</th><th colspan="2">FA 1</th><th rowspan="2">SA 2
(60M)</th><th colspan="2">FA 2</th><th rowspan="2">FA
(75M)</th><th rowspan="2">SA
(25M)</th></tr>
<tr><th>Component-I
(20 Marks)</th><th>Component-II
(20 Marks)</th><th>Component-I
(20 Marks)</th><th>Component-II
(20 Marks)</th></tr>
</table>

Course Articulation Matrix : Theory															
CO	PO												PSO		
	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	-	-	-	-	-	2	2	-	1
3	3	2	1	1	-	-	-	-	-	-	-	1	2	-	1
4	3	2	1	1	-	-	-	-	-	-	-	1	2	-	1
5	3	2	1	2	-	1	-	-	-	-	-	2	2	-	1
6	3	2	1	1	-	-	-	-	-	-	-	1	2	-	1
Avg	**3**	**2**	**1**	**1.2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**1.3**	**2**	**-**	**1**
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			
Course Articulation Matrix : Laboratory															
1	3	2	1	1	3	-	1	1	1	1	-	1	1	-	1
2	3	2	1	1	3	-	1	1	1	1	-	1	2	-	1
3	3	2	1	1	3	-	1	2	2	2	-	1	1	-	2
4	3	2	1	1	3	-	1	2	2	2	-	1	1	-	2
5	3	2	1	2	3	-	1	1	2	1	-	1	2	-	2
6	3	2	1	1	3	-	1	1	2	1	-	1	2	-	2
Avg	**3**	**2**	**1**	**1.2**	**3**	**-**	**1**	**1.3**	**1.7**	**1.3**	**-**	**1**	**1.5**	**-**	**1.7**
1	Reasonably agreed			2	Moderately agreed			3				Strongly agreed			

SEMESTER 5

21CE501	CONSTRUCTION PLANNING AND MANAGEMENT	3/0/3/4.5
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.
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

C501.1	Apply the elementary concepts in construction management andplanning	[AP]
C501.2	Model and plan construction problems using various network methods	[AN]
C501.3	Apply the principles of scheduling for construction projects	[AP]
C501.4	Examine the cost analysis using crashing in construction management	[AN]
C501.5	Illustrate the ideas of quality control	[AP]
C501.6	Examine the notions of safety and health management system	[AN]

Course Contents: Theory

Module 1: Introduction to Management and Planning **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 precedence relationships, preparation of CPM networks - Work Breakdown structure - PERT –-Activity float and schedules - Resource oriented scheduling-Scheduling with resource constraints and precedence‘s - Scheduling with uncertain durations – Crashing and time/cost trade-offs -Resource smoothing and Leveling, Critical Chain method, Introduction to computational scheduling. Software packages for project management

Module 3: Construction Quality and Safety Management **15 Hrs.**

Definition, 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 - Safety Audit, Health andEnvironment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health. Last Planner System, Problems on safety (elementary).

		Total Hours	**45 Hrs**
Course Outcomes : Laboratory **Upon completion of the Laboratory, students shall have ability to**			
C501.1	Categorize and create activities for the project		[AP]
C501.2	Classify the tasks and milestones associated with a project		[AP]
C501.3	Plan and allocate resource for the activities involved in a project		[AN]
C501.4	Determine the critical path for the projects		[AN]
C501.5	Analyze the optimum resource required by smoothing and leveling		[AN]
C501.6	Examine and track the project status in the report		[AN]

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Navigate and Customize the Project 2013 Interface, AddingTasks and Resources to a Project.	C501.1	[AP]
2	Creating Calendars and Changing Working Time withCalendars	C501.1	[AP]
3	Determination of Summary Tasks and Milestones	C501.2	[AP]
4	Allocation of Resources to tasks and Levelling WorkResources	C501.3	[AN]
5	Use of MS Project to assign and Review the Over allocated Resources	C501.3	[AN]
6	Determination of Critical path and activities using MS Project	C501.4	[AN]
7	Identification of Critical path for simple and complex projects	C501.4	[AN]
8	Resource allocation for activities involved in 2BHK Residential building	C501.5	[AN]
9	Resource smoothing and Resource leveling for Commercial projects	C501.5	[AN]
10	Use of MS Project for Scheduling of activities in a 2BHK Residential building	C501.5	[AN]
11	Scheduling of activities in a G+3 Multistoried building usingMS Project	C501.6	[AN]
12	Tracking and Report generation for a project by updating the activities with the use of MS Project	C501.6	[AN]
		Total Hours	**45 Hrs**

Text Books:

1	Neeraj Kumar Jha, Construction Project Management-Theory and Practice Pearson Education India; 2nd edition, 2015.
2	Steven Mccabe, ―Quality Improvement Techniques in Construction: Principles and Methods Routledge, 2016.
3	Steve Rowlinson, Construction Safety Management Systems Routledge, 2019.

Suggested Readings:

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	Brian Thorpe and Peter Sumner, 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
4	https://www.coursera.org/specializations/project-management

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 & C501.3	Apply	Assignment	20
C501.2	Analyze	Seminar	20
C501.4 & C501.6	Analyze	Online Quiz	20
C501.5	Apply	Group assignment	20

Assessment based on Summative and End Semester Examination - Theory			
Bloom's Level	**Summative Assessment (15%) [120 Marks]**		**End Semester Examination (35%) [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 - Practical

Bloom's Level	Continuous Assessment (25%) [100 Marks]		End Semester Examination (15%) [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	-	-	-

Assessment based on Continuous and End Semester Examination

<table>
<tr><th colspan="8">Continuous Assessment (50%)</th><th>End Semester Examination (50%)</th></tr>
<tr><th colspan="3">CA 1
(100 Marks)</th><th colspan="3">CA 2
(100 Marks)</th><th colspan="2">Practical Exam
(100 Marks)</th><th rowspan="3">Theory Examination (35%)
Practical Examination (15%)</th></tr>
<tr><th rowspan="2">SA 1
(60M)</th><th colspan="2">FA 1</th><th rowspan="2">SA 2
(60M)</th><th colspan="2">FA 2</th><th rowspan="2">FA
(75M)</th><th rowspan="2">SA
(25M)</th></tr>
<tr><th>Component-I
(20 Marks)</th><th>Component-II
(20 Marks)</th><th>Component-I
(20 Marks)</th><th>Component-II
(20 Marks)</th></tr>
</table>

Course Articulation Matrix : Theory

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	1	2	-	-	-	2	-	2	3	2	2	2	-
2	3	2	1	2	-	-	-	2	-	2	3	2	2	2	-
3	3	3	2	2	-	-	-	2	-	2	3	1	2	2	-
4	3	2	1	2	-	-	-	2	-	2	3	2	2	2	-
5	3	2	1	2	-	-	-	2	-	2	3	1	2	2	-
6	3	3	2	2	-	-	-	2	-	2	3	2	2	2	-
Avg	**3.0**	**2.3**	**1.3**	**2.0**	**-**	**-**	**-**	**2.0**	**-**	**2.0**	**3.0**	**1.6**	**2.0**	**2.0**	**-**

1 Reasonably agreed | 2 Moderately agreed | 3 Strongly agreed

Course Articulation Matrix : Laboratory

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	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	-
6	3	3	2	2	3	-	-	2	2	2	3	1	2	2	-
Avg	**3.0**	**2.3**	**1.3**	**2.0**	**3.0**	**-**	**-**	**2.0**	**2.0**	**2.0**	**3.0**	**1.0**	**2.0**	**2.0**	**-**

1 Reasonably agreed | 2 Moderately agreed | 3 Strongly agreed

21CE502	DESIGN OF REINFORCED CONCRETE STRUCTURES	3/0/3/4.5
Nature of Course	Problem Analytical	
Pre requisites	Solid Mechanics; Engineering Geology and Concrete Technology	

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 ofreinforced 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	Apply the philosophy of different methods for design of reinforced concrete elements.	[U]
C502.2	Design the reinforced concrete beam subjected to bending and shear.	[AP]
C502.3	Design slabs with different boundary conditions and RC Staircases.	[AP]
C502.4	Design of underground and overhead water tank; design principle of retaining wall	[AN]
C502.5	Design of short and long columns for axial, uniaxial and biaxial loading.	[AP]
C502.6	Design of footings for axial load; design principle of combined and raft foundation.	[AN]

Course Contents: Theory

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

Introduction to reinforced concrete design - methods - Philosophy and principle of limit state design with assumptions - Stress block parameters, concept of balanced section, under reinforced and over reinforced section - Limit State design and detailing of singly, doubly reinforced rectangular and flanged beam for bending and shear - Design of beams for combined effect (bending, shear and torsion) as per IS-456. Check for serviceability: deflection and width of crack - Design for development length.

Module 2: Design of slab, Water tank and Retaining wall 15 Hrs.

Design and detailing of one way and two-way rectangular slabs subjected to uniformly distributed load for various boundary conditions and corner effects - Design of grid floor- Design of flat slab (interior panel) - Design of staircase - waist slab (dog legged). Principle of working stress method with assumptions - Design and detailing of underground rectangular tanks - Design of overhead circular water tank (Design principle only) - Cantilever and counter fort retaining walls (Design principle only)

Module 3: Limit State Design of Columns and Footings 15 Hrs.

Types of reinforced concrete column - Design concepts of the column - Limit state design and detailing of short and long columns for axially, uniaxial and biaxial load using interaction charts - Design and detailing of rectangular column footings with axial load and moment - Design and detailing of combined footings - Raft foundation (Design principle only)

Total Hours	**45 Hrs**

Course Outcomes : Laboratory

Upon completion of the Laboratory, students shall have ability to

C502.1	Design and Detailing of reinforced concrete beam.	**[AP]**
C502.2	Design and Detailing of reinforced concrete slab	**[AP]**

C502.3	Design and Detailing of reinforced concrete retaining wall	**[AP]**
C502.4	Design and Detailing of reinforced concrete water tank	**[AP]**
C502.5	Design and Detailing of reinforced concrete column	**[AP]**
C502.6	Design and Detailing of reinforced concrete footing	**[AP]**

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Design and detailing of a singly reinforced beam using spread sheets and drafting package	C502.1	[AN]
2	Design and detailing of a doubly reinforced beam using spread sheets and drafting package	C502.1	[AN]
3	Design and detailing of a Tee beam using spread sheets and drafting package	C502.1	[AN]
4	Design and detailing of a reinforced concrete one way slab using spread sheets and drafting package	C502.2	[AN]
5	Design and detailing of a reinforced concrete Two way slab using spread sheets and drafting package	C502.2	[AN]
6	Design and detailing of a cantilever retaining Wall using spread sheets and drafting package	C502.3	[AN]
7	Design and detailing of a counterfort retaining Wall using spread sheets and drafting package	C502.3	[AN]
8	Design and detailing of an underground rectangular water tank using spread sheets and drafting package	C502.4	[AN]
9	Design and detailing of a overhead water tank using spread sheets and drafting package	C502.4	[AN]
10	Design and detailing of columns using spread sheets and drafting package	C502.5	[AN]
11	Design and detailing of isolated footing using spread sheets and drafting package	C502.6	[AN]
12	Design and detailing of combined footing using spread sheets and drafting package	C502.6	[AN]
		Total Hours	**45 Hrs**

Text Books:

1	Punmia B.C. and Jain A.K, Limit State Design of Reinforced Concrete, Laxmi PublicationsPvt.Ltd, New Delhi, 2016.
2	Unnikrishna Pillai and Devdass Menon, Reinforced Concrete Design, Tata McGraw Hill Publishing Company Ltd. New Delhi, 2016.
3	Krishna Raju. N, Reinforced Concrete Design:IS:456-2000, Principles and Practice, NewAge International Publishers, New Delhi, 2018.

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, 2013.

3	Sinha,S.N. Reinforced Concrete Design-Tata McGrawHill Publishing Company Ltd. New Delhi, 2014.
4	Shah V L and Karve S R., Limit State Theory and Design of Reinforced Concrete, Structures Publications, Pune, 2013
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.
6	IS 3370 (Part 1, 2, 3 and 4) - 2021 Concrete Structures for Retaining Aqueous Liquids, BIS, New Delhi.
7	IS 14458 : 1998 Retaining wall for hill area - Guidelines, BIS, New Delhi
Web Reference:	
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]**
C502.1-C502.2	AP	Online Quiz - 1	20
C502.3-C502.4	AP	Group assignment - 1	20
C502.5	AP	Online Quiz - 2	20
C502.6	AP	Group assignment - 2	20

Assessment based on Summative and End Semester Examination - Theory		
Bloom's Level	**Summative Assessment (15%) [120 Marks]**	**End Semester Examination (25%)**

	CIA1: (60 Marks)	CIA2: (60 Marks)	[100 Marks]
Remember	10	10	10
Understand	20	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	-	-	-
Understand	20	20	20
Apply	30	30	30
Analyse	50	50	50
Evaluate	-	-	-
Create	-	-	-

<table>
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<tr><th colspan="8">Continuous Assessment (50%)</th><th>End Semester Examination (50%)</th></tr>
<tr><th colspan="3">CA 1
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(100 Marks)</th><th rowspan="3">Theory Examination (25%)
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(60M)</th><th colspan="2">FA 2</th><th rowspan="2">FA
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(20 Marks)</th></tr>
</table>

Course Articulation Matrix : Theory

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	-	1	-	-	-	-	-	1	-	3	2	-	2
2	3	2	3	2	-	-	-	-	-	1	-	3	2	-	2
3	3	2	3	2	-	-	-	-	-	1	-	3	2	-	2
4	3	2	3	2	-	-	-	-	-	1	-	3	2	-	2
5	3	2	3	2	-	-	-	-	-	1	-	3	2	-	2
6	3	2	3	2	-	-	-	-	-	1	-	3	2	-	2
Avg	**3**	**1.83**	**3**	**1.83**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**3**	**2**	**-**	**2**
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

Course Articulation Matrix : Laboratory

1	3	1	-	1	-	-	-	-	-	1	-	3	2	-	2
2	3	2	3	2	-	-	-	-	-	1	-	3	2	-	2

3	3	2	3	2	-	-	-	-	-	1	-	3	2	-	2
4	3	2	3	2	-	-	-	-	-	1	-	3	2	-	2
5	3	2	3	2	-	-	-	-	-	1	-	3	2	-	2
6	3	2	3	2	-	-	-	-	-	1	-	3	2	-	2
Avg	**3**	**1.83**	**3**	**1.83**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**3**	**2**	**-**	**2**
1		Reasonably agreed				2	Moderately agreed			3		Strongly agreed			

21CE503	MECHANICS OF MATERIALS	3/0/3/4.5
Nature of Course	Problem Analytical	
Pre requisites	Solid Mechanics	

Course Objectives:

1	To impart the energy principles to analyse the beams, frames and plane trusses
2	To check the beams and columns load carrying capacities using various theories
3	To compute the collapse load using plastic analysis theory.
4	To compute the load carrying capacity of structural members using various failure theories.

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

C503.1	Apply the Energy principles to analyse the trusses, beams and frames.	[AP]
C503.2	Analyze the indeterminate beams and sketch shear force and bending moments.	[AN]
C503.3	Analyse the column stability and compute the critical load using various theories.	[AN]
C503.4	Apply theory of structural plastic analysis to determine collapse load of structural members.	[AN]
C503.5	Apply the failure theories to compute the load carrying capacity ofstructural members.	[AP]
C503.6	Analyse thick cylinders and compound cylinders and compute thestresses.	[AN]

Course Contents: Theory

Module 1: Energy methods and Three moment theorem **15 Hrs.**
General energy theorems - Castigliano‘s theorem, Maxwell Bettie‘s reciprocal theorem - Virtual work and unit load method for deflection - Application to problems of beams and trusses; Indeterminate Beams - Propped cantilever and fixed beams - fixed end moments and reactions for concentrated load, uniformly distributed load and combined load; Analysis of continuous beams - theorem of three moments - shear force and bending moment diagrams

Module 2: Column stability and Plastic analysis **15 Hrs.**
Columns - Stability of Structures - Euler‘s Formula for Pin-Ended Columns - Extension of Euler‘s Formula to Columns with Other End Conditions - eccentrically loaded columns – Rankine‘s-Gordon formula - Secant Formula – Plastic analysis: ultimate load carrying capacity of members in axial tension and compression - Plasticity in ductile materials, elasto-plastic behavior of beam in flexure - shape factor for different cross sections - concept of plastic hinge - Conditions and basic theorems of plastic analysis - determination of collapse load for beams and portal frames - bending moment diagram at collapse - limitations of plastic analysis.

Module 3: Failures Theories and Thick Cylinders **15 Hrs.**
Two-dimensional state of stress at a point - Mohr‘s Circle - Stress paths - Normal and shear stresses on any plane - Principal planes and principal stresses - Maximum shear stress - Theories of failure – Principal stress theory – Principal strain theory – Shear stress theory – strain energy theory and distortion energy theory - Thick cylinders - compound cylinders.

Total Hours	**45 Hrs.**

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

C503.1	Analyze and compute the shear force and bending moment of beams and frames using analysis package.	[AN]

C503.2	Analyze and compute the member forces of a roof truss using analysis package.	[AN]
C503.3	Analyze and compute the deflection of beams and trusses usinganalysis package.	[AN]
C503.4	Analyze and compute the spring stiffness, modulus of rigidity of the spring wire and maximum strain energy stored.	[AN]
C503.5	Analyze and compute the material properties of beams using deflection measurements.	[AN]
C503.6	Apply the basic principles for bending analysis of the beams.	[AP]

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Computation of shear force and bending moment of beamsf or various supports and load conditions using analysis package.	C503.1	[AN]
2	Computation of shear force and bending moment of portal frames for various supports and load conditions using analysis package.	C503.1	[AN]
3	Computation of member forces for a roof truss for various supports and load conditions using analysis package.	C503.2	[AN]
4	Computation of deflections for beams and trusses using analysis package.	C503.3	[AN]
5	Determination of Elastic properties of open coiled helical springs.	C503.4	[AN]
6	Determination of Elastic properties of closed coiled helical springs.	C503.4	[AN]
7	Verification of Maxwell‘s Reciprocal Theorem.	C503.5	[AP]
8	Determine the modulus of elasticity of simply supported metal beam using four-point bending test.	C503.5	[AN]
9	Determine the modulus of elasticity of simply supported beam using three point bending test.	C503.5	[AN]
10	Determine the modulus of elasticity of the given structural material by measuring deflection of continuous beam.	C503.5	[AN]
11	Determine the bending stress of cantilever beam subjected to various load cases.	C503.6	[AN]
12	Determine the bending stress of propped cantilever beam subjected to various load cases.	C503.6	[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, 2012.
3	Punmia B.C and Jain A.K., Mechanics of Materials‖, Laxmi Publications Ltd, New Delhi,2012.

Suggested Readings:

1	William A. Nash, Strength of Materials, Tata McGraw-Hill Publishing Co. Ltd, New Delhi,2010
2	Gambhir M.L. ¯Fundamentals of Solid Mechanics‖, PHI Learning Private Ltd., New Delhi,2010.
3	~~Kazimi S.M.A., Solid Mechanics ", Tata McGraw-Hill Publishing Company, New Delhi, 2017~~

4	Hibbeler R.C. (2011). Mechanics of Materials, 8e, Pearson Prentice Hall.
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]**
C503.1& C503.2	Analyse	Online Quiz/ Assignment	20
C503.3	Analyse	Online Quiz/ Assignment	20
C503.4	Analyse	Online Quiz/ Assignment	20
C503.5 & C503.6	Analyse	Online Quiz/ 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	10	10	20
Understand	40	40	20
Apply	50	40	40
Analyse	-	10	20
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)				

Course Articulation Matrix : Theory															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	3	-	-	-	-	-	-	-	3	3	-	3
2	3	3	3	3	-	-	-	-	-	-	-	3	3	-	3
3	3	3	3	3	-	-	-	-	-	-	-	3	3	-	3
4	3	3	3	3	-	-	-	-	-	-	-	3	3	-	3
5	3	3	3	3	-	-	-	-	-	-	-	3	3	-	3
6	3	3	3	3	-	-	-	-	-	-	-	3	3	-	3
Avg	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**3**
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

Course Articulation Matrix : Laboratory															
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
6	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			

SEMESTER 6

21CE601	**CONSTRUCTION COST ESTIMATION AND VALUATION**	**3/0/3/4.5**
Nature of Course	Theory Application	
Pre requisites	Nil	

Course Objectives:

1	To apply 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 in tender and contract preparation, valuation, and report preparation.

Course Outcomes:

Upon completion of the course, students shall have ability to

C601.1	Describe the various types and methods of estimation with their advantages and disadvantages.	[U]
C601.2	Prepare the estimation of load-bearing, framed RCC structures, septictanks and roads.	[AP]
C601.3	Prepare tender notice and contract works for various works inconstruction.	[AP]
C601.4	Perform the rate analysis for different items of work in an RCC building.	[AP]
C601.5	Evaluate the valuation of an RCC building by various methods and describe the concepts involved in it.	[AN]
C601.6	Prepare reports for various building typologies and fix the rent forbuildings.	[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, soak pit, sanitary and water supply installations - Estimate of bituminous and cement concrete roads - Estimate of retaining walls - Estimation of Structural Steel Buildings.

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 – Reason for deviation with respect to quoted rate by contractor and departmental estimate case study report - Contracts - Types of Contracts - Drafting of contract documents - Arbitration and legal requirements - Schedule of rates and Data book – 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 - Introduction to softwares in estimation preparation.	
Total Hours	**45 Hrs**

Course Outcomes : Laboratory

Upon completion of the Laboratory, students shall have ability to

C601.1	Prepare a detailed estimate of the residential building (load-bearing)	[AP]
C601.2	Prepare the detailed estimate of the tube well and septic tank with soakpit	[AP]
C601.3	Prepare a detailed estimate of flexible and rigid pavement for Highways.	[AP]
C601.4	Prepare a tender notice and contract documents for the given infrastructure	[AP]
C601.5	Perform rate analysis for items of work and prepare a report of estimate for any given infrastructure.	[AP]
C601.1	Prepare a detailed estimate of the residential building (load-bearing)	[AP]

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Verification of Maxwell‘s reciprocal theorem	C503.1	[AP]
2	Estimation of a Single Room Building: Load bearing structure using spreadsheets.	C601.1	[AP]
3	Estimation of 1 BHK Residential Building: Load bearingstructure using spreadsheets.	C601.2	[AP]
4	Estimation of 1 BHK Residential Building: RC framed structure using spreadsheets.	C601.2	[AP]
5	Estimation of septic Tank with Soak Pit for 2-BHK House using spreadsheets.	C601.2	[AP]
6	Estimation of Flexible and Rigid Pavement for State Highway using spreadsheets.	C601.2	[AP]
7	Preparation of tender Notice and document for proposed realtime project.	C601.3	[AP]
8	Drafting of contract documents for a proposed real timeproject.	C601.3	[AP]
9	Rate Analysis for different items of work in an R.C.C building construction.	C601.4	[AP]
10	Valuation of a masonry residential building by depreciation method.	C601.5	[AP]
11	Valuation of a reinforced Cement Concrete framed building (G+1) by depreciation method.	C601.5	[AP]
12	Fixation and calculation of rent of proposed GovernmentBuilding.	C601.5	[AP]
		Total Hours	**45 Hrs**

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 Code of Practice :	
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 Reference:	
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]**

C601.1-601.2	AN	Assignment -1	20
C601.3	AN	Technical Quiz	20
C601.4-601.5	AN	Assignment - 2	20
C601.6	AN	Technical Seminar	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	30	20	20
Apply	60	30	30
Analyse	-	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	-	-	-
Understand	30	30	30
Apply	40	40	40
Analyse	30	30	30
Evaluate	-	-	-
Create	-	-	-

<table>
<tr><th colspan="9">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><th colspan="8">Continuous Assessment (50%)</th><th>End Semester Examination (50%)</th></tr>
<tr><th colspan="3">CA 1
(100 Marks)</th><th colspan="3">CA 2
(100 Marks)</th><th colspan="2">Practical Exam
(100 Marks)</th><th rowspan="3">Theory Examination (25%)
Practical Examination (25%)</th></tr>
<tr><th rowspan="2">SA 1
(60M)</th><th colspan="2">FA 1</th><th rowspan="2">SA 2
(60M)</th><th colspan="2">FA 2</th><th rowspan="2">FA
(75M)</th><th rowspan="2">SA
(25M)</th></tr>
<tr><th>Component-I
(20 Marks)</th><th>Component-II
(20 Marks)</th><th>Component-I
(20 Marks)</th><th>Component-II
(20 Marks)</th></tr>
</table>

Course Articulation Matrix : Theory

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

4	3	2	2	-	-	-	-	2	2	3	1	2	2	1	1
5	3	2	2	-	-	-	-	2	2	3	1	2	2	1	1
6	3	2	2	-	-	-	-	2	2	3	1	2	2	1	1
Avg	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**3**	**1**	**2**	**2**	**1**	**1**
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			
Course Articulation Matrix : Laboratory															
1	3	2	2	-	2	-	-	2	2	3	1	2	2	1	1
2	3	2	2	-	2	-	-	2	2	3	1	2	2	1	1
3	3	2	2	-	2	-	-	2	2	3	1	2	2	1	1
4	3	2	2	-	2	-	-	2	2	3	1	2	2	1	1
5	3	2	2	-	2	-	-	2	2	3	1	2	2	1	1
6	3	2	2	-	2	-	-	2	2	3	1	2	2	1	1
Avg	**3**	**2**	**2**	**-**	**2**	**-**	**-**	**2**	**2**	**3**	**1**	**2**	**2**	**1**	**1**
1		Reasonably agreed				2	Moderately agreed			3		Strongly agreed			

21CE602	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

C602.1	Interpret the Structural steel - types, grades, properties and analyse, design, detail bolted connections.	[AN]
C602.2	Analyse, design and detail Welded connections.	[AN]
C602.3	Analyse, design, detail tension members, splices and lug angles.	[AN]
C602.4	Analyse, design and detail Simple, built-up compression member,splices and column bases.	[AN]
C602.5	Analyse, design and detail laterally supported, unsupported beams,plate girders and gantry girder.	[AN]
C602.6	Analyse, design and detail Roof trusses for industrial applications.	[AN]

Course Contents: Theory

Course Contents:

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 plate girders-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)

Total Hours	**45 Hrs**

Course Outcomes : Laboratory

Upon completion of the Laboratory, students shall have ability to

C602.1	Analyse, design and detail bolted, welded connections using software packages.	[AN]

C602.2	Analyse design and detail tension members, compression members, column bases using software packages.	[AN]
C602.3	Analyse, design and detail laterally supported, unsupported and built-up beams using software packages.	[AN]
C602.4	Analyse, design and detail the plate and gantry girder using software packages.	[AN]
C602.5	Analyse, design the components of steel roof trusses using software packages.	[AN]
C602.6	Plan, analyze, design and detail a real time steel structure usingsoftware packages.	[E]

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Design and detailing of Bolted Connections using software packages.	C602.1	[AN]
2	Design and detailing of Welded Connection using software packages.	C602.1	[AN]
3	Design and detailing of Tension Members and lug anglesusing software packages.	C602.2	[AN]
4	Design and detailing of simple and built-up Compression Members software packages.	C602.2	[AN]
5	Design and detailing of Column bases using softwarepackages.	C602.2	[AN]
6	Design and detailing of Laterally unsupported Beams using software packages.	C602.3	[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.	C602.4	[AN]
9	Design and detailing of Plate girder using software packages.	C602.5	[AN]
10	Design and detailing of Gantry girder design using software packages.	C602.5	[AN]
11	Analysis, design and detail of steel workshop shed usingsoftware packages.	C602.6	[AN]
12	Planning, Analysis, design and detailing of a real time structure.	C602.6	[E]
		Total Hours	**45 Hrs**

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 Structures‖, Oxford university press,2018

Suggested Readings:	
1	Teaching Resource for Structural Steel Design, Vol. 1,2,3 INSDAG- Institute for SteelDevelopment 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 Code of Practice :	
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 of IndianStandards, New Delhi.
Web Reference:	
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]**
C602.1-602.2	AN	Assignment -1	20
C602.3	AN	Technical Quiz	20
C602.4-602.5	AN	Assignment -2	20
C602.6	AN	Seminar	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	20	10	20
Apply	30	20	20
Analyse	50	70	60
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	30	30	30
Analyse	70	70	70
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)			

Course Articulation Matrix : Theory

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	1	-	1	1	2		2	-	2	3	-	2
2	3	3	3	1	-	1	1	2		2	-	2	3	-	2
3	3	3	3	1	-	1	1	2		2	-	2	3	-	2
4	3	3	3	1	-	1	1	2		2	-	2	3	-	2
5	3	3	3	1	-	1	1	2		2	-	2	3	-	2
6	3	3	3	1	-	1	1	2		2	-	2	3	-	2
Avg	3	3	3	1	-	1	1	2		2	-	2	3	-	2
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

Course Articulation Matrix : Laboratory

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

4	3	3	3	1	3	1	1	2	2	2	-	2	3	-	2
5	3	3	3	1	3	1	1	2	2	2	-	2	3	-	2
6	3	3	3	1	3	1	1	2	2	2	-	2	3	-	2
Avg	3	3	3	1	3	1	1	2	2	2	-	2	3	-	2
1	Reasonably agreed				2	Moderately agreed			3		Strongly agreed				

21CE603	STRUCTURAL ANALYSIS	3/0/2/4

Nature of Course	Problem analytical
Pre requisites	Mechanics of Solids and Mechanics of Materials.

Course Objectives:

1	To understand use of influence line concept to sketch the shear force, bending moment for determinate structures
2	To understand the arch behavior and analyze the arches.
3	To perform analysis of indeterminate structures by slope deflection method and moment distribution method.
4	To perform analysis of indeterminate structures by matrix methods

Course Outcomes:

Upon completion of the course, students shall have ability to

C603.1	Apply the ILD concepts to beams to analyze and compute the forcesand moments.	[AN]
C603.2	Analyze the various types of arches, cables and suspension bridges	[AN]
C603.3	Apply the slope deflection method to analyze the indeterminate beamsand frames.	[AN]
C603.4	Apply the moment distribution method to analyze the indeterminate beams and frames.	[AN]
C603.5	Apply the Stiffness matrix concepts to analyze the continuous beamsand frames.	[AN]
C603.6	Apply the Flexibility matrix concepts to analyze the continuous beams and frames.	[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, two hinged and arches – Analysis of cables – suspension bridges with three and two hinged stiffeninggirder

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

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

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

Static Indeterminacy – kinematic indeterminacy -Degrees of freedom 2D and 3D. Matrix methods - Introduction to matrix methods - Concepts of stiffness and flexibility and their equivalence, Formation of flexibility and stiffness matrix - derivation of element stiffness for plane truss and beam - 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

C603.1	Analyze and design of determinate beams	[AN]

C603.2	Analyze and design of indeterminate beams	[AN]
C603.3	Analyze and design of single storey framed structure	[AN]
C603.4	Analyze and design of multi storey framed structure	[AN]
C603.5	Analyze and design of footings	[AN]
C603.6	Analyse and design of all components of a framed structure	[AN]

Laboratory Course Content:

S. No	List of Experiments	CO Mapping	BT
1	Analysis of determinate beams under vertical and horizontalloads using analysis software	C603.1	[AN]
2	Design of determinate beams under vertical and horizontalloads using analysis software	C603.1	[AN]
3	Analysis of indeterminate beams under vertical and horizontal loads using analysis software	C603.2	[AN]
4	Design of indeterminate beams under vertical and horizontalloads using analysis software	C603.2	[AN]
5	Analysis of single storey 2D framed structure under all loadsusing analysis software	C603.3	[AN]
6	Design of single storey 2D framed structure under all loads using analysis software	C603.3	[AN]
7	Analysis and design of multi storey framed structure under all loads using analysis software	C603.4	[AN]
8	Design of multi storey 2D framed structure under all loadsusing analysis software	C603.4	[AN]
9	Analysis of footings using structural design software	C603.5	[AN]
10	Design of footings using structural design software	C603.5	[AN]
11	Analysis of all components of a 3D framed structure	C603.6	[AN]
12	Design of all components of a 3D framed structure	C603.6	[AN]
		Total Hours	**30 Hrs**

Text Books:

1	Bhavikatti S S,Structural Analysis Vol-1and 2, Vikas publishing House, PVT, LTD., 2013
2	Vaidyanathan,R and Perumal,P, Structural Analysis‖ Vol.1 & 2 Laxmi Publications, New Delhi,2016.
3	Devdas Menon, Structural Analysis, Narosa Publishing House, 2018

Suggested Readings:

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 Matrixapproach 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]**
C603.1& C603.2	Analyse	Online Quiz/ Assignment	20
C603.3	Analyse	Online Quiz/ Assignment	20
C603.4	Analyse	Online Quiz/ Assignment	20
C603.5 & C603.6	Analyse	Online Quiz/ Assignment	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	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 (15%) [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	-	-	-

<table>
<tr><th colspan="9">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><th colspan="8">Continuous Assessment (50%)</th><th>End Semester Examination (50%)</th></tr>
<tr><th colspan="3">CA 1
(100 Marks)</th><th colspan="3">CA 2
(100 Marks)</th><th colspan="2">Practical Exam
(100 Marks)</th><th rowspan="3">Theory Examination (35%)
Practical Examination (15%)</th></tr>
<tr><th rowspan="2">SA 1
(60M)</th><th colspan="2">FA 1</th><th rowspan="2">SA 2
(60M)</th><th colspan="2">FA 2</th><th rowspan="2">FA
(75M)</th><th rowspan="2">SA
(25M)</th></tr>
<tr><th>Component-I
(20 Marks)</th><th>Component-II
(20 Marks)</th><th>Component-I
(20 Marks)</th><th>Component-II
(20 Marks)</th></tr>
</table>

Course Articulation Matrix : Theory

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	3	2	-	-	-	-	-	-	-	3	3	-	2
2	3	3	3	2	-	-	-	-	-	-	-	3	3	-	2
3	3	3	3	2	-	-	-	-	-	-	-	3	3	-	2
4	3	3	3	2	-	-	-	-	-	-	-	3	3	-	2
5	3	3	3	2	-	-	-	-	-	-	-	3	3	-	2
6	3	3	3	2	-	-	-	-	-	-	-	3	3	-	2
Avg	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**

1 Reasonably agreed | 2 Moderately agreed | 3 Strongly agreed

Course Articulation Matrix : Laboratory

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	3	2	3	-	-	-	2	2	-	3	3	-	2
2	3	3	3	2	3	-	-	-	2	2	-	3	3	-	2
3	3	3	3	2	3	-	-	-	2	2	-	3	3	-	2
4	3	3	3	2	3	-	-	-	2	2	-	3	3	-	2
5	3	3	3	2	3	-	-	-	2	2	-	3	3	-	2
6	3	3	3	2	3	-	-	-	2	2	-	3	3	-	2
Avg	**3**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**2**	**2**	**-**	**3**	**3**	**-**	**2**

1 Reasonably agreed | 2 Moderately agreed | 3 Strongly agreed

21EES01	EMPLOYABILITY ENHANCEMENT SKILLS (Industry Internship / Training - 4 Weeks)	0/0/0/2

Nature of Course	Training
Pre requisites	Nil

Course Objectives:

1.	To give a firsthand knowledge of practical problems related to Civil Engineering
2.	To offer firsthand knowledge on 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

C001.1	Identify critical activities in the Construction Industry	[AN]
C001.2	Develop the methodology to solve the identified problem	[AN]
C001.3	Develop skills in facing the problems experienced in the field.	[AP]
C001.4	Develop skills in solving the problems experienced in the field.	[AP]
C001.5	Acquire the skills to communicate effectively	[AP]
C001.6	Present the report clearly to specific audience in both the written and oralforms.	[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 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	PO3	PO 4	PO5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	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
6	3	2	1	1	1	-	-	3	3	3	-	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			

SEMESTER 7

21CE701	DESIGN COMPREHENSIVE PROJECT	0/0/2/1
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	Express the technical ideas, strategies and methodologies	[AN]
C701.3	Investigate the suitable components and interpretation using computational models to validate and justify his solutions	[C]
C701.4	Choose peer groups to collaborate and bring out the sustainable products for commercialization.	[C]
C701.5	Draft and compile the outputs of a project as a report.	[E]
C701.6	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 team and execute a project. The project work could be done in the form of a 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. Project 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 [40marks]			Project Book [20 marks]	End Semester Examination (Viva-Voce) [40marks]
	Review – I [10 marks]	Review – II [10marks]	Review – III [20 marks]		
Remember	-	-	-	-	-

Understand	-	-	-	-	-
Apply	50	40	30	30	30
Analyse	50	40	30	30	30
Evaluate	-	20	20	20	20
Create	-		20	20	20

Course Articulation Matrix

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3		3		2	2		3			2	2	2	2
2	3	3		3		2	2		3			2	2	2	2
3	3	2	3	3	3	2	2		3		2	2	3	3	3
4	3	2	3	3	3	2	2	2	3		2	2	3	3	3
5					1			2	3	3	2				
6					1			2	3	3	2				
Avg.	3	2.5	3	3	2	2	2	2	3	3	2	2	2.5	2.5	2.5
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

SEMESTER 8

21CE801	PROJECT WORK	0/0/24/12
Nature of Course	Practical	

Course Objectives:

1.	To provide students an opportunity to exercise their creative and innovativequalities in a group project environment.
2.	To develop the ability to addressing a specific problem right from itsidentification.
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 analyze the problems and its solutions, reportpreparation 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	Express the technical ideas, strategies and methodologies	[AN]
C801.3	Investigate the suitable components and interpretation using computational models to validate and justify his solutions	[C]
C801.4	Choose peer groups to collaborate and bring out the sustainable products for commercialization.	[C]
C801.5	Draft and compile the outputs of a project as a report.	[E]
C801.6	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. A report on Project should be submitted for evaluation and project work should be presented and demonstrated before the panel of examiners.

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			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	30	30	30
Evaluate	-	20	20	20	20
Create	-		20	20	20

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3		3		2	2		3			2	2	2	2
2	3	3		3		2	2		3			2	2	2	2
3	3	2	3	3	3	2	2		3		2	2	3	3	3
4	3	2	3	3	3	2	2	2	3		2	2	3	3	3
5					1			2	3	3	2				
6					1			2	3	3	2				
Avg.	3	2.5	3	3	2	2	2	2	3	3	2	2	2.5	2.5	2.5
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

PROFESSIONAL ELECTIVE COURSES

21CE901	DAMAGE DETECTION AND REHABILITATION OF CONCRETE STRUCTURES	3/0/0/3

Nature of Course	Theory Concept
Pre requisites	Concrete Technology

Course Objectives:

1	To recognize the importance of maintenance and assess quality of concrete by using various diagnosing techniques of concrete
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

C901.1	Inspect and evaluate the damaged structure.	[AN]
C901.2	Suggest the suitable diagnosing techniques of concrete structures.	[AP]
C901.3	Analyse the structural damages by various monitor techniques.	[AN]
C901.4	Apply the surface repairing techniques in structures	[AP]
C901.5	Apply suitable strengthening method for the damaged structure elements.	[AP]
C901.6	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 of cementations 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-off resistance, 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 to monitor 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 and stabilization **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 - 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.
Suggested Readings:	
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.
Code Books :	
1	IS 13311 (Part 1):1992 Non-Destructive Testing of Concrete - Methods of Test -Ultrasonicpulse 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]
C901.1 - 6	Analyze	Group Assignment	20
C902.1-6	Apply	Tutorial Problem	20
C902.1-6	Apply	Case Study	20
C902.1 - 6	Analyze	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	10	10
Understand	30	30	20
Apply	20	60	40
Analyse	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)**	

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	-	-	1	1	1	1	-	2	3	1	1
2	3	2	1	1	-	-	1	1	1	1	-	2	3	1	1
3	3	2	1	1	-	-	1	1	1	1	-	2	3	1	1
4	3	2	1	1	-	-	1	1	1	1	-	2	3	1	1
5	3	2	1	1	-	-	1	1	1	1	-	2	3	1	1
6	3	2	1	1	-	-	1	1	1	1	-	2	3	1	1
Avg	**3.0**	**2.0**	**1.0**	**1.0**	**-**	**-**	**1.0**	**1.0**	**1.0**	**1.0**	**-**	**2.0**	**3.0**	**1.0**	**1.0**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE902	DESIGN OF SUBSTRUCTURES	3/0/0/3
Nature of Course	Theory and Application	
Pre requisites	Geotechnical Engineering	

Course Objectives:

1	To identify the significance of bearing capacity and settlement in the design of substructure
2	To design shallow and deep foundation considering the load and subsurface soil conditions
3	To design earth retaining structures and bridge substructures
4	To apply suitable design method for special foundations considering codal provisions

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

C902.1	Compute bearing capacity and settlement for shallow foundation	[AP]
C902.2	Design suitable shallow foundation based on bearing capacity and settlement estimates from equations or in-situ test data	[AP]
C902.3	Analyze the concept of load carrying capacity of pile groups	[AN]
C902.4	Design pile foundation for different loading conditions on the pile head and shaft	[AP]
C902.5	Apply suitable design for earth retaining structures and bridge sub-structures	[AP]
C902.6	Design foundation for machine and tower structures	[AP]

Course Contents: Theory

Module1: Shallow Foundation **12 Hrs.**

Bearing Capacity Equations (Terzaghi's, Skempton's, Meyerhof's, Hansen's, Vesics's, IS Code Method)-Effect of Water Table- Bearing Capacity and Settlement from In-situ Test Data – Design of Individual and Combined Footings - Design of Raft Foundation- Seismic Load Considerations -Codal Provisions

Module2: Deep Foundation **18 Hrs.**

Load Carrying Capacity of Pile Groups – Design of Under-reamed Piles – Design of Laterally Loaded Piles - Pile Caps -Settlement of Pile Foundation - Well Foundation - Design of Offshore Piles in Rock Strata – Seismic Load Considerations – Codal Provisions

Module3: Earth Retaining Structure and Special Foundation **15 Hrs.**

Design of Retaining Walls -Design of Bridge Substructures – Abutments and Piers – Introduction to Ring and Shell Foundation – Design of Machine Foundation -Design of Tower 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	Arora, K.R.Soil Mechanics and Foundation Engineering, Standard Publisher Dist., 2020
3	Murthy V.N.S., Textbook of Soil Mechanics and Foundation Engineering Geotechnical Engineering Series, CBS Publishers & Distributors Pvt. Ltd., 2018

Suggested Readings:

1	Wai-Fah Chen and Lian Duan, Bridge Engineering Handbook - Substructure Design,CRC Press, 2014

2	Kameswara Rao, N.S.V. 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
Code Books :	
1	IS 1904: 1986 – Code of Practice for Design and Construction of Foundations in Soils: General Requirements
2	IS 1080: 1985 – Code of Practice for Design and Construction of Shallow Foundations in Soils (Other than Raft, Ring and Shell)
3	IS 6403: 1981 – Code of Practice for Determination of Bearing Capacity of Shallow Foundations
4	IS 2950 (Part 1): 1981 - Code of Practice for Design and Construction of Raft Foundations
5	IS 8009 (Part 1 and 2): 1976 – Code of Practice for Calculation of Settlements of Foundations
6	IS 11089: 1984 - Code of Practice for Design and Construction of Ring Foundation
7	IS 9456: 1980 – Code of Practice for Design and Construction of Conical and Hyperbolic Paraboloidal Types of Shell Foundations
8	IS 2911 (Part 1 to 4): 2010 - Code of Practice for Design and Construction of Pile Foundations – Concrete Piles,
9	IS 2974 (Part 1 to 5): 1982 - Code of Practice for Design and Construction of Machine Foundations
10	IRC 78: 2000 - Standard Specifications and Code of Practice for Road Bridges - Section 7 - Foundations and Substructure
11	IS 9527: 1981 (Part 1) - Code of Practice for Design and Construction of Port and HarbourStructures – Concrete Monoliths
12	IS 4091: 1979 – Code of Practice for Design and Construction of Foundations for Transmission Line Towers and Poles
Web References:	
1	https://theconstructor.org/geotechnical/caisson-types-construction-advantages/503/
2	http://home.iitk.ac.in/~vinaykg/Iset495.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

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 - 6	Apply	Surprise Test	20
C902.1-6	Analyze	Assignment	20
C902.1-6	Apply	Tutorial Problems	20
C902.1 - 6	Analyze	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	-	-	-
Understand	10	10	20
Apply	50	50	40
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)	

Course Articulation Matrix

CO	PO												PSO		
	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	-	2	2	-	1
3	3	2	1	-	-	1	-	1	2	2	-	2	2	-	1
4	3	2	1	-	-	1	1	1	2	2	-	2	2	-	1
5	3	2	1	-	-	1	1	1	2	2	-	2	2	-	1
6	3	2	1	-	-	1		2	2	2	-	2	2	-	1
Avg	3	2	1	-	-	1	1	1.3	2	2	-	2	2	-	1

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE903	DISASTER RESISTANT STRUCTURES	3/0/0/3
Nature of Course	Theory Analytical	
Pre requisites	Nil	

Course Objectives:

1	To understand the factors that make the structures earthquake resistant.
2	To learn the effects of Tsunami and floods in the coastal regions.
3	To analyze the mitigation measures for Tsunami and floods.
4	To acquire knowledge of landslide resistant measures and bye-laws.

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

C903.1	Identify the different methods of earthquake analysis.	[U]
C903.2	Apply the knowledge of seismic resistant concepts in earthquake-resistant building design.	[AP]
C903.3	Compare the various landslide risk and management practices in India.	[AN]
C903.4	Appraise effective land use planning and capacity development.	[AN]
C903.5	Integrate the effects of Tsunami and floods in the coastal regions.	[AN]
C903.6	Analyze the mitigation measures for the Tsunami affected structures.	[AN]

Course Contents: Theory

Module 1: Earthquake Resistant Structures **18 Hrs.**

Earthquakes: Causes - Magnitude and Intensity - Linear Earthquake Analysis: Idealization of Structures - Response Spectrum analysis - Capacity based design - Time history analysis - Nonlinear Earthquake Analysis: Force-deformation relationships – Equation of motion – Ductility – Pushover Analysis – Identification of Seismic damages in RC Buildings: Structural Irregularity effect on the performance of RC buildings - Seismic resistant building architecture - Ductility considerations in the earthquake-resistant design of RC building - Earthquake resistant design concepts: RC frame, Shear wall – Codal and detailing provisions as per IS:1893-2016, IS:13920-2016 - Base shear and Equivalent static forces – Application of Base Isolation – Case Study.

Module 2: Landslide Resistant Structures **15 Hrs.**

Landslide Scenario in India – Impacts and Landslide Management practices – Identifying landslide areas – potential landslide risk indicators – Landslide warning signs – Zonation Mapping - Landslide Risk Assessment Framework – Techniques for reducing Landslide Hazards – Detailed investigation Plan – Early Warning Systems - Landslide Remediation Practices - Capacity Development - Model Town and Village Planning and Land use Bye-Laws -Integration of Landslide Management with Development Planning - Usage of vertical inclinometer used in slope movement - Case Study.

Module 3: Tsunami Resistant Structures **12 Hrs.**

Tsunami - Causes and Effects on structures – Assessing Global Tsunami Hazard – State Rehabilitation Program - Reconstruction of buildings in all coastal areas: Basis of design criteria -Use importance of the buildings - Performance level desired - General design factors for coastal states - RCC design criteria or all coastal areas – Structural and Non-Structural Measures – Floods -Causes and Effects – Flood Plain Zoning – Structural, Water Control, and Non-Structural Mitigation Measures – Blast proof buildings design and philosophy - Structural health monitoring of disaster affected structures - Case Study.

Total Hours	**45 Hrs.**

Text Books:

1	Pankaj Agarwal and Manish Shrikhande, Earthquake resistant design of structures,

	Prentice-Hall, New Delhi, 2019.
2	Sundar V, Sannasiraj S A., Murali K., and Sriram V., Tsunami – Engineering Perspectivefor Mitigation, Protection and Modelling, World Scientific Publishing Co. Pte. Ltd., 2020.
3	Ernest D Werner and Hugh P Friedman., Landslides: Causes, Types & Effects,Nova Science Publishers Inc., UK, 2010.
Suggested Readings:	
1	Duggal S K., Earthquake resistant design of structures, Oxford University Press, 2013.
2	Vinod Hosur., Earthquake-Resistant Design of Building Structures, Wiley Publishers,2012.
3	Derek Cornforth., Landslides in Practice Investigation, Analysis and Remedial, Preventative Options in Soils', John Wiley & Sons, Inc., 2015.
4	Gupta B. L., Principles of Earthquake Resistant Design of Structures and Tsunami, Standard Publishers Distributors, 2017.
Code Books :	
1	IS 1893-2016, Criteria for Earthquake Resistant Design of Structures – Code of Practice, Bureau of Indian Standards, New Delhi.
2	IS 13920-2016, Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces - Code of Practice, Bureau of Indian Standards, New Delhi.
Web References:	
1	https://www.tn.gov.in/tsunami/Projects/RGRP.html
2	https://nidm.gov.in/PDF/modules/Landslide.pdf
3	https://www.pwri.go.jp/icharm/training/ctdpcourse/pdf/action_india.pdf
Online Resources:	
1	https://onlinecourses.nptel.ac.in/noc20_ce52/preview
2	https://coursesity.com/course-detail/earthquake-resistant-design-of-foundations
3	https://www.thoughtco.com/architecture-of-tsunami-resistant-buildings-177703

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 to C903.6	Apply	Assignment	20
C903.1 to C903.6	Apply	Technical Quiz	20
C903.1 to C903.6	Analyze	Case Study Report 1	20

C903.1 to C903.6	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	10	10	10
Understand	30	20	20
Apply	60	40	40
Analyse	-	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)**	

Course Articulation Matrix															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	-	-	2	1	2	2	2	1	2	2	2	1
2	3	2	1	-	-	2	1	2	2	2	1	2	2	2	1
3	3	3	1	-	-	2	1	2	2	3	1	2	2	2	1
4	3	3	1	-	-	2	1	2	2	3	1	2	2	2	1
5	3	3	1	-	-	2	1	2	2	3	1	2	2	2	1
6	3	3	1	-	-	2	1	2	2	3	1	2	2	2	1
Avg	**3.0**	**2.7**	**1.0**	**-**	**-**	**2.0**	**1.0**	**2.0**	**2.0**	**2.7**	**1.0**	**2.0**	**2.0**	**2.0**	**1.0**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE904	GREEN BUILDING TECHNOLOGY	3/ 0/ 0/ 3
Nature of Course	Theory Concept	
Pre requisites	Nil	

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 system 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	Appraise the implementation of the design and aspects involved in building commissioning- benefits.	[AP]
C904.5	Evaluate the design on various rating systems -LEED, Green globes, GRIHA and EDGE.	[AP]
C904.6	Interpret economic aspects of green building – quantifying short term and long-term benefits.	[AP]

Course Contents: Theory

Module 1: Introduction: **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 Charette 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. Sometypical 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	¯Greenbuildingguidelines:Meetingthedemandforlow-energy,resource- efficienthomes‖,Sustainable Buildings Industry Council, 2004.	
3	Guttila Yugantha Jayasinghe,, A text book on Green Buildings Lambert Academic Publishing,2018.	
Suggested Readings:		
1	Charles J.Kibert, Sustainable Construction :Green Building DesignandDelivery‖,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 Profit‖ Builder Books2012.	
4	Mike Montoya Green Building Fundamentals: Practical Guide to Understanding and Applying Fundamental Sustainable Construction Practices and the Leed System‖ Pearson 2 nd edition - 2010.	
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	Apply	Class Room Quiz	20
C904.2	Apply	Group Assignment	20
C904.3 - C904.4	Analyze, Apply	Group Mini Project	20

C904.5 - C904.6	Apply	Technical 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	40	40	50
Apply	40	40	20
Analyse	10	10	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)**	

Course Articulation Matrix															
CO	**PO**												**PSO**		
	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
6	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

21CE905	GROUND IMPROVEMENT AND LAND RECLAMATION METHODS	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 Geo synthetics as soil reinforcement
4	To recommend suitable ground improvement and reclamation for any field situation

Course Outcomes:

Upon completion of the course, students shall have ability to

C905.1	Comprehend the scope of ground improvement in the real time projects	[AN]
C905.2	Identify various ground improvement techniques based on soilconditions	[AN]
C905.3	Analyze the application of geotextiles, geogrids, geonets, geo composites as soil reinforcement	[AN]
C905.4	Apply suitable ground improvement techniques in Roads, Retaining Walls, Embankments and Landfills	[AP]
C905.5	Recognize various methods existing for land reclamation	[AN]
C905.6	Recommend suitable methods for an effective land reclamation in any field situation	[AP]

Course Contents: Theory

Module 1: Ground Improvement **15 Hrs.**

Challenges in Ground Improvement - Principles of Compaction - Shallow Stabilization with additives - Lime, Fly ash and Cement - Deep Stabilization using Stone Column - Sand Drains - Prefabricated Drains - Soil-Lime Column - Vibro-floatation - Dynamic Compaction - Electro-osmosis - Grouting - Permeation, Compaction and Jet - Dewatering Systems - Case Studies

Module 2: Geosynthetics and Soil Reinforcement **15 Hrs.**

Geosynthetics - Types and Materials - Reinforced Soil Structures - Principles of Soil Reinforcement - Geotextiles and Geogrids in Roads, Retaining Walls and Embankments -Geonets and Geo composites as Drains and Filters - Geosynthetics as Covers and Liners in Landfills and Slurry Ponds - Case Studies

Module 3: Land Reclamation Methods **15 Hrs.**

Land Reclamation – Methods – Stabilization/Solidification - Soil Vapour Extraction, Thermal Desorption, Vitrification - Soil Washing, Permeable Reactive Barrier, Electro kinetics, In-situ Chemical Oxidation, Bioremediation - Phytoremediation - Nano remediation- Integrated Reclamation Methods

Total Hours	**45 Hrs.**

Text Books:

1	Purushothama Raj, P. "Ground Improvement Techniques", Laxmi Publications, 2016.
2	Jie Han, ―Principles and Practice of Ground Improvement‖, John Wiley Publications, 2018.

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	Bikas Chandra Chattopadhyay, Ground Improvement Techniques, PHI Learning,2017.
2	Nihar Ranjan Parta, Ground Improvement Techniques, Vikas Publishing House, 2012.
3	Peter G. Nicholson, Soil Improvement and Ground Modification Methods, Butterworth Heinemann, 2014.
4	Maria C. Hernandez Soriano, Environmental Risk Assessment of Soil Contamination‖,Intech Open, 2014.
IS Code Books :	
1	IS 13094:1992 - Selection of ground improvement techniques for foundation in weak soils - Guidelines
2	IS 15284-1:2003 - Design and construction for ground improvement – Guidelines, Part 1: Stone columns
3	IS 15284-2: 2004 - Design and construction for ground improvement – Guidelines, Part 2: Preconsolidation using vertical drains
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
Online Resources:	
1	https://nptel.ac.in/courses/105/108/105108075/
2	https://nptel.ac.in/courses/105/107/105107181/

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 - 6	Evaluate	Group Assignment	20
C905.1 - 6	Analyze	Online Quiz	20
C905.1 – 6	Apply	Case Study and PowerPoint Presentation	20
C905.1 - 6	Evaluate	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	-	-	-
Understand	20	20	20
Apply	40	40	50
Analyse	40	40	30
Evaluate	-	-	-
Create	-	-	-

<table>
<tr><th colspan="7">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><th colspan="6">Continuous Assessment (40%)
[200 Marks]</th><th rowspan="4">End Semester Examination (60%)
[100 Marks]</th></tr>
<tr><th colspan="3">CA 1 : 100 Marks</th><th colspan="3">CA 2 : 100 Marks</th></tr>
<tr><th rowspan="2">SA 1
(60 Marks)</th><th colspan="2">FA 1 (40 Marks)</th><th rowspan="2">SA 2
(60 Marks)</th><th colspan="2">FA 2 (40 Marks)</th></tr>
<tr><th>Component - I
(20 Marks)</th><th>Component - II
(20 Marks)</th><th>Component - I
(20 Marks)</th><th>Component - II
(20 Marks)</th></tr>
</table>

Course Articulation Matrix

CO	PO												PSO		
	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
6	3	2	1	-	-	1		2	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

21CE906	PREFABRICATED STRUCTURES	3/0/0/3
Nature of Course	Theory and Application	
Pre requisites	Nil	

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 the standardization techniques on prefabricated elements	[AP]
C906.3	Apply suitable structural connections for prefabricated members	[AP]
C906.4	Handle the problems during connections on prefabricated members	[AP]
C906.5	Apply the suitable methods to avoid progressive collapse of thestructure	[AN]
C906.6	Apply the various Codal provisions for abnormal loads to avoidstructural collapse	[AP]

Course Contents: Theory

Module 1: Prefabricated Components and Structures **15 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.

Module 2: Joint in Structural Members **15 Hrs**

Disuniting of structures- Design concepts of prefabricated elements - erection loads - 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

Module 3: Design for Abnormal Loads and its Applications **15 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 application of prefabricated components and 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	Kim S. Elliott. Precast Concrete Structures, CRC Press, 2019
3	Handbook on Precast concrete for buildings, ICI Bulletin 02, Indian Concrete Institute, 2016

Suggested Readings:	
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 ofthe 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 Buildingand Construction Authority, May 2001
IS 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&C906.2	Apply	Classroom Learning Experience - Report1	20
C906.3 &C906.4	Apply	Classroom Learning Experience - Report2	20
C906.5	Analyse	Assignment	20
C906.6	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	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)**	

Course Articulation Matrix															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	2	-	-	2	-	-	-	-	3	3	2	2
2	3	2	2	2	-	-	2	-	-	-	-	3	3	2	2
3	3	2	2	2	-	-	-	-	-	-	-	3	3	-	2
4	3	2	2	2	-	-	-	-	-	-	-	3	3	-	2
5	3	2	2	2	-	-	2	-	-	-	-	3	3	2	2
6	3	2	2	2	-	-	2	-	-	-	-	3	3	2	2
Avg	**3**	**2**	**2**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**2**	**2**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE907	PRESTRESSED CONCRETE STRUCTURES	3/0/0/3
Nature of Course	Theory Application	
Pre requisites	Nil	

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 pre stressed concrete	[AP]
C907.2	Analyze prestressed concrete accounting for losses	[AN]
C907.3	Analyze and design the components of pre stressed concrete	[AN]
C907.4	Check for deflection and cracks in concrete element	[AP]
C907.5	Analyze composite structures for their capacity	[AN]
C907.6	Study the concepts of circular pre stressing and its applications	[AP]

Course Contents: Theory

Module 1: Principles and Methodologies of Prestressing **10 Hrs.**

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

Module 2: Analysis, Design and Derailing of Pre stressing Components **20 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 pre stress. Cable profiling, Concordant Cable profile. Design of anchorage.

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

Analysis of composite sections, Analysis of slabs, Analysis of compression members, Circular pre stressing, Pre stressed concrete pipes, Liquid storage tanks, Ring beams. Software package for analyzing pre stressed 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

Suggested Readings:

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
IS 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 - C907.4	Apply	Presentation	20
C907.1 - C907.6	Apply	Assignment	30
C907.1 - C907.6	Apply	Quiz	30

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	-	-	-

<table>
<tr><th colspan="7">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><td colspan="6">Continuous Assessment (40%)
[200 Marks]</td><td rowspan="4">End Semester Examination (60%)
[100 Marks]</td></tr>
<tr><td colspan="3">CA 1 : 100 Marks</td><td colspan="3">CA 2 : 100 Marks</td></tr>
<tr><td rowspan="2">SA 1
(60 Marks)</td><td colspan="2">FA 1 (40 Marks)</td><td rowspan="2">SA 2
(60 Marks)</td><td colspan="2">FA 2 (40 Marks)</td></tr>
<tr><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td></tr>
</table>

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	2	-	-	-	-	-	-	2	3	-	1
2	3	3	2	2	2	-	-	-	-	-	-	2	3	-	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
6	3	3	2	2	-	2	2	1	1	2	1	2	3	1	1
Avg	3.0	2.8	1.8	1.8	2.0	2.0	2.0	1.0	1.0	2.0	1.0	2.0	3.0	1.0	1.0

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

20CE908	TALL STRUCTURES	3/0/0/3
Nature of Course	Theory Analytical	
Pre requisites	Design of Reinforced Concrete Structures, Structural Analysis	

Course Objectives:

1	To know the materials used in tall structures construction
2	To study the analysis and design aspects of tall structures
3	To understand the behavior of structural systems
4	To know the stability calculations of tall structures

Course Outcomes:

Upon completion of the course, students shall have ability to

C908.1	Apply the design philosophy of tall structures.	[AP]
C908.2	Evaluate the loads acting in the tall structures.	[AN]
C908.3	Analyse the behavior of structural systems	[AN]
C908.4	Apply the concepts for design and analysis of structural systems	[AP]
C908.5	Analyse the overall buckling of structural frames	[AN]
C908.6	Evaluate the stability of tall structures	[AN]

Course Contents: Theory

Module 1: Design philosophies and Design loads of Tall Structures **12Hrs.**

Development of High Rise Structures - General Planning Considerations - Design philosophies - Materials used for Construction. Loading: Gravity Loading - Dead Load - Live Load - Live load reduction technique - Impact Load - Construction Load - Sequential Loading, Lateral Loading - Wind load - Earthquake Load. Combination of Loads.

Module 2: Behavior, Analysis and Design of Tall Structures **18 Hrs.**

Behavior of Various Structural Systems - Factors affecting growth, Height and Structural form. High rise behavior of Various structural systems - Rigid frames, braced frames, Infilled frames, shear walls, coupled shear walls, wall-frames, tubular structures, cores, outrigger - braced and hybrid mega systems. Analysis and design of tall buildings as total structural system considering overall integrity and major subsystem interaction - Design of moment connections - simple and semi-rigid - beam-column connection

Module 3: Stability of Tall Structures **15 Hrs.**

Overall buckling analysis of frames, wall-frames, Approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first-order and P-Delta analysis, Translational, Torsional instability, out of plumb effects, stiffness of member in stability, effect of foundation rotation.

Total Hours	**45 Hrs.**

Text Books:

1	Bryan Stafford Smith, Alex coull, Tall Building Structures, Analysis and Design , John Wileyand Sons, Inc., 2011.
2	Taranath B.S., Structural Analysis and Design of Tall Buildings‖, McGraw Hill, 2011.
3	Guy Marriage, Tall: the design and construction of high-rise architecture, Routledge,

	London, 2020
Suggested Readings:	
1	Wolfgang Schueller ¯High Rise Building Structures‖, John Wiley and Sons, New York2018.
2	Lynn S.Beedle, ¯Advances in Tall Buildings‖, CBS Publishers and Distributors, Delhi, 2019
3	Lin.T.Y, StotesBurry.D, ¯Structural Concepts and systems for Architects and Engineers‖, John Wiley, 2011.
4	CBRI, ¯Building materials and components‖, India, 1990.
Web References:	
1	https://www.csiamerica.com/news/tall-buildings-modeling-analysis-designlondon
2	http://www.ctbuh.org/TallBuildings/FeaturedTallBuildings/tabid/1736/language/en- US/Default.aspx
Online Resources:	
1	https://www.udemy.com/course/design-the-high-rise-buildings-level-1/
2	https://www.udemy.com/course/high-rise-building-lateral-loads-resisting-system-types/

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 Articulation Matrix															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	1	-	-	-	-	-	-	-	2	2	-	-
2	3	2	2	1	-	-	-	-	-	-	-	2	2	-	-
3	3	3	2	2	-	-	-	-	-	-	-	2	2	-	-
4	3	3	2	2	-	-	-	-	-	-	-	2	2	-	-
5	3	3	2	1	-	-	-	-	-	-	-	2	2	-	-
6	3	3	2	1	-	-	-	-	-	-	-	2	2	-	-
Avg	**3**	**2.6**	**2**	**1.3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**-**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE909	VALUATION OF CIVIL ENGINEERING STRUCTURES	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

C909.1	Perform valuation of a property with appropriate methods.	[AP]
C909.2	Appraise different legal norms and constraints involved in the valuation of properties.	[AN]
C909.3	Describe Indian accounting standards as applicable to real estate valuation.	[U]
C909.4	Appraise the different approaches to value – income, market, and the cost approach.	[AN]
C909.5	Describe factors influencing the life of the building and estimating the future life. .	[U]
C909.6	Compute various methods of Computation of Depreciation, Functional, Technological and Economic Obsolescence.	[AP]

Course Contents: Theory

Module 1: 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 methods‖, Routledge,2014.
3	Joshua Kahr and Michael C. Thomsett, Real Estate Market Valuation and Analysis, JohnWiley &Sons, Inc., 2005.
Suggested Readings:	
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.
IS 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://www.incometaxindia.gov.in/Acts/Wealth-Tax%20Act,%201957/102120000000026474.html
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]**
C909.1 to C909.6	Apply		20
C909.1 to C909.6	Apply	Technical Quiz	30

C909.1 to C909.6	Analyze	Project Based Learning	30

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)**	

Course Articulation Matrix															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	-	-	-	-	2	2	-	1	1	1	1	1
2	3	2	1	-	-	-	-	2	2	-	1	1	1	1	1
3	3	2	1	-	-	-	-	2	2	-	1	1	1	1	1
4	3	2	1	-	-	-	-	2	2	-	1	1	1	1	1
5	3	2	1	-	-	-	-	2	2	-	1	1	1	1	1
6	3	2	1	-	-	-	-	2	2	-	1	1	1	1	1
Avg	**3.0**	**2.0**	**1.0**	**-**	**-**	**-**	**-**	**2.0**	**2.0**	**-**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE910	AIR AND NOISE POLLUTION MANAGEMENT	3/0/0/3

Nature of Course	Theory application
Pre requisites	-

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	Outline the ambient air quality and noise pollution standards.	[U]
C910.3	Apply Sampling methods to monitor air quality parameters and their influencing meteorological parameters.	[AP]
C910.4	Apply the suitable modeling software to predict the source of emissionand dispersion characteristics.	[AP]
C910.5	Illustrate the relevant source-based noise monitoring parameters and evaluate the causes incurred on the society.	[AN]
C910.6	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 andcontrol 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.
Suggested Readings:	
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
IS 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 - C910.6	Analyze	Massive Open Online Course	40
		Assignment	20
		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	30	10	10
Understand	30	10	20

Apply	40	40	40
Analyse	-	40	30
Evaluate	-	-	-
Create	-	-	-

<table>
<tr><th colspan="7">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><td colspan="6">Continuous Assessment (40%)
[200 Marks]</td><td rowspan="4">End Semester Examination (60%)
[100 Marks]</td></tr>
<tr><td colspan="3">CA 1 : 100 Marks</td><td colspan="3">CA 2 : 100 Marks</td></tr>
<tr><td rowspan="2">SA 1
(60 Marks)</td><td colspan="2">FA 1 (40 Marks)</td><td rowspan="2">SA 2
(60 Marks)</td><td colspan="2">FA 2 (40 Marks)</td></tr>
<tr><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td></tr>
</table>

Course Articulation Matrix

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

21CE911	ECOLOGICAL ENGINEERING	3/0/0/3

Nature of Course	Theory concepts
Pre requisites	-

Course Objectives:

1	To understand the types of ecosystem
2	To study about the functioning of ecotechnology
3	To learn the concepts and principals involved in ecological processes
4	To gain knowledge on biological system design and operation.

Course Outcomes:

Upon completion of the course, students shall have ability to

C911.1	Compare the concepts of ecosystem and its behavior in the ecology	[U]
C911.2	Apply the modeling concept of eco technology	[AP]
C911.3	Analyze the types of ecosystem with its principle	[AN]
C911.4	Identify and apply the process of eco technology for engineered ecosystem	[AP]
C911.5	Apply the concepts of biological principles in the eco system	[AP]
C911.6	Apply the concept of biological processes in kinetic study	[AP]

Course Contents: Theory

Module 1: Ecosystem and Eco technology **15 Hrs.**

Aim, scope and applications of ecology - Development and evolution of ecosystems - Principles and concepts pertaining to communities in ecosystem - Energy flow and material cycling in ecosystems – productivity in ecosystems - Environmental systems as energy systems - Mechanisms of steady-state maintenance in open and closed systems - Modelling and ecotechnology - Elements modeling - Modelling procedure -Classification of ecological model s- Applications of models in ecotechnology - Ecological economics

Module 2: Ecological Engineering Processes **15 Hrs.**

Self-organizing design and processes - Multi seeded microcosms - Interface coupling in ecological systems - Concept of energy - Determination of sustainable loading of ecosystems.Ecosanitation-Principles and operation of soil infiltration systems - Wetlands and ponds - source separation systems – Aquacultural systems - Agro ecosystems - Detritus based treatment for solid wastes - Applications of ecological engineering for marine systems

Module 3: Biological Principal and Processes **15 Hrs.**

Objectives of biological treatment - significance - Principles of aerobic and anaerobic treatment - kinetics of biological growth – Factors affecting growth – attached and suspended growth - Determination of Kinetic coefficients for organics removal - Biodegradability assessment - selection of process- reactors-batch-continuous type.

Total Hours	**45 Hrs.**

Text Books:

1	Jorgensen, S.E. Ecological Engineering: Principles and Practice. CRC Press, 2003

2	Mitsch, J.W. and Jorgensen, S.E. Ecological Engineering - An Introduction toEcotechnology, John Wiley & Sons, New York, 1989
3	Arceivala S.J., and Asolekar S.R "Wastewater Treatment for Pollution Control and reuse Tata McGraw Hill ,3 r d Edition, New Delhi, 2007.
Suggested Readings:	
1	Mitsch, W.J. Ecological Engineering and Ecosystem Restoration, Wiley 2nd Ed., 2003
2	White I.D., Mottershed, D.N. and Harisson, S.J. Environmental systems - An Introductory text, Chapman Hall, London, 1994
3	CPHEEO Manual on Sewerage and Sewage Treatment Systems Part A, B & C, Ministry of Urban Development, Government of India, New Delhi, 2013
4	Metcalf & Eddy, Inc., G. Tchobanoglous, H. D. Stensel, R. Tsuchihashi, and F. L.Burton. ¯Wastewater Engineering: Treatment and Resource Recovery‖5th edition. McGraw Hill Company.2014
Web References:	
1	http://nptel.ac.in/courses/105106119/36
2	https://www.water.wa.gov.au/_data/assets/pdf_file/0008/4040/89343.pdf
3	http://cpheeo.gov.in/upload/uploadfiles/files/chap6.pdf
Online Resources:	
1	https://www.un-ihe.org/online-course-industrial-effluent-treatment
2	https://onlinecourses.nptel.ac.in/noc19_ce32/preview
3	https://alison.com/course/advanced-diploma-in-wastewater-treatment-and-recycling

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	Understand	Online Quiz	20
C911.3	Analyse	Group Assignment	20
C911.4	Understand	Group Assignment	20
C911.5 & C911.6	Apply	Technical 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	30	20	10
Understand	30	30	10
Apply	40	30	40
Analyse	-	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)	

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	2	3										1	2	1
2		2				3							1	2	1
3	1	2					3						1	2	1
4	1	2	3										1	2	1
5	1	2											1	1	1
6	1	2											1	1	1
Avg	1.0	2.0	3.0			3.0	3.0						1.0	1.7	1.0

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE912	ENVIRONMENTAL HAZARD, RISK ASSESSMENT AND MANAGEMENT	3/0/0/3
Nature of Course	Theory application	
Pre requisites	Nil	

Course Objectives:

1	To attain knowledge in the field of hazard identification and risk analysis.
2	To recognize important processes that control contaminant transport.
3	To identify the availability and usage of tools in predicting and estimating the health risk of human.
4	To accomplish awareness on risk management and planning through case studies.

Course Outcomes:

Upon completion of the course, students shall have ability to

C912.1	Identify various sources of environmental hazards and risk	[U]
C912.2	Assess the level of toxicity through various exposures	[AN]
C912.3	Utilize modern methods and tools to analyze and assess the risk.	[AN]
C912.4	Estimate contaminant concentrations in air, water, soils, vegetation and animal products	[AN]
C912.5	Acquire technical knowledge in environmental risk management	[U]
C912.6	Prepare risk management plan from the case studies.	[AP]

Course Contents: Theory

Module-1: Hazard Identification and Risk Analysis **15 Hrs.**

Sources of Environmental hazards - Environmental risk assessment framework - Hazard identificationand accounting - Fate and behaviour of toxics and persistent substances in the environment - Properties, processes and parameters that control fate and transport of contaminants - Receptor exposure to Environmental Contaminants - Exposure Assessment - Exposure Factors, Slope Factors, Dose Response calculations and Conversion Factors - Risk Characterization and consequence determination – Vulnerability assessment – Uncertainty analysis.

Module-2: Tools and Methods for Risk Assessment **15 Hrs.**

HAZOP and FEMA methods - Cause failure analysis - Event tree and fault tree modeling and analysis - Multimedia and multipath way exposure modeling of contaminant migration for estimation of contaminant concentrations in air, water, soils, vegetation and animal products - Estimation of carcinogenic and non-carcinogenic risks to human health - Methods in Ecological risk assessment - Probabilistic risk assessments – radiation risk assessment – Data sources and evaluation.

Module- 3: Environmental Risk Management **15 Hrs.**

Risk communication and Risk Perception - comparative risks - Risk based decision making - Risk based environmental standard setting - Risk Cost Benefit optimization and tradeoffs - Emergency Preparedness Plans - Emergency planning for chemical agent release - Design of risk management programs - risk based remediation; Risk communication, adaptive management, precaution and stake holder involvement. Case studies on risk assessment and management for hazardous chemicalstorage.

Total Hours	**45 Hrs.**

Text Books:

1	Cutter, S.L., Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi,1999.

2	Kolluru Rao, Bartell Steven, Pitblado R and Stricoff ―Risk Assessment and Management Handbook‖, McGraw Hill Inc., New York,1996.
3	Kofi Asante Duah ―Risk Assessment in Environmental management‖, John Wiley and sons, Singapore, 1998.
Suggested Readings:	
1	Kasperson J.X. and Kasperson R.E., ―Global Environmental Risks‖, V.N.University Press,New York, 2003.
2	Susan L Cutter, ―Environmental Risks and Hazards‖ Prentice Hall of India, New Delhi 1999.
3	Joseph F Louvar and B Diane Louver, ―Health and Environmental Risk Analysis fundamentals with applications‖, Prentice Hall, New Jersey 1997.
4	Peter P. Calow, ―Handbook of Environmental Risk Assessment and Management‖, Wiley,1998.
Web References:	
1	https://www.ccohs.ca/oshanswers/hsprograms/risk_assessment.html
2	https://www.britsafe.org/training-and-learning/find-the-right-course-for-you/informational-resources/risk-assessment/
3	https://www.assp.org/news-and-articles/conducting-a-risk-assessment
Online Courses:	
1	https://www.coursera.org/learn/environmental-hazards-and-global-public-health
2	https://ii-es.com/events/environmental-human-health-risk-assessment-e-course/
3	https://alison.com/course/hazard-recognition-and-risk-assessment
4	https://nptel.ac.in/courses/114/106/114106017/

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 & C912.6	AN	**Project Based Learning system** (Project demonstration, Presentation and Reportwriting)	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	-	-	-
Understand	40	20	26
Apply	60	60	60

Analyse	-	20	14
Evaluate	-	-	-
Create	-	-	-

<table>
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[200 Marks]</td><td rowspan="4">End Semester Examination (60%)
[100 Marks]</td></tr>
<tr><td colspan="3">CA 1 : 100 Marks</td><td colspan="3">CA 2 : 100 Marks</td></tr>
<tr><td rowspan="2">SA 1
(60 Marks)</td><td colspan="2">FA 1 (40 Marks)</td><td rowspan="2">SA 2
(60 Marks)</td><td colspan="2">FA 2 (40 Marks)</td></tr>
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</table>

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	3	-	-	-	1	-	1	-	-	-	1	-	-	-
2	3	2	-	2	-	1	-	-	-	-	-	-	1	-	-
3	2	1	-	1	3	-	-	-	1	-	-	1	2	1	3
4	3	2	-	2	-	-	-	1	-	1	-	-	1	1	-
5	2	-	-	-	-	1	1	-	-	-	-	-	-	-	-
6	1	2	3	1	-	1	1	1	1	1	2	1	1	1	2
Avg	**2.2**	**2.0**	**3.0**	**1.5**	**3.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**2.0**	**1.0**	**1.3**	**1.0**	**2.5**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE913	GIS FOR ENVIRONMENTAL ENGINEERING	3/0/0/3
Nature of Course	Theory Concepts	
Pre requisites	Nil	

Course Objectives:

1	To achieve knowledge on GIS techniques and map projections.
2	To understand about data models and data structures.
3	To accustom with several advanced modeling using GIS.
4	To attain knowledge on application of GIS in the field of Civil Engineering.

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

C913.1	Understand the basic components involved in GIS techniques.	[U]
C913.2	Comprehend the geo-referencing and map projection system and its application in GIS.	[AP]
C913.3	Apply the concepts of data analysis and data models involved in GIS	[AP]
C913.4	Analyse the concepts involved in GIS by using modern methods	[AN]
C913.5	Identify field applications of GIS in various resource management	[AP]
C91.3.6	Apply the advanced technologies of GIS in environmental engineering	[AP]

Course Contents: Theory

Module 1: GIS and Data Structures **15 Hrs.**

Introduction to remote sensing and GIS - Components of GIS - Data: Spatial and Non-Spatial - Maps and Projections - Types of Projection - Coordinate system - Geo-referencing and 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.

Module 2: Data analysis and Interpretation Techniques **15 Hrs.**

Data Analysis - Visual interpretation and digital image processing - Data Retrieval - Query - Simple Analysis - Spatial Analysis - Spatial DBMS - Data storage - Overlay - Vector Data Analysis - Raster Data Analysis - Modeling and analysis using GIS software - Digital Elevation Model – Digital Terrain Modeling - Interpolation - Cost and path analysis - Expert Systems - Google Earth Tools - Sources of Errors - Types of Errors - Elimination - Accuracies.

Module 3: Application of GIS in resource management **15 Hrs.**

Applications of GIS - Management and Monitoring of Land, air, water and pollution studies - conservation of natural resources and agriculture - coastal zone management - Water resources and groundwater monitoring - Wasteland management - Social resources - Cadastral records - LIS - Case Studies (Election GIS, School GIS, Health GIS).

Total Hours	**45 Hrs.**

Text Books:

1	Anji Reddy.M, ―Text book of Remote sensing and GIS‖, B.S. Publications., 2019
2	Michael N Demers, Fundamentals of Geographical Information Systems, Third Edition, JohnWiley Publications, 2014.
3	Paul Bolstad, ―GIS Fundamentals‖, XanEdu Publishing Inc.,2016.

Suggested Readings:	
1	Kang-tsung Chang, Introduction to Geographic Information Systems: 9th Edition, 9781259929649, McGraw-Hill Education, 2018
2	Burrough P A, Principles of GIS for Land Resources Assessment, Oxford Publication, 2014.
3	Manugula.S.S and Veeranna Bommakanti, ¯Photogrammetry, GIS and Remote sensing, Edu creation Publishing., 2018
4	Lo, C.P. and Yeung, Albert K.W., Concepts and Techniques of Geographic Information Systems, Pearson, 2016
Web References:	
1	http://www.gdmc.nl/oosterom/PoGISHyperlinked.pdf
2	https://www.researchgate.net/publication/323945547_Fundamentals_of_GIS
3	http://giswin.geo.tsukuba.ac.jp/sis/tutorial/Fundamentals_of_GIS_Estoque.pdf
4	https://webapps.itc.utwente.nl/librarywww/papers_2009/general/principlesgis.pdf
Online Courses:	
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
3	https://2012books.lardbucket.org/pdfs/geographic-information-system-basics.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	Understand	Assignment	20
C913.2 & C91.3.	Apply	Online Quiz	20
C913.4	Analyse	Technical Presentation	20
C913.5 & C913.6	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	20	-	10
Understand	20	30	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)	

Course Articulation Matrix															
CO	PO												PSO		
	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
6	2	2	2	3	3	1	-	-	2	-	1	2	-	2	2
Avg	**2**	**3**	**2**	**3**	**3**	**1**	**2**	**-**	**2**	**-**	**1**	**2**	**1**	**2**	**2**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE914	INDUSTRIAL WASTE TREATMENT AND DISPOSAL	3/0/0/3
Nature of Course	Theory Application	
Pre requisites	Nil	

Course Objectives:

1	To attain basic knowledge on the management of Industrial solid and liquid waste
2	To understand various types of collection, transport and disposal of Industrial solid waste
3	To identify effective technologies for waste management in industries
4	To recognize the types and management of hazardous waste in industries

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

C914.1	Understand the characteristics of Industrial Waste and their effect on the environment.	[U]
C914.2	Apply cleaner production techniques for process, reuse, recycle and recovery of industrial waste.	[AP]
C914.3	Analyze the characteristics of wastewater from major Industries and their reclamation concept.	[AN]
C914.4	Identify industrial hazardous waste and suggest its collection, segregation and treatment	[AP]
C914.5	Identify the suitable treatment technique based on the characteristics of wastewater.	[AN]
C914.6	Apply the suitable disposal techniques for industrial waste	[AP]

Course Contents: Theory

Module 1: Characteristics of Industrial Waste and Cleaner Production **15 Hrs.**

Types of industries and industrial pollution - Characteristics of industrial wastes and its source - Population equivalent - Bioassay studies - effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health -Environmental Social Governance criteria- Environmental policy and legislations related to prevention and control of industrial effluents and hazardous wastes. **Cleaner production** -Waste management Approach - Waste Audit - Zero discharge - Volume and strength reduction - Material and process modifications - Recycle, reuse and byproduct recovery - Applications.

Module 2: Industrial process in major Industries **15 Hrs.**

Sources, Characteristics, waste treatment flow sheets for selected industries: Textiles- Tanneries- Pharmaceuticals- Electroplating industries- Dairy- Sugar- Paper- distilleries- Steel plants- Refineries- fertilizer- thermal power plant. Hazardous wastes types - Sources & Characterization- collection, segregation - Physico chemical treatment

Module 3: Treatment Technologies and Disposal Methods **15 Hrs.**

Equalization - Neutralization - Removal of suspended and dissolved organic solids – Chemical oxidation - Adsorption - Removal of dissolved inorganics - Combined treatment of industrial and municipal wastes - Residue management - Dewatering - sludge Disposal- solidification - incineration - Secured landfills - Bioremediation of contaminated sites - Regulatory aspects.

Total Hours	**45 Hrs.**

Text Books:

1	Rao M.N. and Dutta, A.K. Wastewater Treatment, Oxford - IBH Publication,2017
2	Eckenfelder Jr. W.W., Industrial Water Pollution Control, McGraw-Hill Book Company, New Delhi, 2000
3	Shen, T.T. Industrial Pollution Prevention, Springer, 1999.
Suggested Readings:	
1	Stephenson R.L .and J.B. Blackburn, Jr., Industrial Wastewater Systems Hand book, Lewis Publisher, New York, 1998
2	Freeman H.M., Industrial Pollution Prevention Hand Book, McGraw-Hill Inc., New Delhi,1995.
3	Bishop, P.L., Pollution Prevention: Fundamental & Practice, McGraw-Hill, 2000.
4	Bhatia S.C, Handbook of Industrial Pollution and Control, Volume I & II, CBS Publishers,New Delhi, 2003
Web References:	
1	http://nptel.ac.in/courses/105106119/36
2	https://www.water.wa.gov.au/_data/assets/pdf_file/0008/4040/89343.pdf
3	http://cpheeo.gov.in/upload/uploadfiles/files/chap6.pdf
Online Courses:	
1	https://www.un-ihe.org/online-course-industrial-effluent-treatment
2	https://onlinecourses.nptel.ac.in/noc19_ce32/preview
3	https://alison.com/course/advanced-diploma-in-wastewater-treatment-and-recycling

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	20
C914.2	Apply	Group Assignment	20
C914.3, C914.4	Apply	Technical Video Presentation	20
C914.5, C914.6	Analyse	Case Study 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	-	-	-
Understand	10	10	10
Apply	50	50	50
Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

<table>
<tr><th colspan="7">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><th colspan="6">Continuous Assessment (40%)
[200 Marks]</th><th rowspan="4">End Semester Examination (60%)
[100 Marks]</th></tr>
<tr><th colspan="3">CA 1 : 100 Marks</th><th colspan="3">CA 2 : 100 Marks</th></tr>
<tr><th rowspan="2">SA 1
(60 Marks)</th><th colspan="2">FA 1 (40 Marks)</th><th rowspan="2">SA 2
(60 Marks)</th><th colspan="2">FA 2 (40 Marks)</th></tr>
<tr><th>Component - I
(20 Marks)</th><th>Component - II
(20 Marks)</th><th>Component - I
(20 Marks)</th><th>Component - II
(20 Marks)</th></tr>
</table>

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	3						1	2	1	2	2	2	3
2		2				3			1	2	1	2	2	2	3
3	2	2					3		1	2	1	2	2	2	3
4	2	2	3						1	2	1	2	2	2	3
5	2	2							1	2	1	2	2	2	3
6	2	2							1	2	1	2	2	2	3
Avg	**2.0**	**2.0**	**3.0**			**3.0**	**3.0**		**1.0**	**2.0**	**1.0**	**2.0**	**2.0**	**2.0**	**3.0**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE915	IRRIGATION ENGINEERING	3/0/0/3
Nature of Course	Theory Concepts	
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 learn the concepts involved in elementary hydraulic design of different structures and its maintenance.
4	To learn about Irrigation water management.

Course Outcomes:

Upon completion of the course, students shall have ability to

C915.1	Infer the basic terms and methods of irrigation	[U]
C915.2	Choose the suitability irrigation method for the needed situation	[AP]
C915.3	Inspect the failure reasons for hydraulic structure	[AN]
C915.4	Compare and identify the suitable design of hydraulic structure for appropriate condition	[AN]
C915.5	Develop canal irrigation system	[AP]
C915.6	Make use of the various concepts of irrigation water management	[AP]

Course Contents: Theory

Module 1: Irrigation Methods: **15 Hrs.**

Need and mode of irrigation – Advantages - types of irrigation – consumptive use of water – Duty anddelta - Relationship - Factors affecting duty - Irrigation efficiencies - estimation of Evapo-transpiration using experimental method. Types of irrigation methods- Well irrigation - Tank irrigation - Flooding methods - Merits and demerits –Sprinkler irrigation – Drip irrigation

Module 2: Diversion and Impounding structures: **15 Hrs.**

Diversion head works – Weir and Barrage– Layout of Weir - Causes of failure of weirs and their remedies - Weirs on pervious foundations - Types of impounding structures - Tanks, sluices and weirs - Gravity dams - Earth dams - Arch dams - Spillways - Factors affecting location and type of dams - Forces on a dam – Hydraulic design of Gravity dams.

Module 3: Canal Irrigation and water Management: **15 Hrs.**

Alignment of canals - Classification of canals - Canal drops - Hydraulic design of drops - Cross drainage works - Hydraulic design of cross drainage works - Canal head works - Canal regulators -River training works - Need for optimization of water use - Minimizing irrigation water losses - On form development works - Percolation ponds - Participatory irrigation management - Water users associations.

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 Water Power Engineering‖, Laxmi

	Publications Pvt Ltd., New Delhi, 2009
3	Sahasra Budhe S R, ‾Irrigation and Hydraulic Structures‖, Katson Publishing House,Ludhiana, 2013
Suggested Readings:	
1	Asawa G L,‖Irrigation Engineering‖, New Age International Publishers, New Delhi, 2009.
2	Sharma SK, ‾Irrigation Engineering and Hydraulics Structures‖, S.Chand Publishing,2016
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 Courses:	
1	https://nptel.ac.in/courses/105104140/
2	https://www.ieee.org/sitemap.html
3	http://nptel.ac.in/courses/105104103/

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	Understand	Online Quiz	20
C915.2	Analyse	Group Assignment	20
C915.3	Understand	Group Assignment	20
C915.4 & C915.5	Apply	Technical 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	30	20	10
Understand	30	30	10
Apply	40	30	40
Analyse	-	20	40
Evaluate	-	-	-
Create	-	-	-

<table>
<tr><th colspan="7">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><td colspan="6">Continuous Assessment (40%)
[200 Marks]</td><td rowspan="4">End Semester Examination (60%)
[100 Marks]</td></tr>
<tr><td colspan="3">CA 1 : 100 Marks</td><td colspan="3">CA 2 : 100 Marks</td></tr>
<tr><td rowspan="2">SA 1
(60 Marks)</td><td colspan="2">FA 1 (40 Marks)</td><td rowspan="2">SA 2
(60 Marks)</td><td colspan="2">FA 2 (40 Marks)</td></tr>
<tr><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td></tr>
</table>

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	2	3										1	2	1
2		2				3							1	2	1
3	1	2					3						1	2	1
4	1	2	3										1	2	1
5	1	2											1	1	1
6	1	2											1	1	1
Avg	1.0	2.0	3.0			3.0	3.0						1.0	1.7	1.0

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE916	OCCUPATIONAL HAZARDS AND INDUSTRIAL SAFETY	3/0/0/3
Nature of Course	Concepts and Theory	
Pre requisites	Nil	

Course Objectives:

1	To provide comprehensive knowledge of safety and hazards aspects in industries and the management of hazards.
2	To understand the industrial toxicology, health hazards of industrial environment and control measures
3	To recognize and report industrial hazards, follow safe work practices and participate in hazard inspection
4	To understand the emergency procedures, safety law and employer and employeeresponsibilities

Course Outcomes:

Upon completion of the course, students shall have ability to

C916.1	Identify the various toxic contaminants released from the industries andits toxic effects	[AP]
C916.2	Analyze the type of contaminant and its toxic effects to the surrounding environment by software tools	[AP]
C916.3	Apply the concepts of hazards identification and develop the safetymeasures by various analyzing methods	[AP]
C916.4	Identify the leakages and develop the mitigation measures for thereleases	[AP]
C916.5	Apply the concepts of industrial safety management and its process involved in various industrial activities	[AP]
C916.6	Apply the concepts of legislations related to health, Safety andEnvironment.	[AP]

Course Contents: Theory

Module 1: Industrial Hazards and Hygiene Survey **15 Hrs.**

Industrial atmospheric contaminants – types. Industrial Health Hazards – effects of pressure, humidity, temperature – radiation, light, noise, electricity – accidents, occupational diseases, infections. Modes of entry of toxic substances into the human body – long term and short-term effects – industrial toxicology. Threshold Limit Values, kinds of exposure standards, pollutant concentrations, Industrial Hygiene Survey – Diagnosis – Remedial measures – Occupational Health and Safety Management System (OHSMS) – BS OSHAS 18001.

Module 2: Toxicology and Leakages **15 Hrs.**

Hazards identification-toxicity, fire, static electricity, noise and dust concentration; Material safety data sheet, hazards indices- Dow and Mond indices, hazard operability (HAZOP) and hazard analysis (HAZAN). Spill and leakage of liquids, vapors, gases and their mixture from storage tanks and equipment - Isothermal and adiabatic flows of gases, spillage and leakage of flashing liquids, pool evaporation and boiling - Release of toxics and dispersion - Mitigation measures for leaks and releases.

Module 3: Industrial Safety Management **15 Hrs.**

Introduction to safety and safety management - Accident causation – Hazard – Trigger – Risk – Heinrich Triangle – Frank Bird Triangle - Domino Theory – General Instructions for safety -Industrialsafety practices – classification of accidents – Terms and definitions- General Safety Rules – Integrated Management System -Need for integration of Safety- Health & Environment – Role of topmanagement – Role of National Government & International bodies in formulating framework for regulation of safety – Fundamentals of Safety

	Total Hours	**45 Hrs.**
Text Books:		
1	Farhana Zahir, ‗Introduction to occupational health hazards', Vol. 2, Bentham books, 2019	
2	S. Z. Mansdorf, ‗Handbook of Occupational Safety and Health', 3rd Edition, Wiley, 2019.	
3	R.K. Jain & Sunil S. Rao, ‗Industrial Safety, Health and Environment Management Systems', Khanna Publishers, 2008.	
Suggested Readings:		
1	Haldar, ‗Industrial and Occupational Health', CBS Publishers, 2017	
2	Sarma, ‗Occupational Hazards Safety and Environmental Studies', Pharma Med Press, 2019	
3	L M Deshmukh, ‗Industrial Safety Management', McGraw Hill Education, 2017	
4	Das Akhil Kumar, ‗Principles of Industrial Safety Management', PHI Learning Pvt Ltd, 2020	
Web References:		
1	https://ecu.au.libguides.com/c.php?g=410557&p=6665306	
2	https://www.ilo.org/wcmsp5/groups/public/@dgreports/@dcomm/@publ/documents/publication/wcms_093550.pdf	
Online Courses:		
1	https://onlinecourses.nptel.ac.in/noc20_mg43/preview	
2	https://onlinecourses.nptel.ac.in/noc22_ce39/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]**
C916.1 to C916.6	Apply	Assignment	20
C916.1 to C916.6	Apply	Quiz	20
C916.1 to C916.6	Apply	MOOC course (Minimum 8 Week duration)	40

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	40	40
Apply	60	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)**	

Course Articulation Matrix															
CO	**PO**											**PSO**			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2						-	-				2		1	1
2	2						2	-				2			2
3	3	-	3	3	-	-	2	-	2	1		3	2	2	2
4	2						2	-				2		1	1
5	3	-	2	2	-	-	1	-	2	1		3	2		2
6	2	-		1			2	-				2			2
Avg	**2.3**	**-**	**1.0**	**1.3**	**-**	**-**	**1.7**	**2.0**	**2.0**	**1.0**		**2.3**	**2**	**1.3**	**1.7**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE917	RENEWABLE AND SUSTAINABLE ENERGY	3/0/0/3
Nature of Course	Concepts and Theory	
Pre requisites	Nil	

Course Objectives:

1	To understand the need and feasibility of renewable sources of energy.
2	To identify the new methodologies/technologies for effective utilization of renewable energy sources
3	To study the energy audit and its importance
4	To know the role of energy management in formulating policies

Course Outcomes:

Upon completion of the course, students shall have ability to

C917.1	Recognize the current usage of energy	[U]
C917.2	Investigate the renewable energy for various applications	[AP]
C917.3	Apply the concepts of renewable sources for power generation	[AP]
C917.4	Compare the different energy storage methods and hybrid systems	[U]
C917.5	Identify the importance of energy audit in renewable projects	[AP]
C917.6	Identify the role of management in renewable projects	[AP]

Course Contents: Theory

Module 1: Current state and trends of renewable energy **10 Hrs.**

World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilization – Renewable Energy Scenario in Tamil Nadu, India and around the World - Potentials - Achievements / Applications - Economics of renewable energy systems. Investment issues load management and tariff collection; Distribution and marketing issues,

Module 2: Renewable Energy Sources **20 Hrs.**

Solar energy: Solar Radiation - Measurements of Solar Radiation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications. Wind energy: Wind Data and Energy Estimation - Performance Safety and Environmental Aspects. Bio-energy: Biomass gasifiers, plants and Digesters, Biomass Applications. Tidal energy – Wave Energy – Open and Closed OTEC Cycles-SmallHydro-GeothermalEnergy-HydrogenandStorage-FuelCellSystems-Hybrid Systems.

Module 3: Energy Audit and management **15 Hrs.**

Energy management and audit: Definition, energy audit – need, types of energy audit – understanding energy costs, benchmarking, energy performance, Energy action planning: Key elements, force field analysis, energy policy purpose, perspective contents, formulation, ratification, organizing, location of energy management, top management support, managerial function, roles and responsibilities of an energy manager, Electricity energy act, COP agenda & EIA.

Total Hours	**45 Hrs.**

Text Books:

1	Twidell, J.W. and Weir, A., ¯Renewable Energy Sources‖, EFN Spon Ltd., UK,2015.
2	Sukhatme. S.P., ¯Solar Energy‖, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2008.

3	Barney L Capehart, William J Kennedy and Wayne C Turner, ―Guide to Energy Management‖, River Publishers, 2020
Suggested Readings:	
1	Godfrey Boyle, ―Renewable Energy, Power for a Sustainable Future‖, Oxford University Press, U.K.,2012.
2	David M. Mousdale – Introduction to Biofuels‖, CRC Press, Taylor & Francis Group, USA2010
3	Freris. L.L., ―Wind Energy Conversion Systems‖, Prentice Hall, UK,2004.
4	Charles M Cotlschalk, ―Industrial Energy Conservation‖, John Wiley & Sons, 2002
Web References:	
1	https://alternativeenergysourcesv.com/
2	https://www.edx.org/course/solar-energy
Online Courses:	
1	nptel.ac.in/courses/112105050/
2	nptel.ac.in/courses/108108078/

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-C917.6	Apply	Assignment	20
C917.1-C917.6	Apply	Quiz	20
C917.1 -C917.6	Apply	MOOC course (Minimum 8 Week duration)	40

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	20	20	20
Apply	60	60	60

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

<table>
<tr><th colspan="7">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><td colspan="6">Continuous Assessment (40%)
[200 Marks]</td><td rowspan="4">End Semester Examination (60%)
[100 Marks]</td></tr>
<tr><td colspan="3">CA 1 : 100 Marks</td><td colspan="3">CA 2 : 100 Marks</td></tr>
<tr><td rowspan="2">SA 1
(60 Marks)</td><td colspan="2">FA 1 (40 Marks)</td><td rowspan="2">SA 2
(60 Marks)</td><td colspan="2">FA 2 (40 Marks)</td></tr>
<tr><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td></tr>
</table>

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	-	-	-	-	2	1	2	1		1	2	2	2
2	3	2	1	-	-	-	2	1	2	1		2	2	2	2
3	3	2	1	-	-	-	2	1	2	1		2	2	2	2
4	2	1	-	-	-	-	2	1	2	1		2	2	2	2
5	2	1	-	-	-	-	2	1	2	1		2	2	2	2
6	3	2	1	-	-	-	2	1	2	1		1	2	2	2
Avg	**2.5**	**1.5**	**1**	-	-	-	**2**	**1**	**2**	**1**		**1.7**	**2**	**2**	**2**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE918	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, it's spatial and temporal measurement andtheir applications.
3	To understand the different types of simple statistical analysis and application of probability distribution of rainfall and runoff.
4	To learn the concepts of simple methods of flood routing and ground water hydrology.

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

C918.1	Explain the importance of Hydrological cycle, catchment, and the measurement and analysis of rainfall data	[U]
C918.2	Infer the importance of modeling in surface water hydrology	[U]
C918.3	Estimate the losses viz evaporation, evapotranspiration and infiltration for a catchment area	[AN]
C918.4	Compute the quantity of runoff generated from a catchment	[AN]
C918.5	Develop hydrographs to measure the stream flow	[AN]
C918.6	Estimate floods and propose suitable control measures	[AN]

Course Contents: Theory

Module -1 Surface Hydrology Terms and Definitions **15 Hrs.**

Scope and importance of hydrology, Hydrologic cycle, Global and India's Water resources, Applications of hydrology, Formation of precipitation, Climate and Weather seasons in India. Watershed concept and modeling: Catchment-topographic and groundwater divide, Description of the catchment, catchment processes, demarking a catchment, stream patterns, water budgeting. Classification of models, model formulation, Lumped parameter conceptual models, Physically based models, Model performance testing.

Module -2 Precipitation **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. Abstraction from Precipitation: Losses from precipitation - Evaporation losses - Reservoir evaporation - Infiltration losses - Infiltration capacity-Measurement of infiltration-Infiltration indices-Effective rainfall.

Module -3 Runoff **15 Hrs.**

Watershed, Catchment and basin – Catchment characteristics – Factors affecting runoff – estimationusing 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.

Total Hours	**45 Hrs.**

Text Books:

1	Subramanya,K.,¯Engineering Hydrology‖,TataMcGraw-HillPublishingCo.,Ltd.,2013

2	Raghunath, H. M., ¯Hydrology‖, New Age International Publishers, 2ndedition, 2015
3	Madan Mohan Das, ¯Hyrology‖, Prentice hall India Learning Pvt.Ltd., 2011
4	Jayarami Reddi.P., ¯A Text book of Hydrology‖,LaxmiPublications,NewDelhi,2016
Suggested Readings:	
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 HousePvt.Ltd, 2011
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
3	https://www.researchgate.net/publication/264895381_Engineering_hydrology
4	https://www.pdfdrive.com/hydrology-books.html
Online Courses:	
1	https://easyengineering.net/engineering-hydrology-book-pdf-by-k/
2	http://www.geo.uu.nl/~wwwhydro/folder.pdf
3	http://www.uotechnology.edu.iq/dep-building/LECTURE/dams%20and%20water/third_class/enginerring%20hydrology/Engineering%20Hydrology.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]
C918.1	Understand	Online Quiz	20
C918.2	Understand	Technical presentation	20
C918.4	Apply	Group Assignment	20
C918.3, C918.5	Analyse	Self-Support 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	-	-	-
Understand	60	40	50
Apply	30	30	30
Analyse	10	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)**	

Course Articulation Matrix															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	1	2	3										1	2	1
2		2				3							1	2	1
3	1	2					3						1	2	1
4	1	2	3										1	2	1
5	1	2											1	1	1
6	1	2											1	1	1
Avg	1.0	2.0	3.0			3.0	3.0						1.0	1.7	1.0

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE919	INTELLIGENT TRANSPORTATION SYSTEMS	3/0/0/3
Nature of Course	Theory Concept	
Pre requisites	-	

Course Objectives:

1	To learn the objectives, benefits and the telecommunications in ITS.
2	To understand about Architecture and Hardware in ITS.
3	To Know about the functional areas, user needs and services in ITS.
4	To learn the concepts of Advanced ITS operations and applications.

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

C919.1	Outline the basics of intelligent transport system and its features.	[U]
C919.2	Illustrate the suitable smart technologies to adopt in various transportation functionalities for ITS.	[AP]
C919.3	Apply the various smart monitoring systems to manage and regulate the traffic systems.	[AP]
C919.4	Describe the ITS implementation in various countries.	[U]
C919.5	Explain the advanced models of ITS and its significance.	[U]
C919.6	Apply the advanced techniques of ITS in various functional areas.	[AP]

Course Contents: Theory

Module 1: Intelligent Transport System Architecture and Hardware **15 Hrs**

Introduction to intelligent transport system- Definition - Role and Responsibilities - Advanced Traveller Information System - Fleet Oriented ITS Services - Electronic Toll Collection - Critical issues - Security - Safety - Architecture - ITS Architecture Framework - Hardware Sensors - Vehicle Detection Techniques - Dynamic Message Sign - GPRS - GPS - Toll Collection - Case studies on deployment planning, system design and operation of ITS

Module 2: Intersection Management **15 Hrs**

Video Detection - Virtual Loop - Cameras - ANPR - IR Lighting - Integrated Traffic Management - Control Centre - Junction Management Strategies - automated highway systems - Vehicles in Platoons Integration of Automated Highway Systems. intelligent transport system programs in the World – Overview of ITS implementations in developed countries.

Module 3: Advanced Transport System **15 Hrs**

Concepts of Advanced Traffic Management Systems (ATMS) - Commercial Vehicle Operations (CVO) Advanced Vehicle Control Systems (AVCS) - Advanced Public Transportation Systems (APTS) - Smart Route System - Data Collection - Process - Dessemination to Travellers - Evaluation of Information – Value of Information – Business Opportunities.

Total Hours	**45 Hrs.**

Text Books:

1	Ramachandran M., Metro Rail Projects in India: A study in Project Planning, Oxford University Press, 2011.
2	Sussman, J. M., Perspective on ITS, Artech House Publishers, 2015.
3	Gianluigi Ferrari., Advanced Technologies for Intelligent Transportation System Global Publishers, 2014.

Suggested Readings:	
1	Muhammad Alam., Intelligent Transportation System‖ Springer International Publishing AG,2016.
2	US Department of Transportation, National ITS Architecture Documentation, 2007(CDROM).
3	ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.
4	Choudury M A and Sadek A, ―Fundamentals of Intelligent Transportation Systems Planning‖ Artech House, 2003.
Web References:	
1	http://www.its.dot.gov/
2	http://ops.fhwa.dot.gov/
3	http://www.fhwa.dot.gov/research/
Online Courses:	
1	https://nptel.ac.in/courses/105191908/48
2	https://courses.moodle.wisc.edu/prod/course/view.php?id=148

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 - C919.6	Apply	MOOC	40
C919.1 - C919.6	Apply	Quiz	20
C919.1 - C919.6	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	40	20	20
Understand	40	30	20
Apply	20	50	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)	

Course Articulation Matrix															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	-	-	-	-	-	1	1	-	-	-	1	-	-	1
2	3	-	1	2	-	-	-	-	-	-	-	1	2	-	-
3	3	2	-	1	-	-	2	1	-	-	-	-	2	-	-
4	2	-	-	-	-	-	-	-	-	-	-	1	-	-	1
5	2	-	-	-	-	-	1		-	-	-	1	-	-	1
6	3	2	1	2	-	-	1	1	-	-	-	-	2	-	-
Avg	**2.5**	**2.0**	**1.0**	**1.7**	**-**	**-**	**1.3**	**1.0**	**-**	**-**	**-**	**1.0**	**2.0**	**-**	**1.0**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE920	CONSTRUCTION METHODS AND EQUIPMENT MANAGEMENT	3/0/0/3
Nature of Course	Theory	
Pre requisites	Construction Materials and Techniques	

Course Objectives:

1	To study and understand the various types of Sub Structure construction methods
2	To study and understand the various types of Super Structure construction methods
3	To analyse the methods of Equipment management
4	To make students know the Equipment used in Construction process

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

C920.1	Identify various equipment utilized for substructure construction	[U]
C920.2	Apply suitable techniques for the construction of substructure	[AP]
C920.3	Identify various Super Structural Construction techniques	[AP]
C920.4	Analyze the characteristics and applications of Super Structural equipment and its working	[AN]
C920.5	Examine the equipment planning management during the process of construction	[AP]
C920.6	Analyze the replacement, control and safety management of construction equipment	[AN]

Course Contents: Theory

Module 1: Substructure Construction methods **15 Hrs.**

Techniques and equipment for Box jacking and Pipe jacking - Construction of diaphragm walls and basement – Piling techniques and equipment: Pile driving hammers, vibratory drivers - Special equipment for Offshore construction: Caissons, Cofferdams, Foundation grouting - Tunnelling techniques and equipment - Tunnel Boring Machine - Blasting techniques and equipment: blasting material, firing charge, safety fuse, electric blasting caps, drilling patterns, transporting and handling of explosives- Method of construction of Retaining wall and equipment used

Module 2: Super Structure Construction methods **15 Hrs.**

Shoring, Scaffolding methods and equipments - Special Concreting methods and equipments - Steel Construction techniques and equipments - Equipment and methods of Composite structures – Techniques and equipment: Prefabricated, Pre-Engineered structures, Pre-Tensioning and Post Tensioning methods - Bridge Construction methods and equipment: incremental launching, using false work and its criteria, balanced cantilever construction method, plate girder method

Module 3: Construction Equipment management **15 Hrs.**

Identification Identification of equipment - Planning of equipment - Selection of Equipment - Equipment Management in Projects - Maintenance Management - Equipment cost - Operating cost - Cost Control of Equipment - Depreciation Analysis – Replacement of Equipment- Replacement Analysis - Safety Management - Factors affecting the performance of equipment – IOT integration of equipment

Total Hours	**45 Hrs.**

Text Books:

1	Jerry Irvine, Advanced Construction Techniques, CA Rocketr, 2014.

2	Purifoy, R.L., Ledbetter, W.B. and Schexnayder,C.., Construction Planning, Equipment and Methods, McGraw Hill, Singapore, 2018
3	Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 2002.
Suggested Readings:	
1	Deodhar, S.V. Construction Equipment and Job Planning, Khanna Publishers, New Delhi,2012.
2	Dr. Mahesh Varma, Construction Equipment and its planning and Application, MetropolitanBook Company, New Delhi, 2003.
3	Robertwade Brown, Practical foundation engineering hand book, McGraw Hill Publications, 2001.
4	Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008.
Web References:	
1	https://www.concretecentre.com
2	https://www.usu.edu/controllers/files/policies-procedures/equipment-manual.pdf
Online Courses:	
1	https://www.udemy.com/course/methods-of-building-construction/
2	https://www.udemy.com/courses/search/?q=construction+equipment+management&src=sac&kw=construction+equ

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 - C920.4	Understand	Online Quiz	20
		Assignment	20
C920.5 & C920.6	Apply	Group AssignmentClassroom Quiz	40

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	30	30	30

Analyse	30	30	30
Evaluate	-	-	-
Create	-	-	-

<table>
<tr><th colspan="7">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><th colspan="6">Continuous Assessment (40%)
[200 Marks]</th><th rowspan="4">End Semester Examination (60%)
[100 Marks]</th></tr>
<tr><th colspan="3">CA 1 : 100 Marks</th><th colspan="3">CA 2 : 100 Marks</th></tr>
<tr><th rowspan="2">SA 1
(60 Marks)</th><th colspan="2">FA 1 (40 Marks)</th><th rowspan="2">SA 2
(60 Marks)</th><th colspan="2">FA 2 (40 Marks)</th></tr>
<tr><th>Component - I
(20 Marks)</th><th>Component - II
(20 Marks)</th><th>Component - I
(20 Marks)</th><th>Component - II
(20 Marks)</th></tr>
</table>

Course Articulation Matrix

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

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE921	DISASTER MANAGEMENT PLANNING AND MITIGATION	3/0/0/3

Nature of Course	Theory
Pre requisites	Nil

Course Objectives:

1	To understand the knowledge of disaster management and its influence.
2	To study and analyze the vulnerability.
3	To study and assess the building behavior during various disasters.
4	To understand the policy and procedure involved during a disaster.

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

C921.1	Analyze the various types of disasters	[AN]
C921.2	Identify the potential deficiency of existing building during a disaster with remedial measures	[AP]
C921.3	Distinguish the protection measures against all disasters	[AN]
C921.4	Examine the hazard assessment procedure for all disaster	[AN]
C921.5	Plan the capacity building and programs for all the disasters	[AP]
C921.6	Discuss the policy and schemes for disaster management in India	[AN]

Course Contents: Theory

Module 1: Dimensions of Disasters **15 Hrs.**

Dimensions of natural & anthropogenic disasters - Difference between hazard and disaster-Types of disaster - Phases of disaster management- Principles/Components of disaster management, Relationship between Disasters and Development - 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 - Hazard affecting buildings - Building safety against hazards: Floods, Cyclone, Landslides, Fire, Earthquakes – Case Studies.

Module 2: Disaster Mitigation and Planning **15 Hrs.**

Disaster Mitigation and Planning – Seismic hazard assessment - Vulnerability assessment – Community planning and community contingency plan – Retrofitting of existing buildings: reinforced concrete and masonry structures - Performance of ground and buildings in past earthquakes – Seismic strengthening of structural and nonstructural components -Earthquake hazard map - Landslide zoning map – Flood zoning map – Tropical cyclone and its effects on buildings – Effect of Tsunami on built structures – Protection measures for damages in the buildings - Nuclear Disasters, Chemical and Industrial accidents – Mitigation strategies – Case Studies.

Module 3: Disaster Management Policy and Procedure in India **15 Hrs.**

Disaster management in India – Disaster Management Act, 2005 – DM Policy, 2009 for Disaster preparedness and programs – Organizational structure for disaster management – Disaster management schemes – Planning commission: Tsunami – Role of NDRF and news media in disaster management – Forecasting and warning of disasters – Medical first responder – Psychological and social dimensions in disasters – Trauma and Stress – Emotional Intelligence.

Total Hours	**45 Hrs.**

Text Books:

1	Singh. R. B. ―Disaster Management‖, Rawat publications, 2012.
2	Ghosh G. K. ―Disaster Management‖, A.P.H Publishing Corporation, 2015.
3	Geol S.L ―Encyclopedia of Disaster Management‖, Deep and deep publication Pvt. Ltd,

	2015.
Suggested Readings:	
1	Brian Tomaszewski, Geographic Information Systems (GIS) for Disaster Management, CRC Press, Taylor and Francis Group of publication, 2015.
2	Sharma S.C., ¯Disaster Management, Khanna Publishing House, 2019.
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.
IS 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.
3	IS:1893 (Part I) - 2009 ¯Code of practice for Earthquake Resistant Design of Structures, Bureau of Indian Standards, New Delhi.
Web References:	
1	https://ndma.gov.in/
2	https://nidm.gov.in/
3	https://tnsdma.tn.gov.in/
Online Courses:	
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]**
C921.1	Analyze	Case Study Report	20
C921.2 C921.5	Apply	Technical Report	20
C921.3 C921.4	Analyze	Technical Presentation	20
C921.6	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	30	30	30
Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

<table>
<tr><th colspan="7">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><td colspan="6">Continuous Assessment (40%)
[200 Marks]</td><td rowspan="4">End Semester Examination (60%)
[100 Marks]</td></tr>
<tr><td colspan="3">CA 1 : 100 Marks</td><td colspan="3">CA 2 : 100 Marks</td></tr>
<tr><td rowspan="2">SA 1
(60 Marks)</td><td colspan="2">FA 1 (40 Marks)</td><td rowspan="2">SA 2
(60 Marks)</td><td colspan="2">FA 2 (40 Marks)</td></tr>
<tr><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td></tr>
</table>

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	2	-	2	-	2	-	-	-	1	3	-	2
2	3	3	2	3	-	1	-	2	-	2	-	2	3	-	2
3	3	2	1	2	-	2	-	2	-	-	-	1	3	-	2
4	3	2	1	2	-	2	-	2	-	-	-	1	3	-	2
5	3	3	2	3	-	1	-	2	-	2	-	2	3	-	2
6	3	2	1	2	-	2	-	2	-	-	-	1	3	-	2
Avg	**3.0**	**2.8**	**1.3**	**2.8**	**-**	**1.7**	**-**	**2.0**	**-**	**0.7**	**-**	**1.3**	**3.0**	**-**	**2.0**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE922	INFRASTRUCTURE ASSET MANAGEMENT AND FINANCING	3/0/0/3

Nature of Course	Theory and Concept
Pre requisites	-

Course Objectives:

1	To analyse the value of infrastructure assets over time
2	To know the application of an infrastructure asset management
3	To optimize the use of available resources in infrastructure projects.
4	To identify the source of assets and investments in infrastructure management.

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

C922.1	Apply the financial characteristics of infrastructure facilities and their role	[AP]
C922.2	Apply general asset management principles and strategies for infrastructure projects	[AP]
C922.3	Assess major sources of funding in infrastructure projects and total project cost, inventory and database principles	[AP]
C922.4	Apply cost and benefit analysis principles for life cycle of infrastructure projects	[AP]
C922.5	Analyse the benefits of integrating the infrastructure evaluation, maintenance, and renewal process into a good asset management program	[AN]
C922.6	Analyse the different ways to quantitatively select optimal planning alternatives for asset management	[AN]

Course Contents: Theory

Module 1: Infrastructure asset management principles and concepts **15Hrs.**
Concepts of infrastructure assets and their management – Performance of infrastructure assets – Stakeholders involved – Factors affecting the demand and supply of public works services – Relating infrastructure and economic development – Strategies for financing public works – Performance indicators and measures

Module 2: Framework for infrastructure management **15Hrs.**
Design for reliability, maintainability, supportability and service life - Inventory and database management - Condition assessment - Performance modelling and failure analysis - Maintenance strategies, Life Cycle assessment - cost and benefit analysis - Introduction to the basic policies and initiatives of the Government.

Module 3: Infrastructure projects and its financing **15Hrs.**
Bridge management system, Pavement management system, Pipeline management system, Hydro-system asset management, Waste management asset and financing, Power generation and transmission asset and financial management, Telecommunication asset and financial management

Total Hours	**45 Hrs.**

Text Books:

1	Haas, Ralph, W., Ronald Hudson, and Waheed Uddin. Public Infrastructure Asset Management, 2nd Edition. McGraw-Hill Companies, Inc., New York, 2013.
2	Waheed Uddin, W. Ronald Hudson, Ralph Haas. ¯Public Infrastructure asset management,

	2nd edition, McGraw – Hill, 2013
3	Payant, Richard P. and Bernard T. Lewis. Facility Manager's Maintenance Handbook, 2ndEdition. McGraw-Hill Companies, Inc., New York, 2007.
Suggested Readings:	
1	Wood, Brian. Building Maintenance, Wiley- Blackwell, West Sussex, UK, 2009.
2	Raina, V.K. Concrete Bridges: Inspection, Repair, Strengthening, Testing and Load Capacity Evaluation, 1st Edition. . McGraw-Hill Companies, Inc., New York, 2004.
3	Amekudzi, A. and McNeil. S. Infrastructure Reporting and Asset Management, American Society of Civil Engineers, Virginia, 2008.
4	Andrew Ang. Asset Management: A system approach to factor investing, Oxford University Press, 2014.
Web References:	
1	http://casmia.ch/en/home/
2	https://www.ipwea.org/communities/am/assetmanagement
Online Courses:	
1	https://www.udemy.com/course/asset-mgt/
2	https://www.coursera.org/courses?query=asset%20management

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 - C922.6	Apply	Online Quiz	20
		Assignment	20
C922.1 - C922.6	Analyze	Class/Video 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	-	-	-
Understand	-	-	-
Apply	60	60	60
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)	

Course Articulation Matrix															
CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	-	-	2	-	1	-	-	-	1	3	1	2	2	-
2	2	-	-	2	-	1	-	-	-	1	3	1	2	2	-
3	2	-	-	2	-	1	-	-	-	1	3	1	2	2	-
4	2	-	-	2	-	1	-	-	-	1	3	1	2	2	-
5	2	-	-	2	-	1	-	-	-	1	3	1	2	2	-
6	2	-	-	2	-	1	-	-	-	1	3	1	2	2	-
Avg	**2**	**-**	**-**	**2**	**-**	**1**	**-**	**-**	**-**	**1**	**3**	**1**	**2**	**2**	**-**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE923	PAVEMENT CONSTRUCTION AND MANAGEMENT	3/0/0/3
Nature of Course	Theory Analytical	
Pre requisites	Transportation Engineering	

Course Objectives:

1	To understand various analysis and design procedures of pavements.
2	To design the flexible pavement and rigid pavement
3	To preparation of subgrade and construction of pavement
4	To implement the maintenances and pavements management systems

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

C923.1	Apply the philosophy of different methods for design of pavements.	[AN]
C923.2	Analyse and design flexible pavements.	[AP]
C923.3	Analyse and design rigid pavements.	[AP]
C923.4	Apply the construction techniques for rigid pavement and joints	[AP]
C923.5	Decide the repair techniques for distressed flexible pavement and rigid pavement	[AN]
C923.6	Apply the concept to evaluate and strengthening the 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	PratabChraborthy 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
Suggested Readings:	
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.
IS Code of Practice:	
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-4DibI9hHIP3-64h/view
2	https://drive.google.com/file/d/1afPJycv9m2Pz3erMLJvXZm--pE0BWNax/view
Online Courses:	
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]**
C923.1 & C923.6	Analyze	Quiz	20
C923.1 & C923.6	Analyze	Outside classroom learning	40
C923.1 & C923.6	Analyze	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	-	-	-

Understand	20	10	20
Apply	20	30	20
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)**	

Course Articulation Matrix

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	1	-	-	2	-	1	-	-	2	2	-	-
2	3	2	2	1	-	-	2	-	1	-	-	2	2	-	-
3	3	3	2	2	-	-	-	-	1	-	-	2	2	-	-
4	3	3	2	2	-	-	-	-	1	-	-	2	2	-	-
5	3	3	2	1	-	-	-	-	1	-	-	2	2	-	-
6	3	3	2	1	-	-	-	-	1	-	-	2	2	-	-
Avg	**3**	**2.6**	**2**	**1.3**	**-**	**-**	**2**	**-**	**1**	**-**	**-**	**2**	**2**	**-**	**-**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE924	Project Safety Management		3/0/0/3
Nature of Course	Theory and Concept		
Pre requisites	Nil		

Course Objectives:

1	To understand the causes and factors of accidents in construction industry
2	To understand the safety practices and systems in construction industry.
3	To study the construction accidents, safety programmes, contractual obligations, and design for safety
4	To analyse the roles and responsibilities of engineers in safety management

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

C924.1	Understand the concepts of construction safety management	[U]
C924.2	Assessment of important key legislations in safety management	[AP]
C924.3	Analyze the risk assessment method followed in construction projects	[AN]
C924.4	Assess modern construction safety techniques to be adopted in the construction of buildings and special structures	[AP]
C924.5	Identify the owner‘s responsibilities in construction safety management	[AP]
C924.6	Analyze the alertness against accidents and safety management.	[AN]

Course Contents: Theory

Module 1: Principles of Safety Management **15 Hrs.**

Safety - importance and principle - accidents and causes - human factors in construction safety - costs of construction injuries – occupational and safety hazard assessment – legal implications - challenges in construction safety – elements of an effective safety programme – job-site safety assessment – safety meetings and incentives - OSHAS act and standard - History of safety movement: ILO - UNDP -NSC - BSC – ROSPA – CIS – NSC – LPA (India)

Module 2: Safety Systems and Practices in Construction Operations **15 Hrs.**

Safety Culture – safety for first line supervisors, middle managers and top management practices - company activities and safety – safety personnel – sub contractual obligation – project coordination and safety procedures – workers compensation - safety policy – planning for safety and productivity – safety management techniques: sampling and auditing – job analysis – accident recall technique – factories act – insurance and compensation

Module 3: Contractual Obligations and Equipment Handling **15 Hrs.**

Safety in construction contracts – substance abuse – safety record keeping - management‘s commitment towards safety: owner‘s responsibility and preparedness for safety - role of designer in ensuring safety - safety clause in design document - safety in equipment handling: hand tools, grinding, hoisting apparatus and conveyors, mobile cranes - safety during excavation, blasting, timbering, scaffolding - first aid on site - fire hazards and preventing methods - safety in construction material storage - safety awareness program

Total Hours	**45 Hrs.**

Text Books:

1	Patrick X.W. Zou and RizaYosiaSunindijo, ―Strategic Safety Management in 169 Construction and Engineering‖, John Wiley and Sons, USA, 2015.
2	Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall Inc., 2011.
3	Einrich, H.W., Industrial Accident Prevention, McGraw Hill Company, New York, 2010.

Suggested Readings:	
1	Raymond E. Levitt, Nancy M. Samelson,. Construction Safety Management, John Wiley & Sons Inc, 2005.
2	Mishra R. K., Construction Safety, Atbs Publisher, 2012.
3	Tamil Nadu Factory Act, Department of Inspectorate of factories, Tamil Nadu. Health Management, Prentice Hall Inc., 2001.
4	BIS Code of practice for Safety Management
Web References:	
1	https://www.osha.gov/shpguidelines/hazard-Identification.html
2	https://www.pmi.org/learning/library/project-managers-role-safety-champion-8879
3	http://www.nsc.org.in/index.php?option=com_content&view=article&id=56&Itemid=84
4	https://www.iseindia.in/
Online Courses:	
1	https://www.google.com/search?q=1.%09Risk+assessment+A+Practical+Guide%2C+Institution+of+Occupational+Safety+and+Health%2C+United+Kingdom%2C1993.&ie=utf- 8&oe=utf-8&client=firefox-b-ab
2	https://albertabcsafety.com/

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 - C924.6	Apply	Online Quiz	20
		Assignment	20
C924.1 - C924.6	Analyze	Online Course with Minimum 8 Week duration	40

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	40	40	40
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)	

Course Articulation Matrix															
CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	-	-	-	3	3	2	-	-	2	3	-	2	3
2	3	3	-	-	-	3	3	2	-	-	2	3	-	2	3
3	3	3	-	-	-	3	3	3	-	-	2	3	-	2	3
4	3	3	-	-	-	3	3	2	-	-	2	3	-	2	3
5	3	2	-	-	-	3	3	3	-	-	2	3	-	2	3
6	2	2	-	-	-	3	3	2	-	-	2	3	-	2	3
Avg	2.7	2.5	-	-	-	3	3	2.3	-	-	2	3	-	2	3

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE925	SUSTAINABLE BUILDING MATERIALS	3/0/0/3
Nature of Course	Theory application	
Pre requisites	-	

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

C925.1	Demonstrate the principles of sustainability.	[U]
C925.2	Deliberate on the concepts of green building rating and sustainable technologies for building construction.	[AP]
C925.3	Identify and select the suitable alternates sustainable and eco-friendly materials.	[AP]
C925.4	Estimate the impact created by the conventional building materials on the environment and its influence on climate change.	[U]
C925.5	Value the green building certification and environmental assessmentprocess.	[AP]
C925.6	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, WileyIndia Pvt. Ltd., India, 4th Edition, 2016.

3	Umberto Desideri and Francesco Asdrubali, Handbook of Energy Efficiency in Buildings, Elsevier, 1st Edition, 2018.
Suggested Readings:	
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.
IS Code books / Standards / Manuals:	
1	The Energy Conservation Building Code (ECBC), Bureau of Energy Efficiency, Govt. ofIndia, 2017.
2	Eco-Niwas Samhita(Energy Conservation Building Code for Residential Buildings), Bureauof 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://theconstructor.org/building/eco-friendly-building-materials/720/
2	https://www.thespruce.com/eco-friendly-building-materials-1821766
3	https://dozr.com/blog/sustainable-building-materials
4	TERI-Griha‘s Green Design practices (www.teriin.org/bcsd/griha/griha.htm)
5	https://www.buildinggreen.com/feature/sustainability-and-building-codes
6	https://www.wbdg.org/resources/green-building-standards-and-certification-systems
MOOCs:	
1	https://alison.com/course/advanced-diploma-in-sustainable-materials-and-green-buildings
2	https://onlinecourses.swayam2.ac.in/arp19_ap75/preview
3	https://www.classcentral.com/course/swayam-sustainable-materials-and-green-buildings- 14316
4	https://www.edx.org/course/environmental-technologies-in-buildings

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 - C925.6	Understand	Quiz	20
C925.1 - C925.6	Understand	Assignment	20
C925.1 - C925.6	Analyze	Case Study Presentation	40

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	25
Apply	40	40	40
Analyse	30	40	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)**	

Course Articulation Matrix															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	-	1	3	2	1	1	-	2	1	-	2
2	3	2	1	1	-	1	3	2	1	1	-	2	1	-	2
3	3	3	2	2	-	1	3	2	1	1	2	2	1	-	2
4	3	3	2	2	-	1	3	2	1	1	-	2	1	-	2
5	3	3	2	2	-	1	3	2	1	1	-	2	1	-	2
6	3	2	1	1	-	1	3	2	1	1	2	2	1	-	2
Avg	**3.0**	**2.5**	**1.5**	**1.5**	**-**	**1.0**	**3.0**	**2.0**	**1.0**	**1.0**	**2.0**	**2.0**	**1.0**	**-**	**2.0**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE926	TRAFFIC ENGINEERING AND MANAGEMENT		3/0/0/3
Nature of Course	Theory and Problem		
Pre requisites	Transportation Engineering		
Course Objectives:			
1	To understand the traffic components and assess the traffic characteristics and relatedproblems		
2	To expertise in traffic planning and its management		
3	To analyse traffic control devices and its techniques in transportation interaction		
4	To study traffic regulation and management with integrated approach in traffic planning.		
Course Outcomes: **Upon completion of the course, students shall have ability to**			
C926.1	Assess various traffic problems prevailing and generate plans for those traffic systems		[AP]
C926.2	Analyze and design channels, intersections, signals and parking arrangements		[AN]
C926.3	Develop and apply traffic management system for vehicle monitoring and eliminate accidents		[AP]
C926.4	Assess and evaluate different methods of traffic management systems and its controls		[AP]
C926.5	Analyze basic traffic variables and their relationships including speed, density and flow		[AN]
C926.6	Analyze a variety of traffic facilities and evaluate capacity and level of service		[AN]

Course Contents: Theory

Module 1: Traffic characteristics and surveys **15Hrs.** Road characteristics - commuter characteristics - Perception, intellection, emotion, and volition (PIEV) theory - performance characteristics of traffic system - Traffic survey: Vehicles Volume Survey, Origin Destination Survey, Parking Survey - accident analysis - statistical applications in traffic studies and traffic fore-casting - Level of Services - Urban traffic problems in India.

Module 2: Traffic design and visual AIDS **15Hrs.**

Intersection design - channelization and rotary intersection design - Design of signals - coordination of signals - grade separation - traffic signs including Vehicle Monitoring System (VMS) and road markings - significant roles of traffic control personnel - networking pedestrian facilities - networking cycle tracks - street lighting - non motorized transport

Module 3: Traffic Management **15Hrs.**

Traffic System Management (TSM) with IRC standards and area specific - traffic regulatory measures - Travel Demand Management (TDM) - Direct and Indirect methods - congestion and parking pricing - coordination among different agencies - Intelligent Transport System for traffic management, enforcement and education - case study.

Total Hours	**45 Hrs.**

Text Books:

1	Kadiyali.L.R. ―Traffic Engineering and Transport Planning‖, Khanna Publishers, Delhi, 2013
2	Alexa Delbosc, William Young ―Traffic Engineering and Management‖, Monash Institute of Transport Studies, 2018
3	Roger P. Roess, Elena S. Prassas, William R. McShane ―Traffic Engineering‖, PearsonEducation, 2019

Suggested Readings:	
1	Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski ¯Principles of Highway Engineering and Traffic Analysis‖, Wiley India Pvt. Ltd., New Delhi, 2011
2	Garber and Hoel, ¯Principles of Traffic and Highway Engineering‖, CENGAGE Learning,New Delhi, 2010
3	Hobbs.F.D. ¯Traffic Planning and Engineering‖, University of Brimingham, Peragamon pressLtd., 2005
4	Srinivasa Kumar R, ¯Introduction to Traffic Engineering‖, The Orient Blackswan; South Asian edition, 2018
IS Code books / Standards / Manuals:	
1	SP:43-1994, IRC Specification, ¯Guidelines on Low-Cost Traffic Management Techniques‖for Urban Areas, 1994
Web References:	
1	https://www.trafiksol.com/advanced-traffic-management-system/
2	https://rno-its.piarc.org/en/network-control/traffic-management
Online Resources:	
1	https://www.easyguides.com.au/product-category/traffic-management/
2	https://www.digi.com/resources/library/traffic-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]
C926.1 - C926.6	Analyze	Online Quiz	20
C926.1 - C926.6	Analyze	Assignment	20
C926.1 - C926.6	Apply	Class/video Presentation	40

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	-	-	-
Apply	60	60	60
Analyse	40	40	40

Evaluate	-	-	-
Create	-	-	-

Assessment based on Continuous and End Semester Examination

<table>
<tr><td colspan="6">Continuous Assessment (40%)
[200 Marks]</td><td rowspan="4">End Semester Examination (60%)
[100 Marks]</td></tr>
<tr><td colspan="3">CA 1 : 100 Marks</td><td colspan="3">CA 2 : 100 Marks</td></tr>
<tr><td rowspan="2">SA 1
(60 Marks)</td><td colspan="2">FA 1 (40 Marks)</td><td rowspan="2">SA 2
(60 Marks)</td><td colspan="2">FA 2 (40 Marks)</td></tr>
<tr><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td></tr>
</table>

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	3	-	-	1	-	1	1	-	3	2	1	-	2
2	2	2	3	-	-	1	-	1	1	-	3	2	1	-	2
3	2	2	3	-	-	1	-	1	1	-	3	2	1	-	2
4	2	2	3	-	-	1	-	1	1	-	3	2	1	-	2
5	2	2	3	-	-	1	-	1	1	-	3	2	1	-	2
6	2	2	3	-	-	1	-	1	1	-	3	2	1	-	2
Avg	**2**	**2**	**3**	**-**	**-**	**1**	**-**	**1**	**1**	**-**	**3**	**2**	**1.0**	**-**	**2.0**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE927	TRANSPORT AND ENVIRONMENT	3/0/0/3
Nature of Course	Theory application	
Pre requisites	-	

Course Objectives:

1	To understand about Environmental impact of transportation projects
2	To identify appropriate method for analyzing the impact in transportation sector.
3	To give an exposure on overview of the principles of transportation planning.
4	To choose appropriate Mitigation methods and Environmental Management Plan

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

C927.1	Identify the Environmental Impact of Transportation Projects.	[U]
C927.2	Apply the various methods of environmental Impact Analysis in transport sector.	[AP]
C927.3	Analyze the rules and guidelines framed by IRC for transport.	[AN]
C927.4	Illustrate the stage wise Assessment and Prediction of impact of transportation projects	[U]
C927.5	Select appropriate Mitigation methods and Environmental Management Plan	[AP]
C927.6	Reviewing various case studies on environmental impact assessment of transport projects.	[AP]

Course Contents: Theory

MODULE 1: Environmental Impact of Transportation Projects **15 Hrs.**
Historical Development of transport - Transport facilities and planning parameters - Environmental Impact of Transportation Projects -Environmental Inventory -Need for EIA -Elements of EIA - EIA Guidelines for Transportation Project - Methods of Impact Analysis - Applications - Appropriate methodology.

MODULE2:Environmental Assessment and Mitigation **15 Hrs.**
Prediction and Assessment of Impact of Transportation Project at various stages on Environment (Air, Water, Noise, Land), Socio economic impact, indigenous people, aesthetics, health and safety -IRC guidelines - EC for national highway projects - Mitigation of the impact on Natural and Man-made Environment, Health, Public participation

MODULE 3: EIA Management Plan and Case studies **15 Hrs.**
Traffic and environmental hazards - Environmental Management Plan - Energy Conservation - Methods to reduce Global Warming - EIA case studies pertaining to Roadways -Mass Rapid Transport Systems - Railways - Airways - Waterways - Infrastructure Projects.

Total Hours	**45 Hrs.**

Text Books:

1	SalimMomtaz, ZobaidulKabir S M., ―Evaluating Environmental and Social Impact Assessment in Developing Contries‖, Elsevier Publications, 2013
2	Angus Morrison, ―Advanced Introduction to Environmental Impact Assessment‖, Edward Elgar Publising Ltd., 2018.
3	Anjaneyulu,Y, ‖Environmental Impact Assessment methodologies‖, B.S. Publications, 2011

Suggested Readings:

1	Anji Reddy Mareddy, ―Environmental Impact Assessment – Theory and Practice‖, B S Publications, 2017

2	Barthwal R R., ¯Environmental Impact Assessment‖ New age International Pvt.Ltd., 2012
3	James H.Banks, Introduction to Transportation Engineering, McGraw Hill Book Company,2008
4	Priya Ranjan Trivedi, International Encyclopedia of Ecology and Environment - EIA, Indian Institute of Ecology and Environment, New Delhi, 1998
IS Code books / Standards / Manuals:	
1	Indian Road Congress (IRC), Environmental Impact of Highway Projects, IRC, Delhi,
2	World Bank, A Handbook on Roads and Environment, Vol.I and II, Washington DC.
3	NAAQS Guidelines for the measurement of ambient air pollutants by CPCB
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/120108004/
2	https://nptel.ac.in/courses/123105001/

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 -C927.6	Understand	Massive Open Online Course	40
C927.1 - C927.6	Apply	Assignment	20
C927.1 - C927.6	Analyze	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	20	10	10
Understand	20	10	20
Apply	60	60	60
Analyse	-	20	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)	

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	2	1		2	2	-				2	2	1	3
2	2	1	1	1		1	2	-				2	1	2	2
3	3	2	3	3	-	2	2	-	2	1		3	2	2	2
4	2	2	2	1		1	2	-				2	1	1	2
5	3	1	2	2	-	1	2	-	2	1		3	2	2	3
6	2	1	1	1		1	2	-				2	1	1	2
Avg	**2.3**	**1.5**	**1.8**	**1.5**	**-**	**1.3**	**2.0**	**2.0**	**2.0**	**1.0**		**2.3**	**1.5**	**1.5**	**2.3**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

EMERGING ELECTIVE

21CE007	BUILDING SERVICES AND MANAGEMENT	3/0/0/3

Nature of Course	Theory and Application
Pre requisites	Nil

Course Objectives:

1	To study and plan essential services for a structure.
2	To understand the importance of electrical and mechanical services available in buildings
3	To recognize the principles of lighting and plumbing.
4	To identify the safety measures present in a building.

Course Outcomes:

Upon completion of the course, students shall have ability to

C007.1	Plan the essential machineries in a building	[AP]
C007.2	Select appropriate electrical and wiring equipment	[AN]
C007.3	Recognize the basic principles of lighting and plan for Lighting facilities based on the building function	[AN]
C007.4	Identify the basic plumbing equipment and their installation	[AP]
C007.5	Choose appropriate HVAC systems based on building function	[AN]
C007.6	Plan fire safety for buildings and their installation	[AP]

Course Contents: Theory

Module 1: Machineries and Electrical Systems in Buildings **15 Hrs.**

Lifts and Escalators, Universal design, Conveyors, AC/DC motors, Generators. Basics of electricity, Single/Three phase supply, Protective devices in electrical installations, Earthing for safety, Types of wires, wiring systems and their choice, Planning electrical wiring for buildings, Main and distribution boards, NZEB & ZEB.

Module 2: Principles of lighting and plumbing: **15 Hrs.**

Lighting nomenclature - Design of modern lighting, lighting for stores, offices, schools, hospitals and house lighting, Universal design for lighting – Alpha, Rhinoceros, passive design features - design for effective daylighting, lighting sensors and controls, lighting simulation using open source software, BUG rating for assessing exterior lights - Principles of design of water supply in buildings -House service connection - Fixtures and fittings -Systems of plumbing and drawings.

Module 3: HVAC systems and Safety Installation: **15 Hrs.**

Concepts of Air conditioning systems - Principles of air conditioning - HVAC systems - HVAC controls, Psychometric chart - Commissioning of building systems - Building management systems, indoor air quality - Overview of ASHRAE - Causes of fire in buildings - Safety regulations: NBC, ECBC, Planning considerations in building like non-combustible materials, Staircases and lift lobbies, fire escapes and AC systems - Building evacuation process, Fire Protection devices, Integration of services.

Total Hours	**45 Hrs.**

Text Books:

1	Roger Greeno and Fred Hall, ¯Building Services Handbook‖, (8th edition), RoutledgePublishers, New Delhi, 2015.
2	William Paul Gerhard, ¯House-Drainage and Sanitary Plumbing‖, General Books. 2012.

3	Udhayakumar, R., ¯A text book of Building services‖, Eswar Press, Chennai, 2013.
Suggested Readings:	
1	¯National Building Code of India‖, BIS 2005. Reaffirmed 2016.
2	¯Energy Conservation Building Code‖, Bureau of Energy Efficiency, 2017
3	Garg, S.K., "Environmental Engineering", Khanna Publishers, New Delhi, 2010.
4	¯Handbook of Building Engineers in Metric Systems‖, NBC, New Delhi, 2015.
IS Code books / Standards / Manuals:	
1	ASHRAE 62.1, Ventilation for Acceptable Indoor Air Quality, 2019.
2	ASHRAE 55, Thermal Environmental Conditions for Human Occupancy, 2021.
3	ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings, 2019
Web References:	
1	http://www.handbook.curtin.edu.au/units/31/318930.html
2	https://www.ljmu.ac.uk/study/courses/undergraduates/2017/building-services-engineering
3	https://armstrongfluidtechnology.com/en/resources-and-tools/education-and-training/webinar-library
4	Schneider Electric University | by Schneider Electric (schneideruniversities.com)
Online Resources:	
1	http://www.handbook.curtin.edu.au/units/31/318930.html
2	https://www.ljmu.ac.uk/study/courses/undergraduates/2017/building-servicesengineering
3	IBPSA USA - YouTube
4	Indo-Swiss Building Energy Efficiency Project (BEEP) - YouTube

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 - 6	Apply	Project Based Learning (Using software package - Lighting/MEP)	40
C007.1 - 6	Apply	Quiz	20
C007.1 - 6	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	20	20	20
Apply	20	30	30
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)	

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	-	1	-	-	-	-	2	2	-	2	2	-	2
2	3	2	1	1	2	-	-	3	2	2	-	2	2	1	2
3	2	1	-	1	-	1	-	3	2	2	-	2	2	-	2
4	3	2	1	1	2	2	-	-	2	2	-	3	2	1	2
5	2	1	-	1	-	1	2	2	2	2	-	2	2	-	2
6	3	2	1	1	2	2	2	3	2	2	-	2	2	1	2
Avg	**2.5**	**1.5**	**1**	**1**	**2**	**1.5**	**2**	**2.8**	**2**	**2**	**-**	**2.2**	**2**	**1**	**2**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE008	CLEAN ENERGY PRODUCTION		3/0/0/3
Nature of Course	Concepts and Theory		
Pre requisites	-		
Course Objectives:			
1	To acquaint various forms of energy sources – renewable (clean energy) and non-renewable energy		
2	To understand the energy demand, consequences of energy on environment, energy audit, energy management, national and international scenario in energy sources		
3	To identify the best and clean energy resources based on the requirement and potential		
4	To apply the knowledge in clean energy generation and conversion technologies		
Course Outcomes: **Upon completion of the course, students shall have ability to**			
C008.1	Understand the extraction of energy from various resources		[U]
C008.2	Know the significance of energy in economic development and necessity of sustainable development		[U]
C008.3	Identify the potential for solar, wind, hydro, geothermal and biomassenergy		[U]
C008.4	Analyze various process/procedures involved for energy production from clean energy resources		[AN]
C008.5	Comprehend the methods involved for energy production and recovery from hydrogen and wastes		[U]
C008.6	Analyze single or integrated clean energy systems based on the availability of sources, energy demand, and requirements		[AN]

Course Contents: Theory

Module 1: Energy Resources and Management **15 Hrs.**

Energy source – fossil and mineral resources (coal, oil, natural gas) – environmental consequences – greenhouse gases – global warming – climate change – environment (water, soil, air) pollution – sustainable development – significance of clean energy – sources – solar, wind, hydro, geothermal, and biomass – energy demand – energy audit – energy forecast – energy crisis and management – case studies

Module 2: Sustainable Energy Production **15 Hrs.**

Solar radiation – solar power generation – solar ponds – applications of solar energy – wind power estimation – types of wind turbine – wind energy production – wind farm in onshore and offshore – hydro power generation – principle of mini hydel power plants – geothermal – types of wells, methods for extracting the energy – biomass energy generation process – environmental benefits – potential of clean energy production in India – case studies

Module 3: Recent Developments and Applications **15 Hrs.**

Hydrogen energy production, storage and applications – energy recovery from wastes (agricultural residue, industry, municipal) – combustion, gasification, pyrolysis, anaerobic digestion, landfill gas – nuclear power generation – nuclear waste disposal – energy operators and energy distribution – integrated energy systems for buildings – recycling in energy production units (Lithium ion battery wastes, solar panels, wind turbine blades, etc)

	Total Hours	**45 Hrs.**
Text Books:		
1	Subhash L. G., Renewable Sources of Energy, Technical Publications, 1st Edition, 2020	
2	Mehmet K. Yunus A. C. John M. C., Fundamentals and Applications of Renewable Energy, McGraw Hill, 1st Edition, 2020	
3	Bob E., Stephen P., James W., Energy Systems & Sustainability - power for a sustainable future, Oxford Press, 3rd Edition, 2021	
Suggested Readings:		
1	Anjan K. S., Nanda S. P., Renewable Energy & Green Technology, Notion Press, 1stEdition, 2021	
2	Mohammad G. R., Abul K. A., Subhash C. S., Clean Energy for Sustainable Development - Comparisons and contrasts of new approaches, Academic Press, 1st Edition, 2016	
3	Peter M. Schwarz, Energy Economics, Routl edge Publishers, 1st Edition, 2017.	
4	Sharma K. V., Venkataseshaiah P., Energy Management and Conservation, Dream tech Press, 2020	
Web References:		
1	https://www.nrel.gov/docs/fy06osti/39728.pdf	
2	https://www.energy.gov/sites/prod/files/2019/08/f66/BETO--Waste-to-Energy-Report-August--2019.pdf	
Online Resources:		
1	https://onlinecourses.nptel.ac.in/noc22_hs43/preview	
2	https://nptel.ac.in/courses/103/107/103107125/	

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 toC008.6	Understand	Assignment	20
C008.1 toC008.6	Understand and Analyze	Surprise Test	20
C008.1 toC008.6	Analyze	Mini Team Project and Presentation	40

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
Understand	20	20	20
Apply	60	60	50
Analyse	-	20	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)	

Course Articulation Matrix

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

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE009	**FINANCING AND COSTING MANAGEMENT FOR CIVIL ENGINEERS**	**3/0/0/3**

Nature of Course	Theory and Concept
Pre requisites	Nil

Course Objectives:

1	To study the concept of Construction economics and finance.
2	To compare and evaluate alternative proposals and investments.
3	To facilitate the knowledge on management of funds in construction.
4	To understand and perform the management accounting.

Course Outcomes:

Upon completion of the course, students shall have ability to

C009.1	Understand the concepts of economics and finance in constructions.	[U]
C009.2	Examine the basic aspects of management accounting.	[AN]
C009.3	Assess and manage the funds involved in the construction sector.	[AP]
C009.4	Implement International fund management and foreign currency management.	[AP]
C009.5	Relate the worth of money involved in the construction activities.	[AP]
C009.6	Analyse the alternative investment plan in construction.	[AN]

Course Contents: Theory

Module 1: Fundamentals of management accounting **12 Hrs.**

Time Value of Money - Cash Flow diagram - Management accounting: Actual and overhead cost of construction, Tendering process - Financial accounting principles: basic concepts, financial statements, funds flow statement - cash flow statement - Balance sheet - Accounting ratios.

Module 2: Funds management **15 Hrs.**

Project Finance – Sources of finance – Long term and short-term finance, Working Capital Management, Inventory valuation, Mortgage Financing - International financial management - foreign currency management – Target value design – Target value costing.

Module 3: Evaluating alternative proposals and investments **18 Hrs.**

Comparing alternatives – Present Worth Analysis, Annual Worth Analysis, Future Worth Analysis, Rate of Return Analysis, Incremental Rate of Return Analysis, Benefit/Cost Analysis. Real Estate - Investment property, Equipment Replace Analysis, Depreciation - Tax before and after depreciation - Value added Tax (VAT) – Inflation – Case studies.

Total Hours	**45 Hrs.**

Text Books:

1	Bose, D. C., Fundamentals of Financial management, 2nd ed., PHI, New Delhi, 2010
2	Newnan, D. G., Eschenbach, T. G. and Lavelle, J.P., Engineering Economic Analysis, Indian Edition, Oxford University Press, 2010.
3	Peurifoy, R. L.,Schexnayder, C. J. and Shapira,A., Construction Planning, Equipment, and Methods, 7th ed., Tata McGraw-Hill, New Delhi, 2010.

Suggested Readings:	
1	Sullivan, W. G.,Bontadelli, J.A. and Wicks,E. M., Engineering Economy, 11th ed., PrenticeHall, Upper Saddle River, New Jersey, 2001.
2	Peterson,S. J., Construction Accounting and Financial Management, Pearson Education,Upper Saddle River, New Jersey, 2005.
3	Schexnayder, C. J. and Mayo, R.E., Construction Management Fundamentals, International Edition, McGraw-Hill, 2003.
4	Peurifoy, R. L. and Oberlender, G. D., Estimating Construction Costs, 5th ed., McGraw Hill,New Delhi, 2002
Web References:	
1	https://college-corner.com/civil-engineering-vs-finance-major/
2	https://www.cmu.edu/cee/projects/PMbook/07_Financing_of_Constructed_Facilities.html
3	https://en.wikipedia.org/wiki/Engineering_economics_(civil_engineering)
Online Resources:	
1	https://nptel.ac.in/courses/105/104/105104178/
2	https://www.classcentral.com/course/swayam-introduction-to-accounting-and-finance-for-civil-engineers-17650

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 - C009.6	Apply	Online Quiz	20
		Class Presentation	20
C009.1 - C009.6	Analyze	Group Assignment	40

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	30
Apply	40	40	40

Analyse	30	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)**	

Course Articulation Matrix

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	1									3	3	3	2	2
2	2	1									3	3	3	2	2
3	2	2									3	3	3	3	2
4	2	1									3	3	3	3	2
5	1	1									3	3	3	2	2
6	1	1									3	3	3	3	2
Avg	**1.6**	**1.2**									**3**	**3**	**3**	**2.5**	**2**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE010	INSTRUMENTATION AND SENSOR TECHNOLOGIES FOR CIVIL ENGINEERING APPLICATIONS	3/0/0/3
Nature of Course	Theory Concept	
Pre requisites	Basics of Electrical and Electronics Engineering	

Course Objectives:

1	Cognize the principles of operation and characteristics of instrumentation and Integrated sensor systems.
2	Diagnose and apply measurement best practice and identify ways to improve measurement and evaluation
3	Troubleshoot and solve problems in instrumentation and measurement systems
4	Interpretation of signals to get deeper insight into physical phenomena

Course Outcomes:

Upon completion of the course, students shall have ability to

C010.1	Choose right use of sensors and instruments for different applications along with limitations	[AP]
C010.2	Differentiate the sensors and their modes of operation measurements	[AN]
C010.3	Suggest proper sensor technologies for specific applications	[AN]
C010.4	Implement his knowledge gained to set up quantification systems	[AP]
C010.5	Analyse the data from signal processing	[AN]
C010.6	Characterize the requirements during the transmission of measuredsignals	[AP]

Course Contents: Theory

Module 1: Fundamentals of Measurement, Sensing and Instrumentation 12 Hrs.

Definition of measurement and instrumentation - physical variables - common types of sensors and their functions - Sensor applications – interpretation of signals from a known sensor type - types of instrumentation - Sensor Specifics. Basic IoT Sensor - Motion Detector, Liquid Level Detector, Humidity and Pressure Measurement.

Module 2: Sensor Installation, Operation, Analysis and Interpretation 18 Hrs.

Predict the response of sensors to various inputs - Construct a conceptual instrumentation and monitoring program - sensor installation - Differentiate between types of sensors and their modes of operation and measurement - Piezometer, Inclinometer, Strain gauge - Time domain signal processing - Discrete signals, Signals and noise - a few examples of statistical information to calculate are: Average value (mean), On average, how much each measurement deviates from the mean (standard deviation), Midpoint between the lowest and highest value of the set (median), Most frequently occurring value (mode), Span of values over which your data set occurs (range).

Module 3: Frequency Domain Signal Processing and Analysis 15 Hrs.

Need for frequency domain analysis and its principles - Draw conclusions about physical processes based on analysis of sensor data - Combine signals in a meaningful way to gain deeper insight into physical phenomena - Basic concepts in frequency domain signal processing and analysis - Fourier Transform - FFT (Fast Fourier Transform) - Example problems: Noise reduction with filters, Leakage, Frequency resolution.

Total Hours	**45 Hrs.**

Text Books:	
1	David A. Bell, ―Electronic Instrumentation and Measurements‖, Oxford University Press,India, 2013.
2	Ilya Gertsbakh, ―Measurement Theory for Engineers‖, Springer, 2010.
3	Aruthur Whitemore Smith, ―Principles of Electrical Measurements‖, Nabu Press, 2010.
Suggested Readings:	
1	Albert D. Helfrick, ―Modern Electronic instrumentation and measurement techniques‖,Pearson Education, India, 2015.
2	Rajput R. K., ―Electrical and Electronic Measurements and Instrumentation‖, S Chand and Company, 2016.
3	Navani J. P., ―Electronic Measurement and Instrumentation‖, S Chand and Co. Ltd, 2015.
4	Johnson, ―Process Control Instrumentation Technology‖, Pearson Education India, 2015
Web References:	
1	https://lecturenotes.in/subject
2	www.worldsensing.com
Online Resources:	
1	https://youtu.be/qbKnW42ZM5c
2	www.ivt.ntnu.no/imt/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]**
C010.1 -C010.6	Analyse	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	-	-	-
Understand	60	30	30
Apply	40	30	30
Analyse	-	40	40

Evaluate	-	-	-
Create	-	-	-

<table>
<tr><th colspan="7">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><td colspan="6">Continuous Assessment (40%)
[200 Marks]</td><td rowspan="4">End Semester Examination (60%)
[100 Marks]</td></tr>
<tr><td colspan="3">CA 1 : 100 Marks</td><td colspan="3">CA 2 : 100 Marks</td></tr>
<tr><td rowspan="2">SA 1
(60 Marks)</td><td colspan="2">FA 1 (40 Marks)</td><td rowspan="2">SA 2
(60 Marks)</td><td colspan="2">FA 2 (40 Marks)</td></tr>
<tr><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td></tr>
</table>

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	-	1	-	-	-	1	-	-	-	1	1	1	1
2	3	3	-	1	2	-	-	-	2	-	1	1	2	-	-
3	3	2	-	2	2	-	-	-	2	-	1	1	1	1	1
4	3	2	-	-	2	-	-	-	2	-	1	1	3	1	1
5	2	3	-	2	2	-	-	-	2	-	1	1	3	-	-
6	1	3	-	-		-	-	-	-	-	-	1	1	-	-
Avg	**2.5**	**2.6**	**-**	**1.5**	**2.0**	**-**	**-**	**1.0**	**2.0**	**-**	**1.0**	**1.0**	**1.8**	**1.0**	**1.0**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE011	LEAN STARTUP MANAGEMENT	3/0/0/3

Nature of Course	Theory and Application
Pre requisites	Engineering Economics, Probability and Statistics

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

C011.1	Understand the strategy for lean startup	[R]
C011.2	Identify the challenges and opportunities in lean startup	[U]
C011.3	Develop and use business models and growth drivers	[AP]
C011.4	Analyze market size, cost structure, revenue streams and value chain	[AN]
C011.5	Plan business finance and understand cash flow strategy	[AP]
C011.6	Foresee and quantify business financial risks	[AN]

Course Contents: Theory

Module1: 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

Module2: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)

Module3: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, 2012

2	Steve Blank, The Four Steps to the Epiphany: Successful Strategies for Products That Win, K&S Ranch, 5th edition, 2013
3	Eric Ries, The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Crown Business, 2011
Suggested Readings:	
1	Steve Blank, Holding a Cat by the Tail, K&S Ranch Publishing LLC, 2014
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, 2014
4	Alistair Croll and Benjamin Yoskovitz, Lean Analytics: Use Data to Build a Better Startup Faster, O'Reilly Media, 1st Edition, 2013
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]**
C011.1-6	Understand	Pitching the Idea - Group Assignment	20
C011.1-6	Understand and Analyze	Idea to Product - Case Study and Presentation	40
C011.1-6	Analyze	ss Model Development - TechnicalReport 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	10	-	-
Understand	30	30	30

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)**	

Course Articulation Matrix

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

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21CE012	METRO RAIL ENGINEERING	3/0/0/3
Nature of Course	Theory Concept	
Pre requisites	-	

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]
C012.6	Suggest advance automation systems and environmental concerns for the efficient functioning of metro rail system.	[AN]

Course Contents: Theory

Module 1: Basics of Metro Rail Systems **15 Hrs**

Origin of Metro Rail System - Overview of WorldMetro 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 **18 Hrs**

Overview and construction methods for: 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.

Module 3: Metro Rail Functioning Systems **12 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.
Suggested Readings:	
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.
IS Code books / Standards / Manuals:	
1	Manual for standardsand specifications forrailway stations, 2009.
2	The Metro railways (Operation and Maintenance) ACT, 2002.
Web References:	
1	https://themetrorailguy.com/metro-rail-projects-in-india/
2	https://www.railway-technology.com/projects/delhi-metro/
3	https://en.wikipedia.org/wiki/Urban_rail_transit_in_India
4	http://railsystem.net/rapid-transit-subway-system/
MOOCs:	
1	https://www.railtech.com/infrastructure/2018/04/16/free-online-course-on-railway-systems-engineering/?gdpr=accept
2	https://online-learning.tudelft.nl/courses/railway-engineering-an-integral-approach/
3	https://www.edx.org/course/e-learning-course-on-urban-rail-development

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]**
C012.1 - C012.6	Analyze	Online Quiz	20
C012.1 - C012.6	Apply	Assignment	20
C012.1 - C012.6	Analyze	Seminar presentation	40

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	25
Apply	40	40	40
Analyse	30	20	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)**	

Course Articulation Matrix															
CO	**PO**												**PSO**		
	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
6	3	1	2	-	-	1	2	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

21CE013	PRE - ENGINEERED INDUSTRIAL STRUCTURES	3/0/0/3

Nature of Course	Theory Concept
Pre requisites	-

Course Objectives:

1	To understand the concepts, applications and issues of Pre-Engineered building systems.
2	To appraise the different components of Pre-Engineered structures.
3	To understand the design methodology of Pre-Engineered Building considering all loading conditions.
4	To design the Pre-Engineered Building with all functional and structural requirements.

Course Outcomes:

Upon completion of the course, students shall have ability to

C013.1	Illustrate the concepts of Pre- Engineered Building and their applications	[U]
C013.2	Demonstrate the issues in PEB and techniques to overcome iteffectively.	[AP]
C013.3	Categorize the different components of Pre-Engineered structures and their structural purposes.	[U]
C013.4	Illustrate the standardization and Modularization of Pre- Engineered building system.	[AP]
C013.5	Interpret the design methodology of Pre-Engineered Buildings as per codal provisions.	[AP]
C013.6	Design the PEB frame considering all possible loading conditions as per codal provisions.	[AN]

Course Contents: Theory

Module 1: Pre- Engineered Building Concepts **12 Hrs.**

History - Concepts and Advantages of Pre- Engineered structures - Diversified Applications of Pre-Engineered Buildings - Materials used for manufacturing of PEB - Difference between Conventional Steel Buildings and Pre-Engineered buildings - Critical success factors - Issues of PEB in market scenario - Fire Protection - Buckling - Microcracks- Corrosion - Welding- Ductility from seismic conditions- Scope in India.

Module 2: Components and Loading Conditions **15 Hrs.**

Standardization and Modularization - Primary or Main frame - Gable End framing or Wind columns - Secondary frame or Purlins, girts etc. - Bracing system - Crane system - Mezzanine system - Insulations - Attachments like canopies, fascia. - Doors, Windows, Ventilators - Accessories like Turbo vents, Ridge Vents, Skylights - Roof & Wall Sheeting- Loading conditions for Pre-Engineered Structures - Codal norms

Module 3: Design Methodology **18 Hrs.**

Design Parameters of PEB Frames - Depth of the section, Depth to Flange width ratios, Thickness of Flange to thickness of Web ratio. d/t_w, b_f/t_f ratios of sections as per IS code. Section Sizes as per Manufacturing Limitations - Analysis and Design of Rigid Frames. Rigid Frame Moment Connection - Shear Connection-Anchor bolt and base plate design (Pinned and Fixed)- Design of PEB frame under the influence of Dead, Live, Collateral, Wind, Seismic and Other applicable Loads

		Total Hours	45 Hrs.
Text Books:			
1	Alexander Newman, ¯Metal Building Systems: Design and Specifications‖, McGraw-Hill Professional; Third edition, 2014.		
2	Subramanian N - ¯Design of Steel Structure‖ Oxford University Press, 2011		
3	Bungale S. Taranath, ¯Structural Analysis and Design of Tall Buildings: Steel andComposite Construction‖, CRC Press; 1 edition, 2011		
Suggested Readings:			
1	Vitor Abrantes, ¯The Pre-Fabrication of Building Facades (Building Research: Design, Construction and Technologies)‖, Springer International Publishing AG, 2018.		
2	IS:8640- 1977, ¯Recommendations for dimensional parameters for industrial building‖,BIS, 1977 (Reaffirmed 2007).		
3	Drew Plunkett, ¯Detail in Contemporary Bar and Restaurant Design (Detailing for Interior Design)‖, Laurence King Publishing, 2013.		
4	Vivek K S and P. Vyshnavi P, ¯Pre - Engineered Steel Building‖, Lap Lambert Academic Publishing, 2017.		
Web Reference:			
1	https://www.zamilsteel.co.in/products/pre-engineered-buildings/		
2	https://www.ediscompany.com/what-is-a-pre-engineered-building/		
Online Resources:			
1	https://pdhonline.com/courses/s120a/s120a_new.htm		
2	http://www.mbma.com/		

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]**
C 013.1 - 6	Apply	Assignment	20
C 013.1- 6	Apply	Quiz	20
C013.1 - 6	Analyse	Project Based Learning	40

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	20
Apply	40	30	40
Analyse	30	50	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)	

Course Articulation Matrix															
CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	-	3	-	-	1	2	2	-	1	2	-	1
2	3	2	1	-	3	1	-	1	2	2	-	1	2	-	1
3	3	2	1	-	3	1	-	1	2	2	-	2	2	-	1
4	3	2	1	-	3	1	-	1	2	2	-	2	2	-	1
5	3	2	1	-	3	1	-	1	2	2	-	1	2	-	1
6	3	2	1	-	3	1	-	1	2	2	-	1	2	-	1
Avg	3	2	1	-	3	1	-	1	2	2	-	1.3	2	-	1
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed				

21CE014	RISK AND RELIABILITY ANALYSIS OF CIVILINFRASTRUCTURE SYSTEMS	3/0/0/3

Nature of Course	Theory Concept
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

C014.1	Understand the feasibility of risk and reliability in civil infrastructure systems	[U]
C014.2	Identify the risk and reliability in engineering projects	[U]
C014.3	Analyze risk and reliability using existing methods and models	[AN]
C014.4	Assess the risk and reliability and make decisions in engineering	[AN]
C014.5	Mitigate risk using various methods and tools	[AP]
C014.6	Manage risk and reliability in engineering projects	[AP]

Course Contents: Theory

Module 1: Risk Analysis **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: Reliability Analysis **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: Management of Risk and Reliability **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 Practice‖ (Upper SaddleRiver, NJ), Prentice-Hall, 2018.

Suggested Readings:	
1	Vose, David , Risk Analysis: A Quantitative Guide, 3 rd Edition, John Wiley & Sons Ltd,2018
2	Harry campbell and Richard Brown, Benefit cost analysis, Cambridge University Press ,UK, 2015.
3	B. M. Ayyub,Risk Analysis in Engineering and Economics, Chapman-Hall/CRC Press, 2010.
4	Modarres M,. Kaminskiy, V. Krivtsov, Reliability Engineering and Risk Analysis: A Practical Guide, 2nd Edition, CRC Press, Taylor & Francis Group, 2010
Web Reference:	
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]**
C014.1-6	Analyze	Project Based Learning(Applications of risk management softwares and providing a project demonstration	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	20
Apply	40	30	40
Analyse	30	50	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)	

Course Articulation Matrix															
CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	3	2	-	-	2	-	2	3	3	3	3	2	-	2
2	2	3	2	-	-	2	-	1	3	3	3	3	2	-	2
3	3	3	3	-	-	3	-	2	3	3	3	3	3	-	3
4	3	3	3	-	-	3	-	2	3	3	3	3	3	-	3
5	3	3	3	-	-	3	-	1	3	3	3	3	3	-	3
6	2	3	2	-	-	2	-	1	3	3	3	3	2	-	2
Avg	2.5	3	2.5	-	-	2.5	-	1.5	3	3	3	3	2.5	-	2.5
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed				

21CE015	RURAL WATER SUPPLY AND ONSITE SANITATION SYSTEMS		3/0/0/3
Nature of Course	Theory Application		
Pre requisites	-		
Course Objectives:			
1	To Understand healthful housing and swimming pool operation and maintenance		
2	To Understand Refuse and food sanitation		
3	To Understand Rural and Urban water supply and sanitation		
4	To educate Rural and Urban water supply and sanitation		
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.		[AP]
C015.5	Apply the various process involved in the solid waste management system		[AP]
C015.6	Analyze the concepts of various solid waste disposal systems in rural sanitation		[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- National rural drinking water program- 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 - 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: Rural and onsite 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, 2003.
2	Sanjay Gupta, ¯Rural Water Supply and Sanitation‖, Vayu Education of India, 1st Edition,2014.
3	Green Well Allan, ¯Rural Water Supply‖, BiblioLife, 2012.

Suggested Readings:

1	Richard C. Carter, ¯Rural Community Water Supply‖, Practical Action Publishing, 2008.
2	Forrest Blythe Wright, ¯Rural Water Supply and Sanitation‖, Krieger Publishing Company, 3^{rd} Edition, 2007.
3	B. M. Ayyub,Risk Analysis in Engineering and Economics, Chapman-Hall/CRC Press, 2010.
4	Modarres M,. Kaminskiy, V. Krivtsov, Reliability Engineering and Risk Analysis: A Practical Guide, 2nd Edition, CRC Press, Taylor & Francis Group, 2010
Web Reference:	
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				**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 - C015.6	Apply	Assignment	20
	Apply	Quiz	20
	Apply	MOOC Online Courses	40

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	60	30	30
Analyse	-	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)	

Course Articulation Matrix

CO	PO												PSO		
	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	-	1	1	1	1	1
4	3	-	-	-	-	-	1	-	2	-	1	1	3	1	1
5	2	-	-	2	-	-	2	-	2	-	1	1	3	-	-
6	1	-	-	-		-	1	-	-	-	-	1	1	-	-
Avg	**2.5**	**-**	**-**	**1.5**	**-**	**-**	**1.3**	**1.0**	**2.0**	**-**	**1.0**	**1.0**	**1.8**	**1.0**	**1.0**
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed				

21CE016	CONTAMINATED SITE ASSESSMENT AND REMEDIATION	3/0/0/3
Nature of Course	Theory 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**		
C016.2	Investigate the contaminated surface water and groundwater site and suggest suitable remediation technologies	[U]
C016.3	Analyze the contamination pathway of land and subsurface	[AN]
C016.4	Analyze the significance of waste containment in landfills and slurry ponds and assess the contaminated land and subsurface site	[AN]
C016.5	Apply suitable reclamation methods for contaminated land and subsurface	[AP]
C016.6	Investigate contaminated site and recommend appropriate methods for an effective land reclamation	[AP]
C016.2	Investigate the contaminated surface water and groundwater site and suggest suitable remediation technologies	[U]
Course Contents: Theory		
Module1: Surface and Groundwater Contamination **15 Hrs.** Contamination – sources and pathways of surface and groundwater contamination –site investigation and risk assessment – pump and treat, permeable reactive barrier walls – application of emerging techniques in surface water and groundwater management – case studies **Module2: Land and Subsurface Contamination** **15 Hrs.** Causes, types, contaminant characteristics, pathway – contaminant transport mechanisms – solute transport modeling techniques - soil and contaminant interaction – waste containment in landfills, slurry ponds and deep disposal techniques - leachate - site assessment - case studies **Module3: Remediation Technologies** **15 Hrs.** Contaminate 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 Reference:	
1	Clu-In Contaminated Site Clean-up Information EPA www.clu-in.org
2	ITRC Guidance Documents and other Information ITRC www.itrcweb.org
Online Resources:	
1	https://nptel.ac.in/content/storage2/courses/105103025/pdf/pdf4.pdf
2	https://hppcb.nic.in/NGT/Vol-II.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]**
C016.1 - 6	Understand and Analyze	Group Assignment	20
C016.1-6	Analyze	Case Study and Presentation	40
C016.1-6	Apply	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	10	-	-
Understand	30	40	30
Apply	60	60	50
Analyse	-	-	20
Evaluate	-	-	-
Create	-	-	-

<table>
<tr><th colspan="6">Assessment based on Continuous and End Semester Examination</th><th></th></tr>
<tr><td colspan="6">Continuous Assessment (40%)
[200 Marks]</td><td rowspan="4">End Semester Examination (60%)
[100 Marks]</td></tr>
<tr><td colspan="3">CA 1 : 100 Marks</td><td colspan="3">CA 2 : 100 Marks</td></tr>
<tr><td rowspan="2">SA 1
(60 Marks)</td><td colspan="2">FA 1 (40 Marks)</td><td rowspan="2">SA 2
(60 Marks)</td><td colspan="2">FA 2 (40 Marks)</td></tr>
<tr><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td></tr>
</table>

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	2	-	2	-	-	-	2	-	-	3	2	-
2	3	3	2	2	-	2	-	-	-	2	-	-	3	2	-
3	3	3	2	2	-	2	-	-	-	2	-	-	3	2	-
4	3	3	2	2	-	2	-	-	-	2	-	-	3	2	-
5	3	3	2	2	-	2	-	-	-	2	-	-	3	2	-
6	3	3	2	2	-	2	-	-	-	2	-	-	3	2	-
Avg	**3**	**3**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**2**	**-**
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed				

21CE017	SMART CITY PLANNING AND DEVELOPMENT	3/0/0/3
Nature of Course	Theory	
Pre requisites	-	

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

C017.1	Describe characteristics of a smart city like smart economy, smart people, smart governance, smart mobility and smart environment.	[U]
C017.2	Involve in Public private partnership model of urban governance.	[AP]
C017.3	Discuss global context of smart cities and smart cities mission of Indian Government.	[U]
C017.4	Critically evaluate the smart cities.	[AN]
C017.5	Describe the global context of smart cities and smart cities mission of Indian Government.	[U]
C017.6	Achieve a balance between smart and sustainable development of cities.	[AP]

Course Contents: Theory

Module 1: 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

Module 3: 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.
Suggested Readings:	
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 Reference:	
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				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 & C017.2	Understand	Online Quiz	20
C017.3 & C017.4	Understand	Class Presentation	20
C017.5 & C017.6	Analyse	Group AssignmentClassroom Quiz	40

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	50	40	40
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)	

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	-	-	-	-	2	2	-	-	-	-	2	1
2	3	3	2	-	-	-	-	2	2	-	-	-	-	2	1
3	3	3	2	-	-	-	-	2	2	-	-	-	-	2	1
4	3	3	2	-	-	-	-	2	2	-	-	-	-	2	1
5	3	3	2	-	-	-	-	2	2	-	-	-	-	2	1
6	3	3	2	-	-	-	-	2	2	-	-	-	-	2	1
Avg	3	3	2	-	-	-	-	2	2	-	-	-	-	2	1
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed				

21CE018	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 applications 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

C018.1	Understand the concept of smart materials and their structural applications.	[U]
C018.2	Apply the vibration absorbers appropriately.	[AP]
C018.3	Apply strain gauges to measure the strain values.	[AP]
C018.4	Use control techniques in Civil Engineering.	[AP]
C018.5	Understand the applications of Shape Memory techniques - Alloys inBridges.	[AP]
C018.6	Apply the Structural Health Monitoring using modern tools.	[AP]

Course Contents: Theory

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: Measuring Techniques and Control of Structures **15 Hrs.**

Strain Measuring Techniques using Electrical strain gauges - Types - Resistance - Capacitance -Inductance - Wheatstone bridges - Pressure transducers - Load cells - Temperature Compensation - Strain Rosettes - Chemical and bio chemical sensing in structural assessment -Control modelling of structures - Control strategies and limitations - Classification of control systems: Classical control, Modern control, Optimal control and Digital control - Active structures in practice.

Module 3: Applications In Civil Engineering **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.

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

Suggested Readings:

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 Reference:	
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]**
C018.1	Understand	Online Quiz	20
C018.2 & C018.3	Understand	Group assignment	20
C018.4 & C018.5	Apply	Case study	20
C018.6	Apply	Technical 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
Understand	80	70	50
Apply	-	30	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
Assessment based on Continuous and End Semester Examination			
Continuous Assessment (40%) [200 Marks]			**End Semester Examination**

<table>
<tr><th colspan="3">CA 1 : 100 Marks</th><th colspan="3">CA 2 : 100 Marks</th><th rowspan="3">(60%)
[100 Marks]</th></tr>
<tr><td rowspan="2">SA 1
(60 Marks)</td><td colspan="2">FA 1 (40 Marks)</td><td rowspan="2">SA 2
(60 Marks)</td><td colspan="2">FA 2 (40 Marks)</td></tr>
<tr><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td></tr>
</table>

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	-	3	-	-	2	2	2	-	1	1	1	1
2	3	2	1	-	3	-	-	2	2	2	-	1	1	1	1
3	3	2	1	-	3	-	-	2	2	2	-	1	1	1	1
4	3	2	2	-	3	-	-	2	2	2	-	1	1	1	1
5	3	2	1	-	3	-	-	2	2	2	-	1	1	1	1
6	3	2	1	-	3	-	-	2	2	2	-	1	1	1	1
Avg	**3**	**2**	**1**	-	**3**	-	-	**2**	**2**	**2**	-	**1**	**1**	**1**	**1**
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed				

OPEN ELECTIVE

21CE001	DISASTER MANAGEMENT	3/0/0/3

Nature of Course	Theory Concepts
Pre requisites	-

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 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 response 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 occursdue to disaster.	[AP]
C001.4	Apply disaster management in Forecasting and warning of disasters and disaster management technique in Statistical seismology.	[AP]
C001.5	Examine the recent trends in disaster management.	[AN]
C001.6	Classify the Emergency Management System for all the disasters.	[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 news media and NDRF in Disaster management -Rehabilitation of victims - Operations Management(OM) - Risk assessment and disaster response - NGO management – 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	Palanivel K., ―Disaster Management‖, Allied Publishers, 2015.

2	Sulphey M.M., ―Disaster Management‖ PHI Learning Publications, 2017.
3	Singh A., Punia M, Haran N P and Singh T B., ―Development and Disaster Management‖, Springer, 2018.
Suggested Readings:	
1	Rajendra Kumar Pandey., ―Disaster Management in India‖, SAGE Publications Pvt. Ltd.,2020.
2	Shrivastava A.K., ―Text book of Disaster Management‖, Scientific Publications, 2021.
3	Arulsamy S., and Jeyadevi J., ―Disaster Management‖, Neelkamal Publications, 2016.
4	Hand Books on Disaster Management, Disaster Management Cell, Regional Centre for Urban and Environmental Studies, Lucknow University Campus, Lucknow.
IS 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 Reference:	
1	https://ndma.gov.in/
2	https://nidm.gov.in/
3	https://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 to C001.6	Apply	MOOC Certifications	20
C001.1 to C001.6	Analyze	Technical Report	20
C001.1 to C001.6	Apply	Assignment	20
C001.1 to C001.6	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)	

Course Articulation Matrix															
CO	PO												PSO		
	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
6	3	2	1	2	-	2	-	2	-	-	-	1	3	-	2
Avg	**2.8**	**2.3**	**1.3**	**2.3**	**-**	**1.7**	**-**	**2.0**	**-**	**2.0**	**-**	**1.7**	**3.0**	**2.5**	**2.7**
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed				

21CE002	ENGINEERING RISK AND UNCERTAINTY	3/0/0/3

Nature of Course	Theory and Applications
Pre requisites	-

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	Acquire knowledge about risk and uncertainty in engineering	[AN]
C002.2	Identify the risk and uncertainty in engineering projects	[AN]
C002.3	Analyze risk and uncertainty using existing methods and models	[AN]
C002.4	Assess the risk and uncertainty and make decisions in engineering	[AP]
C002.5	Mitigate risk using various methods and tools	[AP]
C002.6	Manage risk and uncertainty in engineering projects	[AP]

Course Contents: Theory

Module 1: Concepts of Risk and Uncertainty **15 Hrs.**

Importance of Risk – Source and Types of risks in Civil 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
Suggested Readings:	
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 hydro system engineering, Springer, 2013
3	Mohammad Modarres, Mark P.Kaminskiy and Vasiliy Krivitsov, 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.
Web Reference:	
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
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

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 - 6	Analyze	Assignment	20
C002.1 - 6	Analyze	Quiz	20
C002.1 - 6	Apply	Group Project and Presentation	40

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	20	20	20

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

<table>
<tr><th colspan="7">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><td colspan="6">Continuous Assessment (40%)
[200 Marks]</td><td rowspan="4">End Semester Examination (60%)
[100 Marks]</td></tr>
<tr><td colspan="3">CA 1 : 100 Marks</td><td colspan="3">CA 2 : 100 Marks</td></tr>
<tr><td rowspan="2">SA 1
(60 Marks)</td><td colspan="2">FA 1 (40 Marks)</td><td rowspan="2">SA 2
(60 Marks)</td><td colspan="2">FA 2 (40 Marks)</td></tr>
<tr><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td><td>Component - I
(20 Marks)</td><td>Component - II
(20 Marks)</td></tr>
</table>

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	3	2	-	-	2	-	2	3	3	3	3	2	-	2
2	2	3	2	-	-	2	-	1	3	3	3	3	2	-	2
3	3	3	3	-	-	3	-	2	3	3	3	3	3	-	3
4	3	3	3	-	-	3	-	2	3	3	3	3	3	-	3
5	3	3	3	-	-	3	-	1	3	3	3	3	3	-	3
6	2	3	2	-	-	2	-	1	3	3	3	3	2	-	2
Avg	**2.5**	**3**	**2.5**	**-**	**-**	**2.5**	**-**	**1.5**	**3**	**3**	**3**	**3**	**2.5**	**-**	**2.5**
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed				

21CE003	ENVIRONMENTAL IMPACT ASSESSMENT AND LIFE CYCLE ANALYSIS	3/0/0/3
Nature of Course	Theory and Applications	
Pre requisites	-	

Course Objectives:

1	To acquire knowledge regarding the methods of assessing the impact
2	To know about the various impacts of development projects on environment and themitigating measures
3	To understand the risk assessment related to the environment
4	To know about the Life Cycle Analysis and its importance in industrial sectors

Course Outcomes:

Upon completion of the course, students shall have ability to

C003.1	Understand the detailed process involved in EIA methodologies and methods to obtain the EIA clearance	[U]
C003.2	Apply the concepts of various assessment tools for the preparation of EIA report and Environment Management plan	[AP]
C003.3	Evaluate the risk assessment based on response analysis	[AP]
C003.4	Apply the concepts of Risk assessment tools and the mitigation measures for various engineering projects	[AP]
C003.5	Apply the process of Life Cycle assessment and the challenges facing by the industries in recent days	[AP]
C003.6	Identify the problems and analyse the various concepts of LCA to overcome the various issues	[AN]

Course Contents: Theory

Module-1: EIA Methodologies and Assessment of EMP **15 Hrs.**

Evolution of Environmental Impact Assessment (EIA)-Baseline Study- Framework of EIA-Stages of EIA-Environmental Impact Statement (EIS) -Terms of Reference- EIA capability and limitations – Legal provisions on EIA. Methods of EIA -Check lists - Matrices - Networks - Overlay -Cost-benefit analysis. Assessment of Impact and mitigation measures of impact on: land, water, air, noise, social, cultural flora and fauna - Public participation - Documentation of EIA Findings and Report Preparation - Rapid EIA. Environmental Management Plan - Environmental legislation in India and Environmental Audit.

Module-2: Environmental Risk Management& Case Studies **15 Hrs.**

Environmental risk assessment framework-Hazard identification - Exposure Assessment - Exposure Factors, Tools for Environmental Risk Assessment- HAZOP and FEMA methods - Risk Characterization -Risk communication - Emergency Preparedness Plans- Case Studies: EIA for infrastructure projects - Large scale Industries-Mining-Hydropower projects- Bridges - Highways - Dams - Water Supply and Drainage Projects.

Module- 3: Life Cycle Analysis& Assessment **15 Hrs.**

Introduction to Sustainability Concepts and Life Cycle Analysis - Life Cycle Assessment – Detailed Methodology and ISO Framework - Environmental Data Collection and LCA Methodology - Life Cycle Inventory and Impact Assessments - Factors for Good LCA Study - Design for Sustainability - Case Studies.

Total Hours	**45 Hrs.**

Text Books:	
1	Anjaneyulu,Y, ‖Environmental Impact Assessment methodologies‖, B.S. Publications,2011
2	Anji Reddy Mareddy, Environmental Impact Assessment - Theory and Practice, B S Publications, 2017
3	Michael Z. Hauschild Ralph K. Rosenbaum Stig Irving Olsen, Life Cycle Assessment - Theory and Practice Springer, 2018
Suggested Readings:	
1	Barthwal R R., Environmental Impact Assessment New age International Pvt.Ltd., 2012
2	Angus Morrison, Advanced Introduction to Environmental Impact Assessment, Edward Elgar Publising Ltd., 2018.
3	Salim Momtaz, Zobaidul Kabir S M., Evaluating Environmental and Social Impact Assessment in Developing Contries, Elsevier Publications, 2013
4	Walter Klöpffer., Life Cycle Assessment (LCA): A Guide to Best Practice 1st Edition, Wiley-VCH, 2014
Web Reference:	
1	https://nptel.ac.in/courses/120108004/
2	https://nptel.ac.in/courses/123105001
Online Resources:	
1	https://nptel.ac.in/courses/120108004/
2	https://nptel.ac.in/courses/123105001

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 - C003.6	Apply	Assignment	20
		Quiz	20
		MOOC Online Courses	40

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	40	20	20
Apply	50	30	30
Analyse	-	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)**	

Course Articulation Matrix															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2						-	-				2		1	1
2	2						2	-				2			2
3	3	-	3	3	-	-	2	-	2	1		3	2	2	2
4	2						2	-				2		1	1
5	3	-	2	2	-	-	1	-	2	1		3	2		2
6	2	-		1			2	-				2			2
Avg	**2.3**	**-**	**1.0**	**1.3**	**-**	**-**	**1.7**	**2.0**	**2.0**	**1.0**		**2.3**	**2**	**1.3**	**1.7**
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed				

21CE004	GEOGRAPHICAL INFORMATION SYSTEM	3/0/0/3

Nature of Course	Theory and Concepts
Pre requisites	-

Course Objectives:

1	To acquire knowledge on GIS techniques and map projections.
2	To have a clear understanding about data models and data structures.
3	To acquaint with several advanced modeling and application of GIS.
4	To comprehend and apply social and environmental systems information in the design and planning process.

Course Outcomes:

Upon completion of the course, students shall have ability to

C004.1	Understand the basic components involved in GIS techniques.	[U]
C004.2	Comprehend the Geo-referencing and map projection system and its application in GIS.	[AP]
C004.3	Apply the concepts of data analysis and data models involved in GIS	[AP]
C004.4	Analyse the concepts involved in GIS by using modern methods	[AN]
C004.5	Identify field applications of GIS in various resource management	[AP]
C004.6	Apply the advanced technologies of GIS in various fields.	[AP]

Course Contents: Theory

Module 1: GIS and map projections **15 Hrs.**

Introduction to Remote sensing and GIS - Components of GIS – Data; Spatial and Non-Spatial - Mapsand Projections – Map Scale - Types of Projection - Coordinate system – Geo-referencing and 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.

Module 2: Data analysis and Image Processing **15 Hrs.**

Data Analysis - Visual interpretation and digital image processing - Data Retrieval - Query - Simple Analysis - Spatial Analysis - Spatial DBMS - Data storage - Overlay - Vector Data Analysis - Raster Data Analysis - Data models - Modeling and analysis using ARC GIS - Digital Elevation Model – Digital Terrain Modeling - Interpolation - Cost and path analysis - Expert Systems - Google Earth Tools.

Module 3: Application of GIS in resource management **15 Hrs.**

Applications of GIS - Management and Monitoring of Land, air, water and pollution studies - conservation of natural resources and agriculture - coastal zone management - Water resources and groundwater monitoring - Wasteland management - Social resources - Cadastral records - LIS - Limitations - AM/FM - Utility Network Management - Integration with Remote Sensing - Knowledge based techniques - multi-criteria Techniques.

Total Hours	**45 Hrs.**

Text Books:

1	Anji Reddy.M, Text book of Remote sensing and GIS, B.S.Bublications., 2019
2	Michael N Demers, Fundamentals of Geographical Information Systems, Third Edition,

	John Wiley Publications, 2014.
3	Sinha.S.K, Remote sensing and GIS, Ayushman Publication house., 2014
Suggested Readings:	
1	Lo, C.P. and Yeung, Albert K.W., Concepts and Techniques of Geographic Information Systems, Pearson, 2016
2	Burrough P A, Principles of GIS for Land Resources Assessment, Oxford Publication, 2014.
3	Manugula.S.S 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 Reference:	
1	http://www.gdmc.nl/oosterom/PoGISHyperlinked.pdf
2	https://www.researchgate.net/publication/323945547_Fundamentals_of_GIS
3	http://giswin.geo.tsukuba.ac.jp/sis/tutorial/Fundamentals_of_GIS_Estoque.pdf
4	https://webapps.itc.utwente.nl/librarywww/papers_2009/general/principlesgis.pdf
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
3	https://2012books.lardbucket.org/pdfs/geographic-information-system-basics.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]**
C004.1	Understand	Assignment	20
C004.2 & C004.3.	Apply	Online Quiz	20
C004.4	Analyse	Technical Presentation	20
C004.5 & C004.6	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	20	-	10
Understand	20	30	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)	

Course Articulation Matrix															
CO	PO												PSO		
	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
6	2	2	2	3	3	1	-	-	2	-	1	2	-	2	2
Avg	**2**	**3**	**2**	**3**	**3**	**1**	**2**	**-**	**2**	**-**	**1**	**2**	**1**	**2**	**2**
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed				

21CE005	INDUSTRIAL POLLUTION CONTROL AND PREVENTION TECHNIQUES	3/0/0/3
Nature of Course	Theory and Applications	
Pre requisites	-	
Course Objectives:		
1	To acquire knowledge on types of industrial pollutants and its source, environmental pollution prevention policy and legislations, concepts, and terminologies	
2	To recommend suitable techniques and approaches for minimizing the generation ofwastewaters at the source and to reduce energy consumption	
3	To attain knowledge on application of physico-chemical, biological and advanced treatment methods for recovery, reuse and disposal of wastewater for effective pollution control from industries	
4	To understand the process and types of pollution and technology for managing pollution from different industries	
Course Outcomes: **Upon completion of the course, students shall have ability to**		
C005.1	Recognize the types and sources of industrial pollutants	[U]
C005.2	Apply the environmental policy and legislations for industries to dispose the wastewater	[AP]
C005.3	Apply cleaner production, waste minimization techniques and management strategies to industries.	[AP]
C005.4	Identify the suitable treatment and disposal technique based on the pollutant from industries	[AP]
C005.5	Differentiate the type of pollutants from various industries	[AN]
C005.6	Suggest suitable pollution control and prevention techniques for different industries	[AN]

Course Contents: Theory

Module 1: Environmental Concern by Industries **15 Hrs.**

Man and the environment - Consequences of industrial growth - Impact on environment by industrial growth - Sources - Types of Industrial pollutants and their source of industry - Mass and Energy balance system- Industrial management Concept - effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health - Environmental legislations related to prevention and control of industrial pollution - Waste Audit - Zoning Atlas and guidelines.

Module 2: Pollution Prevention Technologies **15 Hrs.**

Cleaner Production - Life Cycle Assessment - Environmental Impact Assessment - Waste Management Strategies - Remediation techniques: Physical, Chemical, Biological and Thermal treatment technologies - Zero Effluent Discharge - ETP & CETP - Sludge disposal techniques - Air pollutant emissions and control – Noise Pollution control measures.

Module 3: Case Studies on Industrial Process and pollution prevention **15 Hrs.**

Industrial Process and pollution prevention: Tannery Industry - Textile Industry - Petroleum Industry - Chemical Industry - Pulp & Paper Industry - Cement Industry.

Total Hours	**45 Hrs.**

Text Books:

1	M.N. Rao & A.K.Dutta, Wastewater Treatment, Oxford - IBH Publication,2017
2	W .W. Eckenfelder Jr., Industrial Water Pollution Control, McGraw-Hill Book Company, New Delhi, 2000
3	S.C.Bhatia, Handbook of Industrial Pollution and Control, Volume I & II, CBS Publishers, New Delhi, 2003
Suggested Readings:	
1	R.L.Stephenson and J.B.Blackburn, Jr., Industrial Wastewater Systems H and book, Lewis Publisher, New York, 1998
2	H.M.Freeman, Industrial Pollution Prevention Hand Book, McGraw-Hill Inc., New Delhi, 1995.
3	Bishop, P.L., Pollution Prevention: Fundamental & Practice, McGraw-Hill, 2000.
4	T.T.Shen, Industrial Pollution Prevention, Springer, 1999.
Web Reference:	
1	http://www.cpcb.nic.in
2	http://www.moef.nic.in/report/0203/chap-05.pdf
3	http://www.moef.gov.in/citizen/specinfo/enguin.html
Online Resources:	
1	https://www.un-ihe.org/online-course-industrial-effluent-treatment
2	https://onlinecourses.nptel.ac.in/noc19_ce32/preview
3	https://alison.com/course/advanced-diploma-in-wastewater-treatment-and-recycling

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]**
C005.1	Understand	Online Quiz	20
C005.2	Apply	Group Assignment	20
C005.3, C005.4	Apply	Technical Video presentation	20
C005.5, C005.6	Analyse	Case Study 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	-	-	-
Understand	10	10	10
Apply	50	50	50
Analyse	40	40	40
Evaluate	-	-	-
Create	-	-	-

<table>
<tr><th colspan="7">Assessment based on Continuous and End Semester Examination</th></tr>
<tr><th colspan="6">Continuous Assessment (40%)
[200 Marks]</th><th rowspan="4">End Semester Examination (60%)
[100 Marks]</th></tr>
<tr><th colspan="3">CA 1 : 100 Marks</th><th colspan="3">CA 2 : 100 Marks</th></tr>
<tr><th rowspan="2">SA 1
(60 Marks)</th><th colspan="2">FA 1 (40 Marks)</th><th rowspan="2">SA 2
(60 Marks)</th><th colspan="2">FA 2 (40 Marks)</th></tr>
<tr><th>Component - I
(20 Marks)</th><th>Component - II
(20 Marks)</th><th>Component - I
(20 Marks)</th><th>Component - II
(20 Marks)</th></tr>
</table>

Course Articulation Matrix

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	3					2	1	1		1	1	3	3
2		2				3		2	1	1		1	1	2	3
3	2	2					3	2	1	1		1	1	2	3
4	2	2	3					2	1	1		1	1	2	3
5	2	2						2	1	1		1	1	1	3
6	2	2						2	1	1		1	1	1	3
Avg	2.0	2.0	3.0			3.0	3.0	2.0	1.0	1.0		1.0	1.0	2.7	3.0
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed				

21CE006	SUSTAINABILITY AND INFRASTRUCTURE	3/0/0/3
Nature of Course	Theory and Applications	
Pre requisites	-	

Course Objectives:

1	To correlate the context of sustainability in infrastructure design, construction and maintenance.
2	To interpret the systems of Hydrology and transportation in sustainable infrastructure management.
3	To infer the economic aspects of sustainable infrastructure and its impact in implementation effectiveness.
4	Illustrate the role of land use policies in shaping sustainable infrastructure and cities for future.

Course Outcomes:

Upon completion of the course, students shall have ability to

C006.1	Interpret the context of sustainability in Infrastructure and its importancein recent times.	[AP]
C006.2	Illustrate the landscape ecology, its resilient capacity and role of solid waste management in it.	[AP]
C006.3	Appraise the system of Hydrology and its impact by human development - Remedies	[AP]
C006.4	Infer the role of transportation in sustainable urban management and importance of public transit.	[AP]
C006.5	Categorize the economic aspects of sustainable infrastructures- design, construct and operation phases.	[AP]
C006.6	Interpret the significance of green ways in urban context and infer landuse policies.	[AP]

Course Contents: Theory

Module 1: Green Infrastructure and Ecology **15 Hrs.**

Definitions-Overview, goals and objectives of green infrastructure - Building the Case for Green Infrastructure: State of the Planet-History of the development of green infrastructure, emphasis on the environmental and green movements - Introduction to landscape ecology and resilience- Landscape ecology- Human health and well-being-Health, wellness and restorative landscapes-Recreational Landscapes-Cultural Landscapes and Green Infrastructure-Perception of sustainable landscapes and building public acceptance - Solid waste management

Module 2: Water, Transportation and Energy **15 Hrs.**

Introduction to Water Resources management - as a system – influences of human development at multiple scales-significance of spatial scale and multi-functionality - Transportation and Energy: Transportation, Federal Highway Administration, Federal Transit Administration, Livability in Transportation–Energy: Climate-Climate mitigation at the local and regional level – Micro-climate regulation

Module3: Economic aspects and Green ways **15 Hrs.**

Introduction to greenways-Greenways: an integral part of sustainable community development-multi-functionality of greenways-International greenway: Planning and design-Economic Aspects of Green Infrastructure-Land Use Planning and Policy related to Green Infrastructure-Land use and zoning- current limitations in most urban areas

	Total Hours	**45 Hrs.**

Text Books:	
1	Mark A. Benedict, Edward T McMahon, Green Infrastructure: Linking Landscapes and Communities. Washington: Island Press, 2015
2	Sarté, S.B. 2010. Sustainable Infrastructure: The Guide to Green Engineering and Design. Hoboken, NJ: Wiley Press, 2016
3	Elisabeth M Hamin, Planning for Climate Change: A Reader in Green Infrastructure and Sustainable Design for Resilient Cities, Routledge, 2018
Suggested Readings:	
1	Gary Austin, Green Infrastructure for Landscape Planning: Integrating Human and Natural Systems, 1st Edition, Routledge; 2014.
2	John W. Dover, Green Infrastructure: Incorporating Plants and Enhancing Biodiversity in Buildings and Urban Environments, Routledge,2015
3	Robert A. Francis, Urban Landscape Ecology: Science, policy and practice, Routledge,2016
4	Robert C Bears, Blue and Green Cities: The Role of Blue - Green Infrastructure in Managing urban water resources, Palgrave Macmillan,2020.
IS Code Book:	
1	Energy Conservation Building Code (ECBC 2017), Bureau of Energy Efficiency, Ministry of Power, Government of India
Web Reference:	
1	https://www.unep.org/news-and-stories/story/sustainable-infrastructure-can-drive-development-and-covid-19-recovery-unep
2	https://www.iisd.org/savi/faq/what-is-sustainable-infrastructure-2/
Online Resources:	
1	https://www.coursera.org/lecture/gte-sustainable-cities/the-urban-green-part-2-sdYvx
2	https://www.edx.org/course/building-expertise-on-developing-sustainable-and-r?index=product&queryID=4f368baafb57deb425b5a3ed38a66c39&position=1

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 -	AN	Assignment	20

C006.6	AN	Case studies	20
	AN	Quiz	20
	AN	Group 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	-	-	-
Understand	30	20	20
Apply	50	70	70
Analyse	20	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)**	

Course Articulation Matrix

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1				2			1		1	2	2	1
2	3	2	1				2			1		1	2	2	1
3	3	2	1				2			1		1	2	2	1
4	3	2	1				2			1		1	2	2	1
5	3	2	1				2			1		1	2	2	1
6	3	2	1				2			1		1	2	2	1
Avg	3	2	1				2			1		1	2	2	1
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed				

MANDATORY COURSES

21MC101	INDUCTION PROGRAMME (FOR ALL BRANCHES OF B.E / B.TECH PROGRAMMES)	1/0/0/0
Nature of Course	Induction Programme	
Pre requisites	-	

Course Objectives:

1	To have broad understanding of society and relationships
2	To nurture the character and fulfil 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.**

Course Articulation Matrix

CO	PO												PSO		
	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**	**3**	**3**	**3**	**3**	**3**	**3**			**1**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21MC102	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 the social 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	Understand the importance of natural resources and conservation of biodiversity.	[U]
C102.3	Understand and analyze the impact of engineering solutions in a globaland societal context.	[U]
C102.4	Apply the gained knowledge to overcome pollution problems.	[AP]
C102.5	Apply the gained knowledge in various environmental issues and sustainable development.	[AP]

Course Contents: Theory

Module 1: Natural Resources **10 Hrs.**

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.

Module 2: Environmental Pollutions **10 Hrs.**

Definition – causes, effects and control measures of: a. Air pollution-Acid rain - Green house effect-Global warming- Ozone layer depletion – case study- Bhopal gas tragedyb. Water pollution c. 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.

Module 3: Social issues and the Environment **10 Hrs.**

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 – ISO 14001 standard. HIV AIDS.

Total Hours	**30 Hrs.**

Text Books:

1	AnubhaKaushik and C P Kaushik ―Perspectives in Environmental Studies‖4th Edition, Newage International (P) Limited, Publisher Reprint 2014. New Delhi
2	Rajagopalan, R, ―Environmental Studies-From Crisis to Cure‖, Oxford University Press 2015

Suggested Readings:	
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.
IS Code Book:	
1	Energy Conservation Building Code (ECBC 2017), Bureau of Energy Efficiency, Ministry of Power, Government of India
Web Reference:	
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**
C201.1	Remember	Quiz	10
C201.2	Understand	Case study based on environmental aspect	20
C201.3	Understand	Class presentation	10
C201.4& C201.5	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**
C201.1							3								

C201.2							3								
C201.3						2	3								
C201.4							3								
C201.5							3								
Avg						**2**	**3**								

	3	Strongly agreed	2	Moderately agreed	1	Reasonably agreed	

21MC103	SOFT SKILLS		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.		
2	To teach the students to be effective 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 their profession.		[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 in corporate environment.		[AP]
C103.4	Analyse and apply creativity skills, critical thinking skills and problem solving skills.		[AN]
C103.5	Articulate oral and written messages in an appropriate and persuasive manner to suit specific purposes, audiences and contexts at work place.		[AP]
C103.6	Apply good teamwork skills and Leadership Skills		[AP]

Course Contents: Theory

Module 1: Professional Communication Skills **10 Hrs.**

Introduction to the Soft Skills, Performance Evaluation 1 -Significance of Soft Skills-Understanding the basic Communication Principles -Listening Skills- Listening Exercises-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 - Personal Application/Action Taken.

Advanced Writing Skills-Principles of Business Writing- E mails- Writing Reports- Types of Reports-Strategies for Report Writing- Personal Application/Action Taken.

Verbal Ability- Analogy- Classification- Odd One Out- Idioms and Phrases- Sentence Correction-Empathy and its importance in career -Personal Application/Action Taken.

Module 2: Interpersonal Communication **10 Hrs.**

Nonverbal Communication- Individual, Groups and Cultures- Body Language- Attire and Etiquettes-Interpersonal Skills- dealing with diverse People- Networking- Emotional Intelligence and its importance. Personal Application/Action Taken. Developing Creativity- Critical Thinking and Problem Solving Skills-Making the Right Choice- Never Give Up- Begin to Grow- Personal Application/Action Taken.

Interviews - Facing Job Interviews - Planning and Preparing- Effective Resume along with Covering

Letter- Planning and Preparing- Personal Application/Action taken. Self-Discipline - Self Presentation - Personal Application/Action taken. **Module 3: Teamwork and Leadership Skills** **10 Hrs.** Industry Expectations- Universal Hiring Rule- Personal Application/Action Taken. Importance of Human Values-Importance of Team Work- Developing Key Traits in Motivation, Persuasion, Negotiation and Leadership Skills- Being an Effective Team Player- Personal Application/Action Taken. Planning- Prioritization - Delegation- Conflict Management- Decision and its necessity in crucial situations- Group Discussion- Personal Application/Action Taken. Essential Skills in working Strategies- Presentation and Interaction Skills- What to Present and How- Being Assertive- Multimedia Presentation-Making Effective Presentations. Interview Skills- Do's and Don'ts - Body Language - Answering the Common Questions of Interview- Performance Evaluation 2- Mock Interview	
Total Hours	**30 Hrs.**

Text Books:	
1	Business Communication for managers: An advanced approach, by Penrose, Cengage 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.
Suggested Readings:	
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 Reference:	
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 Blooms 'Taxonomy) – Theory			
Formative assessment based on Capstone Model (40 Marks)			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group**	**Marks**

		Assignment)	
C103.1	Remember	Group Discussion	10
C103.2 & C103.3	Understand	Listening Skills	10
C103.4	Apply	Interview	10
C103.5 & C103.6	Apply	Formal Presentation	10

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	End Semester Examination (Theory) [60 marks]
Remember	30
Understand	40
Apply	30
Analyse	-
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						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
6							1	2	3	3	2	2			1
Avg						1	1	2	2	3	2	2			1

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21MC104	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.	[U]
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	[AN]
C104.6	Apply the empowerment strategy and tactics for productivity	[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, Behavioural influences on decision making - Group decision making - Vroom‘s Participative decision-making model.

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 schange- 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.		
Suggested Readings:			
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.		
4	Udai Pareek, Sushama Khanna, Organization Behavior, 3rd edition, Oxford Publishing, 2012.		
Web Reference:			
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/		
3	https://freevideolectures.com/course/3502/organizational-behaviour-i		
4	https://nptel.ac.in/courses/110/106/110106145/		
Assessment Methods & Levels (based on Blooms'Taxonomy) - Theory			
Formative assessment based on Capstone Model (16 Marks)			
Course Outcome	**Bloom's Level**	**Assessment Component (Choose and map components from the list – Quiz, Assignment, Case study, Seminar, Group Assignment)**	**Marks**
C104.1	Understand	Online Quiz	8
C104.2	Apply		

C104.6			
C104.3	Analyze	Online Course	4
C104.4 C104.5	Apply	Technical Presentation	4

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	End Semester Examination (Theory) [60 marks]
Remember	20
Understand	30
Apply	30
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	1	2	3	1	1	3	2	3	3	3	3	1	1	3	2
2	3	3	3	2	2	2	2	3	3	3	3	2	2	3	3
3	2	2	3	3	3	3	2	3	3	2	3	1	1	3	2
4	3	2	2	3	3	2	2	3	3	3	3	2	2	3	3
5	2	3	3	3	3	3	2	3	3	2	3	2	2	3	2
6	2	2	3	3	2	2	2	3	3	3	3	2	2	3	1
Avg	**2.2**	**2.3**	**2.8**	**2.5**	**2.3**	**2.5**	**2.0**	**3.0**	**3.0**	**2.7**	**3.0**	**1.7**	**1.7**	**3.0**	**2.2**

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed

21MC105	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]
C105.6	Enable effective use of data interpretation, formulas, graphs and assumptions.	[AP]

Course Contents: Theory

Module 1: Number Theory and Statistics **14 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 **8 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 **8 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 (40 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 & C105.6	Apply	Formal interview tests	20

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	End Semester Examination (Theory) [60 marks]
Remember	20
Understand	40
Apply	40
Analyse	
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	-	-
6	3	2	1	-	-	-	-	-	-	-	-	-	2	-	-
Avg	**3**	**2.5**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
1	Reasonably agreed					2	Moderately agreed				3	Strongly agreed			

Value Added Courses

21VA101	ARC GIS	

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

C101.1	Understand the basic components involved in ArcGIS techniques	[U]
C101.2	Illustrate the Geo-referencing and map projection system and its application in GIS	[AP]
C101.3	Apply the concepts of data analysis and data models involved in GIS	[AP]
C101.4	Interpret the spatial data with Arcgis for creating and organizing layers.	[AP]
C101.5	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

21VA102	AUTOCAD- 2D FOR CIVIL ENGINEERS	
Nature of Course	Practical	
Pre-requisites	-	
Course Objectives		
To equip students with expertise knowledge over drafting and detailing skillset in AutoCAD software.		
Course Outcomes: **Upon completion of the course, students shall have ability to**		
C102.1	Understand the AutoCAD user interface, tool bars - their functions and project settings.	[U]
C102.2	Apply the sketching commands, use drawing aids and get acquainted with Layers.	[AP]
C102.3	Illustrate various tools and commands of dimensioning and editing.	[AP]
C102.4	Demonstrate various constraints in sketches and hatching techniques.	[AP]
C102.5	Categorize the layouts and Plotting techniques in AutoCAD.	[AP]
C102.6	Demonstrate the dynamic block application in AutoCAD.	[AP]
Course Contents:		
Module 1 - Introduction to AutoCAD **5 Hrs.** Getting Started with AutoCAD - Starting with Sketching - Drawing Lines - Creating Other 2D Objects - AutoCAD Polylines - Adding Points - Duplicating Objects - Separating and Joining Sketched Objects - Layers - Object Properties - Working with Layers **Module 2 - Dimensioning and Detailing Drawings** **5 Hrs.** Dimensioning - Adding Layers - Editing Dimensions - Dimension Styles - Constraints in a Sketch – Dimensions – Parameters - Equations - Hatching Drawings - Hatching Basics - Modifying Hatch Properties. **Module 3 – Layouts and Blocks** **5 Hrs.** Paper Space Layouts - Working with Viewports - Layout Tools - Plotting Drawings in AutoCAD - Publishing to other File Types - Customizing Templates - Working with Blocks - Build a Sheet Set -Sheet Set Views - AutoCAD and a 360 – AutoCAD in the Cloud.		
Total Hours:	**15 Hrs.**	
Text Books:		
1.	Linkan Sagar, AutoCAD 2019 Training Guide, BPB Publishers, 2019	
2.	Azhar Wahab, A Hand Book on AutoCAD tools practice, Notion press,2020	
3.	AutoCAD (Civil & Architecture) exercise book, Cad Desk,2019	
Suggested Readings:		
1.	Sunil K. Pandey, Learn AutoCAD in a Easy way, S.K. Kataria & Sons 2019	
2.	AutoCAD 2019 For Beginners Paperback, Kishore Publications,2018.	
3.	M.V. Chitawadegi, S.S. Bhavikatti, Building Planning and Drawing, Dream Tech	

	Press, 2019.
4.	Julia Mc Morrough, The Architecture Reference & Specification Book updated & revised: Everything Architects Need to Know Every Day, Rock Port Publishers,2nd edition,2018
Web References:	
1.	https://www.autodesk.in/campaigns/autocad-tutorials
2.	https://www.mycadsite.com/tutorials.html
Online Resources:	
1.	https://www.coursera.org/learn/autodesk-autocad-design-drafting
2.	https://alison.com/course/autocad-beginner-to-professional-training

21VA103	CONSTRUCTION PLANNING AND MANAGEMENT USING PRIMAVERA	
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

C103.1	Understand the fundamental principles of project management	[U]
C103.2	Construct relationship between activities and maintain the project sequence	[AP]
C103.3	Compute the roles and resources for each activity of a project	[AP]
C103.4	Analyze the resource availability and cost involved in a project	[AN]
C103.5	Demonstrate the report performance and documentation	[AP]
C103.6	Analyze the risk involved in time and cost of a project	[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 ManagementPaperback, 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/

21VA104	3D DESIGN AND DRAFTING USING REVIT ARCHITECTURE	
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

C104.1	Understand the concepts and benefits of Building Information Modelling	[U]
C104.2	Apply fundamental concepts and features of Autodesk Revit Architecture	[AP]
C104.3	Apply parametric 3D design tools to start designing projects	[AP]
C104.4	Develop higher-quality, more accurate architectural designs	[AP]
C104.5	Demonstrate various Annotation techniques and Rendering tools.	[AP]
C104.6	Categorize different layout methods for documentation purposes.	[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

21VA105	STRUCTURAL ANALYSIS AND DESIGN USING STAAD.Pro	
Nature of Course	Theory Practical	
Prerequisites	Nil	

Course Objectives:

1.	To understand the basic structural analysis concepts and software layout options.
2.	To learn the concept of analysis and design of reinforced concrete structures.
3.	To learn the concept of analysis and design of steel structures.
4.	To know how to interpret the results of software.

Course Outcomes:

Upon completion of the course, students shall have the ability to

C105.1	Understand the concept of idealization of structures and basic structural Modelling.	[U]
C105.2	Analyze the structures with basic requirements and interpret the results in post processing mode.	[AN]
C105.3	Analysis and Design of a 2D RC frame for various loading conditions.	[AN]
C105.4	Analysis and Design of a 3D RC frame for various loading conditions.	[AN]
C105.5	Analysis and Design of a pin jointed truss and roof truss for various loading conditions.	[AN]
C105.6	Analysis and Design of a steel workshop shed for various loading conditions.	[AN]

Course Contents:

Module 1: Structural Modelling **5 Hrs.**

Overview of STAAD.Pro - Idealization of Structures -Structural Modelling - Property Specification - Member Specification - Loading Specification - Analysis - Graphical User Interface - Results and Post Processing Mode - Check reactions, SFD, BMD, deflections.

Module 2: Analysis and Design of Reinforced Concrete Structures **7 Hrs.**

STAAD Editor – Load Combination – Analysis and Design of a two and three dimensional RC frame for gravity, wind/seismic loading -Analysis and Design of Overhead rectangular and circular water tanks - Analysis and Design of Bridge Deck with Moving loads.

Module 3: Analysis and Design of Steel Structures **3 Hrs.**

Loads on Structures – Load Combination – Analysis and Design of a pin jointed truss - Analysis and Design of a steel roof truss - Analysis and Design of a Steel workshop shed.

Total Hours:	**15 Hrs.**

Text Books:

1.	Technical Reference Manual – ―STAAD.Pro‖, Bentley Systems, 2012.
2.	Structural Analysis and Design Manual, CADD Centre Training Services Pvt. Ltd., 2009.
3.	Structural Analysis and Design using STAAD. Pro V8i Manual, Professional Development Training Centre, 2015.

Suggested Readings:	
1.	Sukanta Adhikari and Dr Alka Pisal., Guide to structural engineering using STAAD.Pro Connect, Kindle Edition, 2021.
2.	Sarma, T. S., STAAD Pro V8i for Beginners, Notion Press, 2014.
3.	Sham Tickoo., Learning Bentley Staa.Pro V8i for Structural Analysis, Dreamtech Press, 2015.
4.	Sham Tickoo., Exploring Bentley STAAD. Pro Connect Edition, CADCIM Technologies, 2018.
Web References:	
1.	https://www.sseacademy.com/s/store/courses/description/Learn-STAAD-Pro-online-English
2.	https://communities.bentley.com/products/ram-staad/w/structural_analysis_and_design_wiki/27659/online-training-resources-for-staad-pro
3.	https://books-library.net/files/download-pdf-ebooks.org-1512858630Bo3Y2.pdf
Online Resources:	
1.	https://www.udemy.com/course/staadpro-cs/
2.	https://coursesity.com/course-detail/bentley-staad-pro-v8i
3.	https://www.civilera.com/staad

21VA106	TOTAL STATION AND GPS SURVEYING	
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

C106.1	Understand the working of Total Station equipment and solve the surveying problems.	[U]
C106.2	Analyze the working principle of Total station & GPS, its components, signal structure of GPS and error sources	[AN]
C106.3	Distinguish the advantages of electronic surveying over conventional surveying methods	[AP]
C106.4	Apply the concepts of various techniques available for surveying and mapping with total station and GPS	[AP]
C106.5	Apply the concepts of GPS and data processing in various types of civil engineering works	[AP]
C106.6	Interpret the data with modern software tools for analyzing the results obtained 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 – software modules -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 and Remote 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