



**SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY**

**An Autonomous Institution, Affiliated to Anna University**

**Coimbatore - 641 008**

**DEPARTMENT OF CIVIL ENGINEERING**



**CURRICULUM AND SYLLABI  
BE CIVIL ENGINEERING  
REGULATION 2020**



**SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY**

An Autonomous Institution affiliated to Anna University, Chennai

Accredited by NAAC with 'A' Grade

Kuniamuthur, Coimbatore - 641 008

**DEPARTMENT OF CIVIL ENGINEERING**

**BE CIVIL ENGINEERING  
CURRICULUM AND SYLLABI  
REGULATION 2020  
CHOICE BASED CREDIT SYSTEM**

# SRI KRISHNA COLLEGE OF ENGINEERING 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**

- Provide high quality technical education for Undergraduate, Post Graduate and Doctoral Programmes in Civil Engineering.
- Create excellent infrastructural facility and state-of-the-art Laboratories.
- Encourage faculty and students to carry out socially relevant research through collaboration with industry.
- Inculcate ethics and ensure commitment to the society with leadership qualities.

### 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

- |       |   |  |
|-------|---|--|
| PEO 1 | <b>Employability Skills</b>               | Graduates will emerge as competitive professionals in collaboration with renowned builders and set a benchmark in the field of construction.   |
| PEO 2 | <b>Technical Competencies</b>             | Graduates will adapt to the latest technological development and continue to be a competitive Civil Engineer / Entrepreneur.   |
| PEO 3 | <b>Critical Analysis and Design Tools</b> | Graduates will apply logical reasoning and analytical thinking to analyze, interpret, solve multifaceted problems in the field of Civil Engineering and identify advanced tools to satisfy the demands of the society. |

## 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

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

<b>SEMESTER I</b>							
<b>SL. No.</b>	<b>Course Code</b>	<b>Course</b>	<b>L/T/P</b>	<b>Contact hrs./wk.</b>	<b>C</b>	<b>Ext./Int.</b>	<b>Cat.</b>
<b>THEORY</b>							
1.	20CE101	Introduction to Civil Engineering	3/0/0	3	3	50 /50	ESC
<b>THEORY CUM PRACTICAL</b>							
2.	20MA101	Engineering Mathematics I	2/1/2	5	4	40/60	BSC
3.	20CH101	Engineering Chemistry	3/0/3	6	4.5	40/60	BSC
4.	20CS111	Problem Solving Using C Programming	3/0/2	5	4	40/60	ESC
5	20EN101	Technical Communication Skills	2/0/2	4	3	40/60	HSMC
<b>PRACTICAL</b>							
6	20ME111	Engineering Graphics	1/0/3	4	2.5	40/60	ESC
<b>MANDATORY COURSE</b>							
7.	20MC101	Mandatory Course I	3 WEEKS		0	0/100	MC
<b>Total</b>			<b>14/1/12</b>	<b>27</b>	<b>21</b>	<b>700</b>	

<b>SEMESTER II</b>							
<b>SL. No.</b>	<b>Course Code</b>	<b>Course</b>	<b>L/T/P</b>	<b>Contact hrs./wk.</b>	<b>C</b>	<b>Ext./Int.</b>	<b>Cat.</b>
<b>THEORY CUM PRACTICAL</b>							
1.	20CE201	Architectural Planning and Building Drawing	3/0/2	5	4	40/60	ESC
2.	20MA201	Engineering Mathematics II	2/1/2	5	4	40/60	BSC
3.	20PH201	Applied Physics	3/0/3	6	4.5	40/60	BSC
4.	20EE111	Basics of Electrical and Electronics Engineering	3/0/2	5	4	40/60	ESC
<b>PRACTICAL</b>							
5.	20CS211	Python for Engineers Laboratory	1/0/3	4	2.5	40/60	ESC
6.	20ME103	Engineering Practices Laboratory	0/0/3	3	1.5	40/60	ESC
<b>MANDATORY COURSE</b>							
7.	20MC102	Mandatory Course II	2/0/0	2	0	0/100	MC
<b>Total</b>			<b>14/1/15</b>	<b>30</b>	<b>20.5</b>	<b>700</b>	

<b>SEMESTER III</b>							
<b>SL. No.</b>	<b>Course Code</b>	<b>Course</b>	<b>L/T/P</b>	<b>Contact hrs./wk.</b>	<b>C</b>	<b>Ext./Int.</b>	<b>Cat.</b>
<b>THEORY</b>							
1.	20ME201	Engineering Mechanics	3/1/0	4	4	50/50	ESC
2.	20GE201	Universal Human Values	3/0/0	3	3	50/50	HSMC
<b>THEORY CUM PRACTICAL</b>							
3.	20MA301	Engineering Mathematics III	2/1/2	5	4	40/60	BSC
4.	20CE301	Construction Materials and Techniques	3/0/2	5	4	40/60	PCC
5.	20CE302	Fluid Mechanics and Hydraulic Machinery	3/0/2	5	4	40/60	PCC
6.	20CE303	Surveying and Geomatics	3/0/2	5	4	40/60	PCC
<b>MANDATORY COURSE</b>							
7.	20MC104	Mandatory Course III	2/0/0	2	0	0/100	MC
<b>Total</b>			<b>19/2/8</b>	<b>29</b>	<b>23</b>	<b>700</b>	

<b>SEMESTER IV</b>							
<b>SL. No.</b>	<b>Course Code</b>	<b>Course</b>	<b>L/T/P</b>	<b>Contact hrs./wk.</b>	<b>C</b>	<b>Ext./Int.</b>	<b>Cat.</b>
<b>THEORY</b>							
1.	20CE401	Solid Mechanics	3/0/0	3	3	50/50	PCC
<b>THEORY CUM PRACTICAL</b>							
2.	20MA401	Probability and Numerical Methods	2/1/2	5	4	40/60	BSC
3.	20CE402	Engineering Geology and Concrete Technology	3/0/2	5	4	40/60	PCC
4.	20CE403	Environmental Engineering	3/0/2	5	4	40/60	PCC
5.	20CE404	Geotechnical Engineering	3/0/2	5	4	40/60	PCC
6.	20CE405	Transportation Engineering	3/0/2	5	4	40/60	PCC
<b>MANDATORY COURSE</b>							
7.	20MC103	Mandatory Course IV	2/0/0	2	-	0/100	MC
<b>Total</b>			<b>19/1/10</b>	<b>30</b>	<b>23</b>	<b>700</b>	

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

<b>SEMESTER VI</b>							
<b>SL. No.</b>	<b>Course Code</b>	<b>Course</b>	<b>L/T/P</b>	<b>Contact hrs./wk.</b>	<b>C</b>	<b>Ext./Int.</b>	<b>Cat.</b>
<b>THEORY</b>							
1.	20xxxxx	Open Elective II	3/0/0	3	3	50/50	OEC
2.	20CE0xx	Emerging Elective II	3/0/0	3	3	50/50	EEC
3.	20CE9xx	Professional Elective II	3/0/0	3	3	50/50	PEC
<b>THEORY CUM PRACTICAL</b>							
4.	20CE601	Construction Cost Estimation and Valuation	3/0/3	6	4.5	40/60	PCC
5.	20CE602	Design of Steel Structures	3/0/3	6	4.5	40/60	PCC
6.	20CE603	Structural Analysis	3/0/2	5	4	40/60	PCC
<b>EMPLOYABILITY ENHANCEMENT SKILLS</b>							
7.	20EES01	Employability Enhancement Skills (Summer Internship / Summer Training - 4 weeks)			2	40/60	EES
<b>Total</b>			<b>18/0/8</b>	<b>26</b>	<b>24</b>	<b>700</b>	

SEMESTER VII							
SL. No.	Course Code	Course	L/T/P	Contact hrs./wk.	C	Ext./Int.	Cat.
<b>THEORY</b>							
1.	20CE0xx	Emerging Elective III	3/0/0	3	3	50/50	EEC
2.	20CE0xx	Emerging Elective IV	3/0/0	3	3	50/50	EEC
3.	20CE9xx	Professional Elective III	3/0/0	3	3	50/50	PEC
4.	20CE9xx	Professional Elective IV	3/0/0	3	3	50/50	PEC
5.	20CE9xx	Professional Elective V	3/0/0	3	3	50/50	PEC
6.	20CE9xx	Professional Elective VI	3/0/0	3	3	50/50	PEC
<b>PROJECT WORK</b>							
6.	20CE701	Design Comprehensive Project	0/0/2	2	1	40/60	PROJ
<b>Total</b>			<b>18/0/2</b>	<b>20</b>	<b>19</b>	<b>700</b>	

SEMESTER VIII							
SL. No.	Course Code	Course	L/T/P	Contact hrs./wk.	C	Ext./Int.	Cat.
<b>PROJECT WORK</b>							
1.	20CE801	Project Work	0/0/24	24	12	40/60	PROJ
<b>Total</b>			<b>0/0/24</b>	<b>24</b>	<b>12</b>	<b>100</b>	

#### 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
<b>Total</b>		<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>5+2</b>	<b>5+2</b>	<b>1+6</b>	<b>1</b>	<b>40+10</b>

### COURSES DISTRIBUTION - SUMMARY

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

### 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
<b>Total</b>		<b>21</b>	<b>20.5</b>	<b>23</b>	<b>23</b>	<b>22.5</b>	<b>24</b>	<b>19</b>	<b>12</b>	<b>165</b>	<b>100</b>

## 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
<i>*Minor Variations is allowed as per need of the respective disciplines</i>			

**HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT (10.5 Credits)**

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	20EN101	Technical Communication skills	2/0/2	4	3	HSMC
2.	20GE201	Universal Human Values	3/0/0	3	3	HSMC
3	20CE602	Construction Engineering 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.	20MA101	Engineering Mathematics I	2/1/2	5	4	BSC
2.	20CH101	Engineering Chemistry	3/0/3	6	4.5	BSC
3.	20MA201	Engineering Mathematics II	2/1/2	5	4	BSC
4.	20PH201	Applied Physics	3/0/3	6	4.5	BSC
5.	20MA301	Engineering Mathematics III	2/1/2	5	4	BSC
6.	20MA401	Probability and Numerical Methods	2/1/2	5	4	BSC

**ENGINEERING SCIENCE COURSES (25.5 Credits)**

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	20CE101	Introduction to Civil Engineering	3/0/0	3	3	ESC
2.	20CS111	Problem Solving using C Programming	3/0/2	5	4	ESC
	20ME111	Engineering Graphics	1/0/3	4	2.5	ESC
3.	20EE111	Basics of Electrical and Electronics Engineering	3/0/2	5	4	ESC
4.	20CS211	Python for Engineers Laboratory	1/0/3	4	2.5	ESC
5.	20ME103	Engineering Practices Laboratory	0/0/3	3	1.5	ESC
6.	20ME101	Engineering Mechanics	3/1/0	4	4	ESC
7.	20CE201	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.	20CE301	Construction Materials and Techniques	3/0/2	5	4	PCC
2.	20CE302	Fluid Mechanics and Hydraulic Machinery	3/0/2	5	4	PCC
3.	20CE303	Surveying and Geomatics	3/0/2	5	4	PCC
4.	20CE401	Solid Mechanics	2/1/0	3	3	PCC
5.	20CE402	Engineering Geology and Concrete Technology	3/0/2	5	4	PCC

6.	20CE403	Environmental Engineering	3/0/2	5	4	PCC
7.	20CE404	Geotechnical Engineering	3/0/2	5	4	PCC
8.	20CE405	Transportation Engineering	3/0/2	5	4	PCC
9.	20CE502	Design of Reinforced Concrete Structures	3/0/3	6	4.5	PCC
10.	20CE503	Mechanics of Materials	2/1/3	6	4.5	PCC
11.	20CE601	Construction Cost Estimation and Valuation	3/0/3	6	4.5	PCC
12.	20CE602	Design of Steel Structures	3/0/3	6	4.5	PCC
13.	20CE603	Structural Analysis	2/1/2	5	4	PCC

### PROFESSIONAL ELECTIVE COURSES (18 Credits)

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
<b>Elective Stream I: Structural and Foundation Engineering</b>						
1.	20CE901	Damage Detection and Rehabilitation of Concrete Structures	3/0/0	3	3	PEC
2.	20CE902	Design Concepts of Substructure	3/0/0	3	3	PEC
3.	20CE903	Disaster Resistant Design of Structures	3/0/0	3	3	PEC
4.	20CE904	Green Building Technology	3/0/0	3	3	PEC
5.	20CE905	Ground Improvement and Land Reclamation Methods	3/0/0	3	3	PEC
6.	20CE906	Prefabricated Structures	3/0/0	3	3	PEC
7.	20CE907	Prestressed Concrete Structures	3/0/0	3	3	PEC
8.	20CE908	Tall Structures	3/0/0	3	3	PEC
9.	20CE909	Valuation of Civil Engineering Structures	3/0/0	3	3	PEC
<b>Elective Stream II: Environmental and Water Resource Engineering</b>						
1.	20CE910	Air and Noise Pollution	3/0/0	3	3	PEC
2.	20CE911	Ecological and Biological Principles and Process	3/0/0	3	3	PEC
3.	20CE912	Environmental Risks: Hazard, Assessment and Management	3/0/0	3	3	PEC
4.	20CE913	GIS for Environmental Engineering	3/0/0	3	3	PEC
5.	20CE914	Industrial Wastes Treatment and Disposal	3/0/0	3	3	PEC
6.	20CE915	Irrigation Engineering	3/0/0	3	3	PEC
7.	20CE916	Occupational Hazards and Industrial Safety	3/0/0	3	3	PEC
8.	20CE917	Renewable and Sustainable Energy	3/0/0	3	3	PEC
9.	20CE918	Surface Water Hydrology	3/0/0	3	3	PEC
<b>Elective Stream III: Infrastructural Engineering and Management</b>						
1.	20CE919	Airport, Docks and Harbors	3/0/0	3	3	PEC
2.	20CE920	Construction Methods and Equipment Management	3/0/0	3	3	PEC

3.	20CE921	Disaster Preparedness and Planning Management	3/0/0	3	3	PEC
4.	20CE922	Infrastructure Asset Management and Financing	3/0/0	3	3	PEC
5.	20CE923	Pavement construction and management	3/0/0	3	3	PEC
6.	20CE924	Project Safety Management	3/0/0	3	3	PEC
7.	20CE925	Sustainable and Eco-friendly Building Materials	3/0/0	3	3	PEC
8.	20CE926	Traffic Engineering and Management	3/0/0	3	3	PEC
9.	20CE927	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.	20CE007	Building Services and Management	3/0/0	3	3	EEC
2.	20CE008	Clean Energy Production	3/0/0	3	3	EEC
3.	20CE009	Economics and Business finance for Civil Engineers	3/0/0	3	3	EEC
4.	20CE010	Instrumentation and Sensor Technologies for Engineering Applications	3/0/0	3	3	EEC
5.	20CE011	Lean startup Management	3/0/0	3	3	EEC
6.	20CE012	Metro Systems and Engineering	3/0/0	3	3	EEC
7.	20CE013	Pre-Engineered Industrial Structures	3/0/0	3	3	EEC
8.	20CE014	Risk and Reliability Analysis of Civil Infrastructure Systems	3/0/0	3	3	EEC
9.	20CE015	Rural water supply development and Onsite Sanitation Systems	3/0/0	3	3	EEC
10.	20CE016	Contaminated site assessment and Remediation	3/0/0	3	3	EEC
11.	20CE017	Smart City Planning and Development	3/0/0	3	3	EEC
12.	20CE018	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.	20CE001	Disaster Management	3/0/0	3	3	OEC
2.	20CE002	Engineering Risk and Uncertainty	3/0/0	3	3	OEC
3.	20CE003	Environmental Impact Assessment and Life Cycle Analysis	3/0/0	3	3	OEC
4.	20CE004	Geographical Information System	3/0/0	3	3	OEC
5.	20CE005	Industrial Pollution control and Prevention Techniques	3/0/0	3	3	OEC
6.	20CE006	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.	20CE701	Design Comprehensive Project	0/0/2	2	1	PROJ
2.	20CE801	Project Work	0/0/24	24	12	PROJ

**EMPLOYABILITY ENHANCEMENT SKILLS (2 Credits)**

SL. No.	Course Code	Course Title	Duration	C	Cat.
1.	20EES01	Employability Enhancement Skills (Summer Internship / Summer Training)	4 WEEKS	2	EES

**MANDATORY COURSES (Non-credit)**

SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	20MC101	Induction Programme	3 WEEKS		0	MC
2.	20MC102	Environmental Sciences	2/0/0	2	0	MC
3.	20MC103	Soft Skills	2/0/0	2	0	MC
4.	20MC104	Management Organizational Behaviour	2/0/0	2	0	MC
5.	20MC105	General Aptitude	2/0/0	2	0	MC

**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

<b>20CE101</b>	<b>INTRODUCTION TO CIVIL ENGINEERING</b>	<b>3/0/0/3</b>
<b>Nature of Course</b>	Theory	
<b>Prerequisites</b>	Nil	
<b>Course Objectives:</b>		
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 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	
<b>Course Outcomes:</b>		
<b>Upon completion of the course, students shall have the ability to</b>		
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 environmental engineering	[U]
C101.6	Discuss the fundamental principles in transportation engineering	[UP]
<b>Course Contents:</b>		
<b>Module 1: Civil Engineering Structures and Materials</b>		<b>15 Hrs.</b>
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.		
<b>Module 2: Building Components and Construction</b>		<b>15 Hrs</b>
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.		
<b>Module 3: Infrastructure Engineering</b>		<b>15 Hrs</b>
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 Hours**

**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” Createspace Independent Publishers, 2014.
5	Anurag Kandya “Elements Of Civil Engineering” Charotar Publishing House Pvt. Limited, 2015

**Reference Books:**

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	Construction Contracts, <a href="http://www.jnormanstark.com/contract.htm">http://www.jnormanstark.com/contract.htm</a>
2	Internet and Business Handbook, Chap 4, Contracts law, <a href="http://www.laderapress.com/laderapress/contractslaw1.html">http://www.laderapress.com/laderapress/contractslaw1.html</a>
3	Contract & Agreements , <a href="http://www.tco.ac.ir/law/English/agreements/General/Contract%20Law/C.htm">http://www.tco.ac.ir/law/English/agreements/General/Contract %20Law/C.htm</a>
4	Contracts, <a href="http://206.127.69.152/jgretch/crj/211/ch7.ppt">http://206.127.69.152/jgretch/crj/211/ch7.ppt</a>
5	Business & Personal Law. Chapter 7. “How Contracts Arise”, <a href="http://yucaipahigh.com/schristensen/lawweb/lawch7.ppt">http://yucaipahigh.com/schristensen/lawweb/lawch7.ppt</a>
6	Types of Contracts, <a href="http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt">http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt</a>
7	IV. Types Of Contracts And Important Provisions, <a href="http://www.worldbank.org/html/opr/consult/guidetxt/types.html">http://www.worldbank.org/html/opr/consult/guidetxt/types.html</a>
8	Contract Types/Pricing Arrangements Guideline- 1.4.G (11/04/02), <a href="http://www.sandia.gov/policy/14g.pdf">http://www.sandia.gov/policy/14g.pdf</a>
9	<a href="http://www.ieindia.org">www.ieindia.org</a>
10	<a href="https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture-notes/">https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture-notes/</a>
11	<a href="http://nptel.ac.in/courses/113106032/4%20-%20Crystal%20structure.pdf">http://nptel.ac.in/courses/113106032/4%20-%20Crystal%20structure.pdf</a>
12	<a href="https://www.kluniversity.in/physics/pdfs/crypdf.pdf">https://www.kluniversity.in/physics/pdfs/crypdf.pdf</a>

**Tentative Assessment Methods & Levels (based on Revised Bloom’s Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

Course Outcome	Revised Bloom’s Level	Assessment Component	Marks
C101.1 & C101.3	Understand	Online Quiz	5
C101.2	Apply	Group assignment	5
C101.4 & C101.5	Understand	Group assignment	5
C101.6	Understand	Announced test	5

**Summative assessment based on Continuous and End Semester Examination**

Revised Bloom’s	Continuous Assessment			End Semester Examination
	CIA – I	CIA – II	CIA – III	

Level	[10 Marks]	[10 Marks]	[10 Marks]	(50 marks)											
Remember	-	-	-	-											
Understand	50	60	60	60											
Apply	50	40	40	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	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		
<b>Avg</b>	2					2	2	2				2	3		
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

<b>20MA101</b>	<b>ENGINEERING MATHEMATICS I</b> <b>(COMMON TO MECH,MCT,CIVIL,ECE,EEE,CSE,IT,AIDS)</b>		<b>2/1/2/4</b>
<b>Nature of Course</b>	Problem analytical		
<b>Pre requisites</b>	Concept of Differentiation and matrices		
<b>Course Objectives:</b>			
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.		
<b>Course Outcomes:</b>			
<b>Upon completion of the course, students shall have ability to</b>			
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]	
<b>Course Contents: Theory</b>			
<b>Module 1: Matrices</b>			<b>14 Hrs</b>
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.			
<b>Module 2: Solution of Equations and Eigenvalue Problems</b>			<b>16 Hrs</b>
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 – Eigenvalue of a matrix by Power method and Jacobi method.			
<b>Module 3: Calculus</b>			<b>18 Hrs</b>
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.			
<b>Laboratory Course Content:</b>			
<b>S. No</b>	<b>List of Experiments</b>	<b>CO Mapping</b>	<b>BT</b>

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]
<b>Total Hours:(48+12)</b>			<b>60</b>
<b>Text Books:</b>			
1	G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 14 <sup>th</sup> 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", 43 <sup>rd</sup> edition, Khanna Publications, Delhi, 2018.		
<b>Reference Books:</b>			
1	Veerarajan. T, "Engineering Mathematics I", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018.		
2	Glyn James, —Advanced Modern Engineering Mathematics, Pearson Education, 4 <sup>th</sup> edition, 2012.		
3	N.P.Bali and Dr.ManishGoyal,"A Text book of Engineering Mathematics" 9 <sup>th</sup> edition, Laxmi publications ltd, 2014.		
<b>Web References:</b>			
1	<a href="http://www.nptel.ac.in/courses/111105035">http://www.nptel.ac.in/courses/111105035</a>		
2	<a href="http://www.nptel.ac.in/courses/122104017">http://www.nptel.ac.in/courses/122104017</a>		
3	<a href="http://nptel.ac.in/courses/122102009">http://nptel.ac.in/courses/122102009</a>		
4	<a href="http://nptel.ac.in/courses/111107063">http://nptel.ac.in/courses/111107063</a>		
<b>Online Resources:</b>			
1	<a href="https://www.coursera.org/learn/linearalgebra2">https://www.coursera.org/learn/linearalgebra2</a>		
2	<a href="https://www.coursera.org/learn/differentiation-calculus">https://www.coursera.org/learn/differentiation-calculus</a>		
3	<a href="https://www.coursera.org/learn/single-variable-calculus">https://www.coursera.org/learn/single-variable-calculus</a>		
4	<a href="https://alison.com/courses/Algebra-Functions-Expressions-and-Equations">https://alison.com/courses/Algebra-Functions-Expressions-and-Equations</a>		
<b>Tentative Assessment Methods &amp; Levels (based on Blooms' Taxonomy)</b>			
<b>Summative assessment based on Continuous and End Semester Examination</b>			
<b>Bloom's</b>	<b>Continuous Assessment</b>		<b>End Semester</b>

Level	Theory			Practical & Project	Examination (Theory) [40 marks]										
	CIA-I [10 marks]	CIA-II [10 marks]	CIA-III [10 marks]	Rubric based CIA [30 Marks]											
Remember	20	20	20	20	20										
Understand	30	30	30	30	30										
Apply	50	50	50	50	50										
Analyse	-	-	-	-	-										
Evaluate	-	-	-	-	-										
Create	-	-	-	-	-										
<b>Course Articulation Matrix</b>															
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	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		
<b>Avg</b>	3	3	3	3	3	2							3		
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

<b>20CH101</b>	<b>ENGINEERING CHEMISTRY (Common to all I Year B.E. / B.Tech)</b>		<b>3 /0 /3 /4.5</b>
<b>Nature of Course</b>	: E (Theory skill based)		
<b>Pre requisites</b>	: NIL		
<b>Course Objectives:</b>			
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 electroanalytical methods.		
4	To understand the basic concepts, synthesis, and applications of nanomaterials.		
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.		
<b>Course Outcomes:</b>			
<b>Upon completion of the course, students shall have ability to</b>			
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 Nanochemistry.		[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]
<b>Course Contents: Theory</b>			
<b>Module 1: Water chemistry and Corrosion</b>			<b>20 Hrs.</b>
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.			
<b>Module 2: Electrochemistry and Energy sources</b>			<b>20 Hrs.</b>
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<sub>2</sub>-O<sub>2</sub>). Storage Devices-Batteries - Alkaline-Lead acid, Nickel cadmium and Lithium-ion batteries.

**Module 3: Polymer chemistry, Spectroscopic techniques and Synthesis of drug molecules** **20 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-Aspirin, p-nitroaniline from acetanilide.

**Field work:**

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

**Laboratory course contents:**

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]
<b>Total Hours: (60 + 15)</b>			<b>75</b>

**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 redox principle
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 & Company Ltd., New Delhi 2015.
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2	Jain P. C. & Monica Jain., "Engineering Chemistry", 16 <sup>th</sup> Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.
3	Fundamentals of Molecular Spectroscopy, 4 <sup>th</sup> Edition by C. N. Banwell Publishing McGraw-Hill Book Company (P) Ltd, England, 1994.
4	Physical Chemistry, 11 <sup>th</sup> Edition by P. W. Atkins Publishing Oxford University Press (P) Ltd, United Kingdom, 2018.
5	Nanochemistry, 2 <sup>nd</sup> Edition by K. Klabunde, G. Sergeev Springer Publisher, 2013.
6	N.Krishna Murthy, Vallinayagam D., "Engineering Chemistry" 3 <sup>rd</sup> Edition by PHI Learning Pvt Ltd., 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" 3 <sup>rd</sup> Edition PHI Learning Pvt Ltd., 2014.

#### Reference Books:

1	Shikha Agarwal., "Engineering Chemistry and Applications", Cambridge University press, 2016.
2	Liliya.,Bazylak.I.,Gennady.E.,Zaikov.,Haghvi.A.K., "Polymers and Polymeric Composites" CRC Press, 2014.
3	Lefrou.,Christine.,Fabry.,Pierre.,Poignet.,Jean-claude., "Electrochemistry - The Basics, with examples" 2012 ., Springer.
4	Zaki Ahmad, Digby Macdonald, "Principles of Corrosion Engineering and Corrosion Control", Elsevier Science, 2nd Edition 2012.
5	Perez, Nestor, "Electrochemistry and Corrosion Science", Springer, 2016.
6	Introduction to Nano: basics to Nanoscience 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	<a href="http://www.analyticalinstruments.in/home/index.html">http://www.analyticalinstruments.in/home/index.html</a>
2	<a href="http://www.springer.com">www.springer.com</a> › Home › Chemistry › Electrochemistry
3	<a href="https://www.kth.se/.../electrochem/welcome-to-the-division-of-applied-electrochemistry">https://www.kth.se/.../electrochem/welcome-to-the-division-of-applied-electrochemistry</a>
4	<a href="http://www.edx.org/">www.edx.org/</a>
5	<a href="https://www.ntnu.edu/studies/courses">https://www.ntnu.edu/studies/courses</a>
6	<a href="http://www.corrosionsource.com/">www.corrosionsource.com/</a>

#### Online Resources:

1	<a href="http://nptel.ac.in/courses/105104102/hardness.htm">nptel.ac.in/courses/105104102/hardness.htm</a>
2	<a href="https://ocw.mit.edu/courses/chemistry">https://ocw.mit.edu/courses/chemistry</a>
3	<a href="http://nptel.ac.in/courses/105106112/1_introduction/5_corrosion.pdf">nptel.ac.in/courses/105106112/1_introduction/5_corrosion.pdf</a>
4	<a href="https://alison.com">https://alison.com</a> - Spectroscopic technique, Colorimetry
5	<a href="https://ocw.mit.edu/courses/chemistry">https://ocw.mit.edu/courses/chemistry</a>
6	<a href="http://nptel.ac.in/courses/113108051">nptel.ac.in/courses/113108051</a>

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

#### Summative assessment based on Continuous and End Semester Examination

Revised Bloom's Level	Continuous Assessment				End Semester Examination
	Theory			Practical Rubric	
	CIA-1	CIA-2	CIA-3		

	[10 marks]	[10 marks]	[10 marks]	based CIA [30 Marks]	(Theory) [40 marks]
Remember	30	30	30	10	20
Understand	60	50	40	20	50
Apply	10	20	30	40	30
Analyse	-	-	-	30	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

  

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

20CS111	<b>PROBLEM SOLVING USING C PROGRAMMING</b>		3/0/2/4
<b>Nature of Course</b>	F (Theory Programming)		
<b>Pre requisites</b>	Nil		
<b>Course Objectives:</b>			
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		
<b>Course Outcomes</b>			
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]
<b>Course Contents: Theory</b>			
<b>Module 1: Problem Solving Techniques and C Fundamentals</b>			<b>15 Hrs.</b>
<p>Problem Solving Techniques: Algorithm, Pseudo-code and Flowchart. Creative Thinking and Problem solving skills in everyday life. Understanding Compiler and interpreter. Program Development LifeCycle. 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 associativity. Data input and output - Preparing and running a Complete C Program</p>			
<b>Module 2: Control Structures, Arrays, Strings</b>			<b>15 Hrs.</b>
<p>Control Structures: Branching: if-else- Looping – while - do while – for - Nested control structures –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</p>			
<b>Module 3: Pointers, Functions, Structures and Unions:</b>			<b>15 Hrs.</b>
<p>Pointers: fundamentals – Pointer Declaration &amp; 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.</p>			
			<b>Total Hours</b>
			<b>45 Hrs</b>
<b>Laboratory course contents:</b>			
<b>S. No</b>	<b>List of Experiments</b>	<b>CO</b>	<b>BT</b>

		Mapping	
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]
<b>Total Hours (45+30)</b>			<b>75 Hrs</b>

#### Text Books:

1.	Sprankle M, "Problem Solving and Programming Concepts", 9 <sup>th</sup> Edition, Pearson Education, New Delhi, 2013
2.	Yashavant Kanetkar, "Let Us C", 16 <sup>th</sup> Edition, BPB Publication, 2017.
3.	Byron, S. Gottfreid, "Programming with C", McGraw Hill, Schaum's outlines, 4 <sup>th</sup> Edition, 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", 2 <sup>nd</sup> Edition Pearson Publications, 2015

#### Reference Books:

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

#### Web References:

1.	<a href="http://raptor.martincarlisle.com/">http://raptor.martincarlisle.com/</a>
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#### Online Resources:

1.	<a href="https://nptel.ac.in/courses/106/104/106104128/">https://nptel.ac.in/courses/106/104/106104128/</a>
2.	<a href="https://nptel.ac.in/courses/106/105/106105171/">https://nptel.ac.in/courses/106/105/106105171/</a>
3.	<a href="https://www.coursera.org/specializations/c-programming">https://www.coursera.org/specializations/c-programming</a>

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

#### Summative assessment based on Continuous and End Semester Examination

Revised Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory			Practical	
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	Rubric based CIA [30 Marks]	
Remember	30	30	20	20	20
Understand	70	50	30	20	40
Apply	-	20	50	60	40

Analyse	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Evaluate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Create	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Course Articulation Matrix</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
<b>1</b>	3	3	3						2	1		2	2		
<b>2</b>	3	3	3						2	1		2	2		
<b>3</b>	3	3	3						2	1		2	2		
<b>4</b>	3	3	3						2	1		2	2		
<b>5</b>	3	3	3						2	1		2	2		
<b>6</b>	3	3	3						2	1		2	2	1	1
<b>Avg</b>	3	3	3						2	1		2	2	1	1
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

<b>20EN101</b>	<b>TECHNICAL COMMUNICATION SKILLS (MECH/MCT/IT/CIVIL/CSE)</b>	<b>2/0/2/3</b>
<b>Nature of Course</b>	:E(Theory Skill Based)	
<b>Pre requisites</b>	Basics of English Language	
<b>Course Objectives:</b>		
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.	
<b>Course Outcomes:</b>		
<b>Upon completion of the course, students shall have ability to</b>		
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]
<b>Course Contents: Theory</b>		
<b>Module 1: Listening and Speaking</b>		<b>17 Hrs.</b>
Introduction to Effective Communication- Basics of English Language - Importance of LSRW Skills - Self Introduction - Introducing Others - <b>Listening</b> to Short Conversations or Monologues - Listening to Speeches / Talks - Listening and Responding -- Longer Listening Tasks -Recognise Functions <b>Speaking</b> - 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.		
<b>Module 2: Reading</b>		<b>13 Hrs.</b>
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.		
<b>Module 3: Grammar and Writing</b>		<b>15 Hrs.</b>
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).

**Laboratory course contents:**

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]
<b>Total Hours: (45+15)</b>			<b>60</b>

**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.

**Reference Books:**

1	Study Writing. Liz Hamp-Lyons and Ben Heasley. 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	<a href="http://www.academiccourses.com/Courses/English/Business-English">http://www.academiccourses.com/Courses/English/Business-English</a>
2	<a href="https://steptest.in">https://steptest.in</a>

**Online Resources:**

1	<a href="https://www.coursera.org/specializations/business-english">https://www.coursera.org/specializations/business-english</a>
2	<a href="http://www.academiccourses.com/Courses/English/Business-English">http://www.academiccourses.com/Courses/English/Business-English</a>
3	<a href="https://scoop.eduncle.com/one-word-substitution-list">https://scoop.eduncle.com/one-word-substitution-list</a>

**Assessment Methods & Levels (based on Blooms' Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory			Practical	
	CIA-I [10 marks]	CIA-II [10 marks]	Term End Examination [10 marks]		
Remember	20	20	20	20	20
Understand	40	40	40	40	40
Apply	40	40	40	40	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		2			2			
2							3		2			2			
3							3		2			2			
4						3	3		2			2			
5							3		2						
6							3		2			2			
<b>Avg</b>						3	3		2			2			
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

20ME111	ENGINEERING GRAPHICS		1/0/3/2.5
<b>Nature of Course</b>	Practical application		
<b>Pre Requisites</b>	Basic Drawing and Computer Knowledge		
<b>Course Objectives:</b>			
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.		
<b>Course Outcomes:</b>			
<b>Upon completion of the course, students shall have ability to</b>			
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 modelling software.		[A]
<b>Course Contents: Theory</b>			
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.			
<b>Laboratory course contents:</b>			
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 Involute)	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]
<b>Total Hours:</b>			<b>45</b>
<b>Reference Books:</b>			
1	Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50 <sup>th</sup> 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.														
<b>Web References:</b>															
1	<a href="http://nptel.ac.in/courses/112102101/">http://nptel.ac.in/courses/112102101/</a>														
2	www.solidworks.com														
<b>Tentative Assessment Methods &amp; Levels (based on Bloom's Taxonomy)</b>															
<b>Summative assessment based on Continuous and End Semester Examination</b>															
<b>Bloom's Level</b>	<b>Rubric based Continuous Assessment [60 marks]</b>										<b>End Semester Examination [40 marks]</b>				
Remember	30										30				
Understand	30										30				
Apply	20										20				
Analyze	20										20				
Evaluate	0										0				
Create	0										0				
<b>Course Articulation Matrix</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
<b>1</b>	2	2	2				2	2	3		2	2	2		
<b>2</b>	2	2	2				2	2	3		2	2	2		
<b>3</b>	2	2	2				2	2	3		2	2	2		
<b>4</b>	2	2	2				2	2	3		2	2	2		
<b>Avg</b>	2	2	2				2	2	3		2	2	2		
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

## SEMESTER 2

<b>20CE201</b>	<b>ARCHITECTURAL PLANNING AND BUILDING DRAWING</b>	<b>3/0/3/4.5</b>
<b>Nature of Course</b>	Theory Application	
<b>Pre-requisites</b>	Nil	
<b>Course Objectives:</b>		
1.	To introduce the various facets of architecture and planning for a holistic understanding of the disciplines.	
2.	To understand the elements and principles of architecture.	
3.	To understand the design approach of various building types with specific reference to site and climate.	
4.	To understand the building rules, Bye laws and Building Information Modelling (BIM).	
<b>Course Outcomes: Theory</b>		
<b>Upon completion of the course, students shall have ability to</b>		
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 and their significance .	[AP]
C201.6	Discuss the Building Information Modelling concepts and its significance.	[AP]
<b>Course Contents: Theory</b>		
<b>Module 1: Introduction and Elements of Architecture</b>		<b>15 Hrs</b>
<p>Definitions of Architecture – architecture as a discipline – context for architecture as satisfying human needs: functional, aesthetic and psychological- outline of components and aspects of architectural form. Building typologies: Residential, institutional, commercial and Industrial types – Anthropometry and space standards- Functional relationships - Understanding fundamental elements such as point, line, plane, form and space, shape, pattern, light, color, surface and texture. Understanding perceptual effects of geometric forms such as sphere, cube, pyramid, cylinder and cone. Understanding perceptual effects of configuration of architectural spaces – Spatial relationship and its types, Spatial organization and its types – built form and open space relationships.</p>		
<b>Module 2: Principles of Architecture and Climate responsive design</b>		<b>15 Hrs</b>
<p>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</p>		

climate – Characteristics of climate types – Design for various climate types – Passive and active energy controls - Simple passive design considerations.

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

Building Rules and Bye-laws - Overview to National Building Code (NBC) -Overview to Development Control Regulation (DCR) - Guidelines -Floor Space Index (FSI)- Floor Area Ratio (FAR)- Setbacks-Open space reservation (OSR) - Industries - Fire safety regulations-Building services-Building Approval Process -Plan Requirements- Real estate regulatory authority (RERA)- Building Information Modelling –Concepts -Advantages - Drawing based process vs BIM process- 3D Simulations- 4D Scheduling- 5D Costing- 6D Sustainability- 7D Facility and Asset Management- Design Coordination - BIM softwares -Case studies.

**Total Hours** | **45 Hrs**

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

C201.1	Design a single storied residential space for a given client set and draft its sectional and elevation views.	[AN]
C201.2	Design a hospital building with all amenities and draft its sectional and elevational views.	[AN]
C201.3	Design a school building with all amenities and draft its sectional and elevational views.	[AN]
C201.4	Design a factory building with North Light roof truss & G+1 commercial building and draft its sectional and elevational 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 Exercises	CO Mapping	RBT
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 school building	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+1 commercial 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 Light Roof 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 (Navisworks) and Visual Programming environment for automation (Dynamo Studio)	C201.6	[U]

**Text Books :**

1.	Simon Unwin, "Analysing Architecture", Routledge; 4 <sup>th</sup> 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" McGraw Hill Education, fifth reprint edition 2013.

**Reference Books**

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.	<a href="http://www.civilengineeringx.com/building-design-and-construction-handbook">http://www.civilengineeringx.com/building-design-and-construction-handbook</a>
2.	<a href="https://www.thebalancesmb.com/designing-climate-responsive-architecture-3157812">https://www.thebalancesmb.com/designing-climate-responsive-architecture-3157812</a>

**Online Resources:**

1.	<a href="http://char.txa.cornell.edu/language/principl/principl.htm">http://char.txa.cornell.edu/language/principl/principl.htm</a>
2.	<a href="https://www.open.edu.au/sitecore/content/Alchemy/Home/degrees/master-of-urban-and-regional-planning-curtin-university-cur-urp-mas">https://www.open.edu.au/sitecore/content/Alchemy/Home/degrees/master-of-urban-and-regional-planning-curtin-university-cur-urp-mas</a>

**Tentative Assessment Methods and Levels (based on Revised Bloom's Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

Revised Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 Marks]
	Theory			Practical Rubric based CIA [30 Marks]	
	CIA-I [10 Marks]	CIA-II [10 Marks]	CIA-III [10 Marks]		
Remember	20	20	10	-	10
Understand	30	20	20	30	20
Apply	50	60	70	70	70
Analyse	-	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

**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
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<b>1</b>	3	2	1							1		1	2	2	1
<b>2</b>	3	2	1							1		1	2	2	1
<b>3</b>	3	2	1							1		1	2	2	1
<b>4</b>	3	2	1				3			1		1	2	2	1
<b>5</b>	3	2	1							1		1	2	2	1
<b>6</b>	3	2	1							1		1	2	2	1
<b>Avg</b>	3	2	1				3			1		1	2	2	1
<b>Course Articulation Matrix – Laboratory</b>															
<b>1</b>	3	2	1		3		2	3	3	2		1	2	2	1
<b>2</b>	3	2	1		3		2	3	3	2		1	2	2	1
<b>3</b>	3	2	1		3		2	3	3	2		1	2	2	1
<b>4</b>	3	2	1		3		2	3	3	2		1	2	2	1
<b>5</b>	3	2	1		3		2	3	3	2		1	2	2	1
<b>6</b>	3	2	1		3		2	3	3	2		1	2	2	1
<b>Avg</b>	3	2	1		3		2	3	3	2		1	2	2	1
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed				

<b>20MA201</b>	<b>ENGINEERING MATHEMATICS II (COMMON TO MECH,MCT,CIVIL,ECE,EEE,CSE,IT,AIDS)</b>		<b>2/1/2/4</b>
<b>Nature of Course</b>			
		Problem analytical	
<b>Pre requisites</b>			
		Concepts of Differentiation and Integration.	
<b>Course Objectives:</b>			
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 engineering disciplines.		
4	To impart the knowledge of Laplace transform, to find solutions of initial value problems for linear ordinary differential equations.		
<b>Course Outcomes:</b>			
<b>Upon completion of the course, students shall have ability to</b>			
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 a 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 modelling, digital signal processing, process control, solving boundary value problems.		[AP]
C201.6	Apply Laplace transform methods for solving linear differential equations.		[AP]
<b>Course Contents: Theory</b>			
<b>Module 1: INTEGRAL CALCULUS</b>			<b>18 Hrs.</b>
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.			
<b>Module 2: VECTOR CALCULUS</b>			<b>14 Hrs.</b>
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.			
<b>Module 3: LAPLACE TRANSFORM</b>			<b>16 Hrs.</b>
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.

**Laboratory course contents:**

S.No.	List of Exercises	CO Mapping	RBT
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]
<b>Total Hours:(48+12)</b>			<b>60</b>

**Text Books:**

1	G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 14 <sup>th</sup> 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", 43 <sup>rd</sup> edition, Khanna Publications, Delhi, 2014.

**Reference Books:**

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

**Web References:**

1	<a href="http://nptel.ac.in/video.php?subjectId=122107037">http://nptel.ac.in/video.php?subjectId=122107037</a>
2	<a href="http://nptel.ac.in/courses/122107036/">http://nptel.ac.in/courses/122107036/</a>
3	<a href="http://nptel.ac.in/video.php?subjectId=117102060">http://nptel.ac.in/video.php?subjectId=117102060</a>

**Online Resources:**

1	<a href="https://www.coursera.org/learn/pre-calculus">https://www.coursera.org/learn/pre-calculus</a>
2	<a href="https://www.coursera.org/learn/linearalgebra1">https://www.coursera.org/learn/linearalgebra1</a>

3	<a href="https://alison.com/courses/Advanced-Mathematics-1">https://alison.com/courses/Advanced-Mathematics-1</a>
4	<a href="https://www.edx.org/course/algebra-lineal-mexicox-acf-0903-1x">https://www.edx.org/course/algebra-lineal-mexicox-acf-0903-1x</a>

**Assessment Methods & Levels (based on Blooms' Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory			Practical & Project	
	CIA-I [10 marks]	CIA-II [10 marks]	CIA-III [10 marks]	Rubric based CIA [30 Marks]	
Remember	20	20	20	20	20
Understand	30	30	30	30	30
Apply	50	50	50	50	50
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	2	2	2	1	2	1							1		
2	2	2	2	2	2	2							2		
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		
<b>Avg</b>	2	2	2	2	2	2							2		
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed				

20PH201	<b>APPLIED PHYSICS</b> (Common to Mech. MCT and Civil)		3/0/3/4.5
<b>Nature of Course</b>	Theory skill based		
<b>Prerequisites</b>	Nil		
<b>Course Objectives:</b>			
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.		
<b>Course Outcomes: Theory</b>			
<b>Upon completion of the course, students shall have the ability to</b>			
C201.1	Describe the bending behavior beams, analyze the expression for young's modulus and working of torsional pendulum.		[U]
C201.2	Identify the various parameters that are measurable in different instruments.		[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 field of study.		[AP]
<b>Course Contents: Theory</b>			
<b>Module 1: Properties of Matter and Instrumentations:</b>			<b>15 Hrs.</b>
<p><b>Properties of matter:</b> 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 per unit twist of a solid cylinder (derivation), torsional pendulum, expression for period of oscillation.</p> <p><b>Instrumentations:</b> 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.</p>			
<b>Module 2: Harmonic Oscillations and Laser</b>			<b>15 Hrs.</b>
<p><b>Harmonic oscillations:</b> 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.</p> <p><b>Laser:</b> characteristics of laser – Principle of spontaneous emission and stimulated emission – Einstein's theory of matter radiation interaction and A and B coefficients (derivation) –</p>			

Population inversion – Pumping – Different types of lasers: Neodymium laser, CO<sub>2</sub> 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

**45 Hours**

**Laboratory course contents**

S.No.	List of Exercises	CO Mapping	RBT
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]
<b>Life Skills Experiments</b>			
1	How does a fuel (gas/liquid) pump nozzle shut off?	C201.6	[U]
2	How does a circuit breaker work?	C201.6	[U]
3	How to Check Earthing at Home?	C201.6	[U]
<b>Total Hours:</b>			<b>75</b>

**Text Books:**

1	David Halliday, Robert Resnick, Jearl Walker "Fundamentals of Physics" Wileyplus.2018
2	Rajendran, V "Engineering Physics" Mc Graw Hill Publications ltd, New Delhi, 2016.

**Reference Books:**

1	Avadhanulu M.N., Kshirshagar P.G., Arun Murthy TVS "A Text Book of Engineering Physics" S. Chand & Co Ltd, 2018.
2	Sawhney A.K., Puneet Sawhney "A Course In Mechanical Measurements And Instrumentation & Control" Dhanpat Rai & Co, 2013.
3	Richard P. Feynman. Robert B. Leighton, Matthew Sands "The Feynman Lectures on Physics Vol. I": The New Millennium Edition.2015

**Web References:**

1	<a href="https://faraday.physics.utoronto.ca/IYearLab/Elastic-properties-of-solids-manual.pdf">https://faraday.physics.utoronto.ca/IYearLab/Elastic-properties-of-solids-manual.pdf</a>
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2	<a href="https://www.physik.uzh.ch/~matthias/espace-assistant/manuals/en/anleitung_102-tb_e.pdf">https://www.physik.uzh.ch/~matthias/espace-assistant/manuals/en/anleitung_102-tb_e.pdf</a>
3	<a href="https://ir.nctu.edu.tw/bitstream/11536/1680/1/A1995TF11100052.pdf">https://ir.nctu.edu.tw/bitstream/11536/1680/1/A1995TF11100052.pdf</a>
4	<a href="http://www2.optics.rochester.edu/workgroups/cml/whole-enchilada-SPR05.pdf">http://www2.optics.rochester.edu/workgroups/cml/whole-enchilada-SPR05.pdf</a>
5	<a href="https://nptel.ac.in/courses/122/103/122103010/">https://nptel.ac.in/courses/122/103/122103010/</a>
6	<a href="https://nptel.ac.in/courses/115/106/115106119/">https://nptel.ac.in/courses/115/106/115106119/</a>
7	<a href="https://www.eatm.in/upload/srit_unit_i_laser.pdf">https://www.eatm.in/upload/srit_unit_i_laser.pdf</a>
8	<a href="https://nptel.ac.in/courses/115/101/115101107/">https://nptel.ac.in/courses/115/101/115101107/</a>
9	<a href="https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture-notes/">https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture-notes/</a>
10	<a href="http://nptel.ac.in/courses/113106032/4%20-%20Crystal%20structure.pdf">http://nptel.ac.in/courses/113106032/4%20-%20Crystal%20structure.pdf</a>

**Tentative Assessment Methods & Levels (based on Blooms' Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory			Practical	
	CIA-I [10 marks]	CIA-II [10 marks]	CIA-III [10 marks]	Rubric based CIA [30 Marks]	
Remember	30	20	30	20	30
Understand	60	60	60	40	60
Apply	10	20	10	30	10
Analyse	-	-	-	10	-
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	2	1		1					2				1		
2	2	1		1					2				1		
3	2	1		1					2				1		
4	2	1		1					2				1		
5	3	2		2					3				2		
6	3	2		2					3				2		
<b>Avg</b>	2	1		1					2				1		
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

<b>20EE111</b>	<b>BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING (COMMON TO CSE, MECH, CIVIL AND IT)</b>	<b>3/0/2/4</b>
<b>Nature of Course</b> : G (Theory analytical)		
<b>Course Objectives:</b>		
<b>1</b>	To equip students with a basic understanding of Electrical circuits	
<b>2</b>	To learn the working principle of transformers	
<b>3</b>	To understand the DC and AC Machine working principles and to have a knowledge on selection of machine for specific types of applications.	
<b>4</b>	To give a comprehensive exposure to electrical installations.	
<b>5</b>	To equip students with an ability to understand basics of analog and digital electronics.	
<b>Course Outcomes:</b>		
Upon completion of the course, students shall have ability to		
C211.1	Analyze the concepts in ac circuit and dc circuits.	[A]
C211.2	Understand the working principle of single phase and three phase transformers.	[U]
C211.3	Understand the working principle of DC and AC machines.	[U]
C211.4	Utilize the basic components for electrical installations.	[AP]
C211.5	Understand the basic concepts of Analog and Digital Electronics.	[U]
<b>Course Contents: Theory</b>		
<b>Module 1: DC Circuits and AC Circuits</b>		<b>20 Hrs</b>
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, Thevenin 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.		
<b>Module 2: Electrical Machines and Installations</b>		<b>15 Hrs</b>
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, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption.		
<b>Module 3: Basics of Analog and Digital Electronics</b>		<b>10 Hrs</b>
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.		

<b>Laboratory course contents</b>			
<b>S.No.</b>	<b>Lab Exercise</b>	<b>CO Mapping</b>	<b>BT</b>
1.	Familiarization of Electrical Elements, Sources, Measuring Devices and Verification of ohm's law	C211.1	[U]
2.	Estimation of voltage and current by KVL and KCL in Electric Circuits	C211.1	[AP]
3.	Determination of mesh current and node voltage by Mesh and Nodal Analysis	C211.1	[AP]
4.	Application of Superposition theorems, thevenin's and maximum power transfer theorem in electrical circuits	C211.1	[AP]
5.	Measurement of three phase power	C211.2	[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	C211.3	[U]
7.	Load test on dc shunt motor.	C211.3	[AP]
8.	Demonstration of components of LT Switch Gears	C211.4	[U]
9.	Construction of bridge rectifier with and without filters	C211.5	[U]
10.	Verification of logic gates.	C211.5	[U]
<b>Total Hours: 75</b>			
<b>Text Books:</b>			
1	Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', Tata McGraw Hill, 6 <sup>th</sup> edition 2015.		
2	Vincent. Del. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 2 <sup>nd</sup> edition, 2015.		
3	E. Hughes, "Electrical and Electronics Technology", Pearson, 10 <sup>th</sup> 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, 6 <sup>th</sup> edition, 2017		
<b>Reference Books:</b>			
1	Charles A.Gross, Thaddeus A.Roppel, "Fundamentals of Electrical Engineering", CRC press, 2012.		
2	D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 5 <sup>th</sup> edition 2012,		
3	Theodore F. Bogart, Jeffery S. Beasley and Guillermo Rico, 'Electronic Devices and Circuits', Pearson Education, 6 <sup>th</sup> edition, 2019.		
<b>Web References:</b>			
1	<a href="http://nptel.ac.in/course.php?disciplineId=108">http://nptel.ac.in/course.php?disciplineId=108</a>		
2	<a href="https://ocw.mit.edu/courses/find-by-topic/#cat=engineering&amp;subcat=electricalengineering&amp;spec=electricpower">https://ocw.mit.edu/courses/find-by-topic/#cat=engineering&amp;subcat=electricalengineering&amp;spec=electricpower</a>		
3	<a href="https://nptel.ac.in/video.php?subjectId=117103063">https://nptel.ac.in/video.php?subjectId=117103063</a>		
4	<a href="https://onionesquereality.wordpress.com/.../more-video-lectures-iit-open">https://onionesquereality.wordpress.com/.../more-video-lectures-iit-open</a>		
5	<a href="https://nptel.iitg.ernet.in/Elec_Comm_Engg/.../Video-ECE.pdf">https://nptel.iitg.ernet.in/Elec_Comm_Engg/.../Video-ECE.pdf</a>		

**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>

**Tentative Assessment Methods & Levels (based on Blooms' Taxonomy)****Summative assessment based on Continuous and End Semester Examination**

Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory			Rubrics Based Practical Assessment [30 Marks]	
	CIA-I [10 Marks]	CIA-II [10 Marks]	Term End Examination [10 Marks]		
Remember	50	50	40	40	40
Understand	50	50	40	40	40
Apply		-	20	20	20
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	3	3	1				2			2	3	3	3
2	2	1	2	1								2	2	2	2
3	2	1	2	1								2	2	2	2
4	3	2	3	2	2				2			2	3	2	2
5	2	1	2	1								2	2	3	3
<b>Avg</b>	2	1	2	1	2				2			2	2	2	2
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

20CS211	PYTHON FOR ENGINEERS LABORATORY		1/0/3/2.5
<b>Nature of Course:</b>	Theory Programming		
<b>Pre requisites:</b>	Nil		
<b>Course Objectives:</b>			
1	Interpret the use of procedural statements like assignments, conditional statements, loops and function calls.		
2	Infer the supported data structures like lists, dictionaries and tuples in Python.		
3	Improve problem solving skills using strings, and functions		
4	Describe the need for Object-oriented programming concepts in Python..		
<b>Course Outcomes: Theory</b>			
<b>Upon completion of the course, students shall have ability to</b>			
C211.1	Structure simple Python programs for solving problems.		[U]
C211.2	Describe the Python language syntax including control statements, loops and functions to write programs for a wide variety problem in mathematics, science, and games.		[U]
C211.3	Examine the core data structures like lists, dictionaries, tuples and sets in Python to store, process and sort the data.		[AP]
C211.4	Interpret the concepts of Object-oriented programming as used in Python using encapsulation, polymorphism and inheritance.		[AP]
C211.5	Identify the external modules for creating and writing data to excel files and inspect the file operations to navigate the file systems.		[AP]
<b>Course Contents: Theory</b>			
<b>Introduction to Python:</b>			<b>15 Hrs.</b>
<p>Interpreter And Interactive Mode; Values and Data Types, Variables, Expressions, Statements, Operators, <b>Conditionals:</b> Boolean Values and Operators, Conditional (If), Alternative (If-Else), Chained Conditional (If-Elif-Else); <b>Iteration:</b> While, For, Break, Continue, Pass <b>Functions:</b> Function Definition, parameters and arguments, Recursion. <b>Strings:</b> String Slices, String Functions and Methods <b>Lists:</b> List Operations, List Slices, List Methods, List Loop <b>Tuples:</b> Tuple Assignment and Methods <b>Dictionaries:</b> Operations and Methods, Set in Python <b>Files:</b> Text Files, Reading and Writing Files, Command Line Arguments.</p>			
<b>Laboratory course contents :</b> Write Python programs for the following			
<b>S.No.</b>	<b>Lab Experiments</b>	<b>CO Mapping</b>	<b>BT</b>
1	Commands in interactive mode	C211.1	[U]
2	Programs using operators	C211.2	[AP]
3	Programs using I/O Operations	C211.2	[AP]
4	Programs using control structures	C211.3	[AP]
5	Programs using break, continue and pass statements	C211.3	[AP]

6	Programs using loops	C211.4	[AP]
7	Programs using functions	C211.4	[AP]
8	Programs using recursive functions	C211.4	[AP]
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", 2 <sup>nd</sup> edition, 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.

**Reference Books:**

1	Robert Sedgewick, 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 PythonII", 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	<a href="https://www.wileyindia.com/introduction-to-computer-science-using-python.html">https://www.wileyindia.com/introduction-to-computer-science-using-python.html</a>
2	<a href="https://www.programiz.com/python-programming">https://www.programiz.com/python-programming</a>
3	<a href="https://www.fullstackpython.com/best-python-resources">https://www.fullstackpython.com/best-python-resources</a>
4	<a href="https://www.tutorialspoint.com/python/">https://www.tutorialspoint.com/python/</a>
5	<a href="https://www.geeksforgeeks.org/python-programming-language/">https://www.geeksforgeeks.org/python-programming-language/</a>

**Online Resources:**

1	<a href="http://nptel.ac.in/courses/106106145/">http://nptel.ac.in/courses/106106145/</a>
2	<a href="https://www.codecademy.com/learn/learn-python">https://www.codecademy.com/learn/learn-python</a>

**Assessment Methods & Levels (based on Bloom's Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

Bloom's Level	Rubric based Continuous Assessment [60 marks] (in %)	End Semester Examination [40 marks] (in %)
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Remember	-	-
Understand	20	20
Apply	30	30
Analyse	50	50
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	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															
<b>Avg</b>	3	3	3	2	2				2			2	3	3	1
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

<b>20ME103</b>	<b>ENGINEERING PRACTICES LABORATORY</b>		<b>0/0/3/1.5</b>
<b>Nature of Course</b>	Practical application		
<b>Pre Requisites</b>	Nil		
<b>Course Objectives:</b>			
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.		
<b>Course Outcomes:</b>			
<b>Upon completion of the course, students shall have ability to</b>			
C103.1	Identify and solve the basic engineering problems at home and in workplace.		[AP]
C103.2	Develop the surfaces and make simple components like tray and funnel.		[C]
C103.3	Make simple metal joints using welding equipment and wooden joints using 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]
<b>Course Contents:</b>			
<b>GROUP A (CIVIL &amp; MECHANICAL)</b>			
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			
<b>Laboratory Component:</b>			
S.No	List of Experiments	CO Mapping	RBT
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, planing 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	C103.5	[AP]
<b>GROUP B (ELECTRICAL AND ELECTRONICS ENGINEERING)</b>			
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.			
<b>Laboratory Component:</b>			
S.No	List of Experiments	CO Mapping	RBT

1	Study and identification of electronic components with specification.	C103.6	[A]
2	Testing of CRO and Electronic components using Multimeter.	C103.6	[A]
3	Generation and measurement of signals using CRO.	C103.6	[A]
4	Familiarisation of digital basic gate IC's.	C103.6	[A]
5	Soldering practice-components devices and circuits- using general purpose PCB.	C103.6	[A]
6	Demonstration of meters and electrical components.	C103.6	[A]
7	Safety precautions with electrical components.	C103.6	[A]
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**

**Reference Books:**

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 Promoters 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	<a href="http://www.nptel.ac.in">www.nptel.ac.in</a>
2	<a href="http://www.sme.org">www.sme.org</a>
3	<a href="http://www.allaboutcircuits.com/education/">http://www.allaboutcircuits.com/education/</a>

**Tentative Assessment Methods & Levels (based on Bloom's Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

Bloom's Level	Rubric based Continuous Assessment [60 marks]	End Semester Examination [40 marks]
Remember	10	10
Understand	10	10
Apply	40	40
Analyze	20	20
Evaluate	10	10
Create	10	10

**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			3							3	3		
2	3	2			2							2	3	3	
3	3	2			2							2	3	3	
4	3	2			2							2	3	3	
5	3	2			2							2	3	3	
6	3	2			2							2	3	3	
<b>Avg</b>	3	2			2							2	3	3	
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

### SEMESTER 3

<b>20ME201</b>	<b>ENGINEERING MECHANICS</b> (COMMON TO CIVIL AND MECH)	<b>3/1/0/4</b>
<b>Nature of Course</b>	Concepts and Analytical	
<b>Pre Requisites</b>	Engineering Mathematics and Applied Physics	
<b>Course Objectives:</b>		
1	To make the students understand the vector and scalar representation of forces and moments and the static equilibrium of particles and rigid bodies.	
2	To understand the effect of friction on equilibrium, laws of motion, kinematics of motion and their interrelationship.	
3	To make the students understand the properties of surfaces and solids, prediction of behaviour of particles and rigid bodies under motion.	
<b>Course Outcomes:</b>		
<b>Upon completion of the course, students shall have ability to</b>		
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	Determine the sectional properties of surfaces and solids	[AN]
C201.4	Analyse the resistance force of particles and objects for Impending Motion	[AN]
C201.5	Apply the equations of dynamics to determine the unknown quantities of particles in kinetics and kinematics.	[AP]
C201.6	Determine the displacement, velocity and acceleration using equations of kinetics of rigid bodies.	[AP]
<b>Course Contents:</b>		
<b>Module 1: Equilibrium of Particles and Rigid Bodies</b>		<b>20 Hrs</b>
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.		
<b>Module 2: Centre of Gravity, Moment of Inertia and Friction</b>		<b>20 Hrs</b>
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.		
<b>Module 3: Dynamics of Particles and rigid bodies</b>		<b>20 Hrs</b>
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**

**Text Books:**

1	Beer, Johnston, Cornwell, Self, Mazurek and Sanghi, Vector Mechanics for Engineers – Statics and Dynamics, 12 <sup>th</sup> 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
3	Kottiswaran N, Engineering Mechanics - Statics and Dynamics, Sri Balaji Publications, 2018.

**Reference Books:**

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.

**Web References:**

1	<a href="http://nptel.ac.in/courses/122104015/">http://nptel.ac.in/courses/122104015/</a>
2	<a href="http://nptel.ac.in/courses/112103109/">http://nptel.ac.in/courses/112103109/</a>

**Online Resources:**

1	<a href="https://ocw.mit.edu/courses">https://ocw.mit.edu/courses</a>
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**Tentative Assessment Methods & Levels (based on Bloom's Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

Course Outcome	Bloom's Level	Assessment Component	Marks
C201.1	Understand	Objective type Quiz	5
C201.2	Apply	Assignment	5
C201.3 & C201.4	Analyze	Assignment	5
C201.5 & C201.6	Apply	Tutorial	5

**Summative assessment based on Continuous and End Semester Examination**

Bloom's Level	Continuous Assessment			End Semester Examination [50 marks]
	CIA-I [10 marks]	CIA-II [10 marks]	CIA-III [10 marks]	
Remember	10	10	10	10
Understand	10	10	20	20
Apply	50	40	40	40
Analyze	30	40	30	30
Evaluate	-	-	-	-
Create	-	-	-	-

Course Articulation Matrix															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	3	-	1	2									2	-	1
2	3	2	2	3									3	1	1
3	3	3	2	3									3	-	1
4	3	2	2	3									3	1	1
5	3	2	2	3									3	-	1
6	3	2	2	3									3	1	1
<b>AVG</b>	<b>3</b>	<b>2.2</b>	<b>1.83</b>	<b>2.83</b>	-	-	-	-	-	-	-	-	<b>2.83</b>	<b>1</b>	<b>1</b>

<b>20GE201</b>	<b>UNIVERSAL HUMAN VALUES</b> (COMMON TO ALL BRANCHES)		<b>3/0/0/3</b>
<b>Nature of Course</b>	Theory Concept		
<b>Pre Requisites</b>	Interpersonal Communication and Value Sciences		
<b>Course Objectives:</b>			
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 complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings		
6	Highlighting plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature		
<b>Course Outcomes:</b>			
<b>Upon completion of the course, students shall have ability to</b>			
C201.1	Understand about themselves and their surroundings (family, society, nature).		[U]
C201.2	Understand and take responsibilities in life and handle problems to attain sustainable solutions while keeping human relationships and human nature in mind.		[U]
C201.3	Apply responsibilities towards their commitments (human values, human relationship and human society).		[AP]
C201.4	Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.		[AP]
C201.5	Analyse ethical and unethical practices, and formulate strategies to actualize a harmonious environment wherever they work.		[AN]
C201.6	Understand the harmony in nature and existence, and work out mutually on fulfilling participation in the nature.		[U]
<b>Course Contents:</b>			
<b>Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education, Understanding Harmony in the Human Being - Harmony in Myself! 15 Hrs</b>			
<p>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 fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil 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</p>			

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.

<b>Total Hours</b>	<b>45</b>
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**Text Books:**

- |   |   |
|---|---|
| 1 | Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010 |
| 2 | Rajni Setia, Priyanka Sharma, " Human Values", Genius Publication", Jaipur, 2019.                     |

**Reference Books:**

- |   |   |
|---|---|
| 1 | Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004. |
| 2 | The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi  |
| 3 | India Wins Freedom - Maulana Abdul Kalam Azad.                          |

**Web References:**

- |   |   |
|---|---|
| 1 | <a href="https://examupdates.in/professional-ethics-and-human-values/">https://examupdates.in/professional-ethics-and-human-values/</a>                             |
| 2 | <a href="http://hvpe1.blogspot.com/2016/06/notes-human-values-and-professional.html">http://hvpe1.blogspot.com/2016/06/notes-human-values-and-professional.html</a> |
| 3 | <a href="https://www.yourmorals.org/schwartz.2006.basic%20human%20values.pdf">https://www.yourmorals.org/schwartz.2006.basic%20human%20values.pdf</a>               |

**Online Resources:**

- |   |   |
|---|---|
| 1 | <a href="https://nptel.ac.in/courses/109/104/109104068/">https://nptel.ac.in/courses/109/104/109104068/</a> |
|---|---|

2	<a href="https://medium.com/the-mission/the-12-important-life-skills-i-wish-id-learned-in-school-f4593b49445b">https://medium.com/the-mission/the-12-important-life-skills-i-wish-id-learned-in-school-f4593b49445b</a>														
3	<a href="https://www.thebalancecareers.com/life-skills-list-and-examples-4147222">https://www.thebalancecareers.com/life-skills-list-and-examples-4147222</a>														
<b>Tentative Assessment Methods &amp; Levels (based on Bloom's Taxonomy)</b>															
<b>Formative assessment based on Capstone Model (Max. Marks:20)</b>															
<b>Course Outcome</b>	<b>Bloom's Level</b>					<b>Assessment Component</b>							<b>Marks</b>		
C201.1	Understand					Group Discussion							5		
C201.2	Understand					Book Review							5		
C201.3, C201.4	Apply					Role Play							5		
C201.5, C201.6	Apply					Formal Presentation							5		
<b>Summative assessment based on Continuous and End Semester Examination</b>															
<b>Bloom's Level</b>	<b>Continuous Assessment</b>												<b>Term End Assessment [50 marks]</b>		
	<b>CIA-I [10 marks]</b>				<b>CIA-II [10 marks]</b>				<b>CIA-III [10 marks]</b>						
Remember	20				20				20				20		
Understand	40				40				40				40		
Apply	40				40				40				40		
Analyze	-				-				-				-		
Evaluate	-				-				-				-		
Create	-				-				-				-		
<b>Course Articulation Matrix</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
1						3	3	3	2				1		
2						3	3	3	2				1		
3						3	3	3	2				1		
4						2	1	3	1			3	1		
5						3	3	3	2				1		
6						3	3	3	2				1		
<b>Avg</b>	-	-	-	-	-	3	3	3	2	-	-	3	1	-	-
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

<b>20MA301</b>	<b>ENGINEERING MATHEMATICS III</b> (COMMON TO MECH/MCT/CIVIL/ECE/EEE)		<b>2/1/2/4</b>
<b>Nature of Course</b>	Problem analytical		
<b>Pre requisites</b>	Concepts of basic differentiation and Integration		
<b>Course Objectives:</b>			
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 engineering fields.		
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.		
<b>Course Outcomes: Theory</b>			
<b>Upon completion of the course, students shall have ability to</b>			
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		[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		[AP]
<b>Course Contents: Theory</b>			
<b>Module 1: Fourier Series</b>			<b>15 Hrs</b>
Dirichlet's conditions-General Fourier Series-Odd and Even Functions- Half range sine series and cosine series - Parseval's Identity-Harmonic analysis			
<b>Module 2: Fourier Transform and Z Transform</b>			<b>15 Hrs</b>
<b>Fourier Transform:</b> Complex form of Fourier Transforms – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem and Parseval's Identity (Statement only) – Evaluation of integrals using Parseval's Identity. <b>Z-Transform:</b> Convergence of Z transform -Z-transform of Standard functions-Properties - Inverse Z- transform-Convolution theorem(Statement only)-Partial fraction method - Formation of difference equations - Solution of difference equations using Z-transform Techniques.			
<b>Module 3: Partial Differential Equations</b>			<b>15 Hrs</b>
Introduction to PDE – 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).			
<b>Total Hours:</b>			<b>45</b>
<b>Course Outcomes: Laboratory</b>			
<b>Upon the completion of the course, students shall have ability to</b>			
C301.1	Understand the need for a function or its approximation as an infinite series.		
C301.2	Represent discontinuous function which occurs in electrical circuits and signal		

	processing by using Fourier series
C301.3	Demonstrate the use of Fourier transform to connect the time domain and frequency domain
C301.4	Understanding Z- transform and analyzing discrete signals by using Z- transform.
C301.5	To describe homogeneous and higher order partial differential equations using PDE techniques.
C301.6	Understanding of basic concepts in application of partial differential equations in one dimensional heat and wave equations.

**Course Contents: Laboratory**

S.No	List of Experiments	CO Mapping	RBT
1.	To perform symbolic Fourier series calculation of the given full range signals using suitable mathematical software.	C301.1	[AP]
2.	To perform symbolic Fourier series calculation of the given half range signals using suitable mathematical software.	C301.2	[AP]
3.	To plot the Fourier transform of time function using suitable mathematical software.	C301.3	[AP]
4.	To find the Z transform of given expression $f(n)$ using suitable mathematical software.	C301.4	[AP]
5.	To find the inverse Z transform of given expression $f(n)$ using suitable mathematical software.	C301.4	[AP]
6.	To find the solution of homogeneous partial differential equation using suitable mathematical software.	C301.5	[AP]
7.	To find the solution for higher order partial differential equations using suitable mathematical software.	C301.5	[AP]
8.	To solve initial and boundary value problems for systems of partial differential equations in one spatial variable $x$ and time $t$ using suitable mathematical software.	C301.5	[AP]
9.	To perform the solution of Laplace equation using suitable mathematical software.	C301.6	[AP]
10.	To perform the solution of Poisson equation using suitable mathematical software.	C301.6	[AP]
11.	To solve the one-dimensional heat equation using suitable mathematical software.	C301.6	[AP]
12.	To solve the one-dimensional wave equation using suitable mathematical software.	C301.6	[AP]

**Text Books:**

1	Erwin E., "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.

Reference Books:	
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	<a href="https://www.youtube.com/watch?v=jNC0jxb0OxE">https://www.youtube.com/watch?v=jNC0jxb0OxE</a>
2	<a href="https://www.youtube.com/watch?v=iRXXmtcocAQ">https://www.youtube.com/watch?v=iRXXmtcocAQ</a>
3	<a href="https://www.youtube.com/watch?v=OGT59INHz3Y">https://www.youtube.com/watch?v=OGT59INHz3Y</a>

#### Online Resources:

1	<a href="https://nptel.ac.in/courses/111/106/111106111/">https://nptel.ac.in/courses/111/106/111106111/</a>
2	<a href="https://nptel.ac.in/courses/111/107/111107111/">https://nptel.ac.in/courses/111/107/111107111/</a>
3	<a href="https://nptel.ac.in/courses/111/107/111107107/">https://nptel.ac.in/courses/111/107/111107107/</a>

#### Assessment Methods & Levels (based on Blooms' Taxonomy)

##### Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory			Practical & Project	
	CIA-I [10 marks]	CIA-II [10 marks]	CIA-III [10 marks]	Rubric based CIA [30 Marks]	
Remember	20	20	20	20	20
Understand	30	30	30	30	30
Apply	50	50	50	50	50
Analyse	-	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

#### 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	1	1	-	-	-	-	-	-	-	-	-	-	1	-	-
2	2	2	-	-	-	-	-	-	-	-	-	-	1	-	-
3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	3	3	-	-	-	-	-	-	-	-	-	-	1	-	-
5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
6	3	3	-	-	-	-	-	-	-	-	-	-	1	-	-
Avg	2.5	2.5	-	-	-	-	-	-	-	-	-	-	0.6	-	-
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	1	1	-	-	3	-	-	-	-	-	-	-	1	-	-
2	2	2	-	-	3	-	-	-	-	-	-	-	1	-	-
3	3	3	-	-	3	-	-	-	-	-	-	-		-	-
4	3	3	-	-	3	-	-	-	-	-	-	-	1	-	-
5	3	3	-	-	3	-	-	-	-	-	-	-		-	-
6	3	3	-	-	3	-	-	-	-	-	-	-	1	-	-
<b>Avg</b>	<b>2.5</b>	<b>2.5</b>	-	-	<b>3</b>	-	-	-	-	-	-	-	<b>0.6</b>	-	-
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed				

<b>20CE301</b>	<b>CONSTRUCTION MATERIALS AND TECHNIQUES</b>	<b>3/0/2/4</b>
<b>Nature of Course</b>	Theory and Practical Application	
<b>Pre requisites</b>	Engineering Chemistry and Applied Physics.	
<b>Course Objectives</b>		
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.	
<b>Course Outcomes: Theory</b>		
<b>Upon completion of the course, students shall have ability to</b>		
C301.1	Explain the properties and applications of various building materials and their appropriate suitability for a given scenario.	[AP]
C301.2	Demonstrate the manufacturing process of building 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]
<b>Course Content: Theory</b>		
<b>Module 1: Construction materials and Admixtures</b>		<b>15 Hrs.</b>
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.		
<b>Module 2: Alternate, Decorative, Protective and Special Materials</b>		<b>15 Hrs.</b>
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		
<b>Module 3: Construction Machineries and Techniques</b>		<b>15 Hrs.</b>
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**

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

C301.1	Choose the physical inspection methods and analyse the physical characteristics of bricks and blocks	[AN]
C301.2	Assess the strength property of steel using various laboratory methods	[AN]
C301.3	Assess the strength property of metal and steel bar using laboratory methods	[AN]
C301.4	Examine the physical characteristics of cement using various laboratory methods	[AN]
C301.5	Estimate the strength property of cement using various laboratory methods	[AN]
C301.6	Demonstrate the operation of modern building tools	[U]

**Course Content : Laboratory**

S.No.	List of Experiments	CO Mapping	RBT
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]

**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.

**Reference Books:**

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, Equipment and Methods", 9th Edition, McGraw Hill, Singapore, 2018.
4.	Arora S.P and Bindra S.P "Building Construction, Planning Techniques and Method of Construction", Dhanpat rai and Sons, 2013

**IS Code of Practices:**

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"
3.	IS 2386 – 1963 (Part 1 – 8), "Methods of Test for Aggregates for Concrete"
4.	IS 1608 – 2018 (Part 1 – 3), "Metallic Materials — Tensile Testing"

**Web References:**

1.	<a href="https://aquicore.com/blog/10-new-materials-changing-commercial-construction/">https://aquicore.com/blog/10-new-materials-changing-commercial-construction/</a>
2.	<a href="https://www.nbmcw.com/tech-articles/concrete/3725-new-construction-materials-for-modern-projects.html">https://www.nbmcw.com/tech-articles/concrete/3725-new-construction-materials-for-modern-projects.html</a>
3.	<a href="http://www.iaacblog.com/programs/robot-assisted-interior/">http://www.iaacblog.com/programs/robot-assisted-interior/</a>
4.	<a href="https://www.sciencedirect.com/science/article/pii/S2352710219300889">https://www.sciencedirect.com/science/article/pii/S2352710219300889</a>
5.	<a href="https://construction-robotics.eu/journal/">https://construction-robotics.eu/journal/</a>
6.	<a href="https://wingtra.com/drone-mapping-applications/drones-in-construction-and-infrastructure/">https://wingtra.com/drone-mapping-applications/drones-in-construction-and-infrastructure/</a>
7.	<a href="https://www.thenbs.com/knowledge/drones-in-construction">https://www.thenbs.com/knowledge/drones-in-construction</a>

**Online Resources:**

1.	<a href="https://nptel.ac.in/courses/105/106/105106053/">https://nptel.ac.in/courses/105/106/105106053/</a>
2.	<a href="https://onlinecourses.nptel.ac.in/noc20_ar04/preview">https://onlinecourses.nptel.ac.in/noc20_ar04/preview</a>
3.	<a href="https://alison.com/course/diploma-in-characterization-of-construction-materials">https://alison.com/course/diploma-in-characterization-of-construction-materials</a>
4.	<a href="https://www.futurelearn.com/courses/modern-building-design">https://www.futurelearn.com/courses/modern-building-design</a>
5.	<a href="https://www.youtube.com/watch?v=ZTvNm4QamX8">https://www.youtube.com/watch?v=ZTvNm4QamX8</a>
6.	<a href="https://www.youtube.com/watch?v=fyGW_7eGVfo">https://www.youtube.com/watch?v=fyGW_7eGVfo</a>

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

**Summative assessment based on Continuous and End Semester Examination**

Revised Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory			Practical	
	CIA-I [10 marks]	CIA-II [10 marks]	CIA-III [10 marks]	Rubric based CIA [30 marks]	
Remember	10	10	10	-	10

Understand	40	30	30	-	35										
Apply	40	50	50	50	50										
Analyse	10	20	20	50	15										
Evaluate	-	-	-	-	-										
Create	-	-	-	-	-										
<b>Course Articulation Matrix : Theory</b>															
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	-	-	-	-	-	-	-	-	-	-	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
<b>Avg</b>	<b>2.3</b>	<b>2.7</b>	<b>1.7</b>	<b>1.7</b>	<b>2.5</b>	<b>1.0</b>	<b>1.5</b>	<b>2.0</b>	<b>-</b>	<b>-</b>	<b>1.5</b>	<b>-</b>	<b>2.2</b>	<b>2.2</b>	<b>1.0</b>
<b>Course Articulation Matrix : Laboratory</b>															
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	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
<b>Avg</b>	<b>1.8</b>	<b>2.8</b>	<b>-</b>	<b>3.0</b>	<b>2.0</b>	<b>-</b>	<b>-</b>	<b>2.0</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3.0</b>	<b>2.0</b>	<b>2.0</b>	<b>2.0</b>
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

<b>20CE302</b>	<b>FLUID MECHANICS AND HYDRAULIC MACHINERY</b>	<b>3/0/2/4</b>
<b>Nature of Course</b>	Theory Application	
<b>Pre requisites</b>	-	
<b>Course Objectives:</b>		
1.	To study the concepts of fluid mechanics	
2.	To understand the closed conduit flow in different flow condition	
3.	To understand the open channel flow types.	
4.	To understand the application of Dimensional analysis in similitude and model study.	
5	To study the concepts of hydraulic machines viz. flow through turbines and pumps	
6	To study the basics of Computational Fluid Dynamics for Civil Engineering Problems	
<b>Course Outcomes : Theory</b>		
<b>Upon completion of the course, students shall have ability to</b>		
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]
<b>Course Contents : Theory</b>		
<b>Module I: Fluid Mechanics (Fluid Statics, Kinematics &amp; Dynamics)</b>		<b>15 Hrs.</b>
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.		
<b>Module II: Applied Hydraulics</b>		<b>15 Hrs.</b>
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 pi theorem-Hydraulic models – Geometric, kinematic and dynamic similarities - dimensionless numbers – model and prototype relations.		
<b>Module III: Hydraulic Machines and Computational Fluid Dynamics</b>		<b>15 Hrs.</b>
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**

**Course Outcomes : Laboratory**

**Upon completion of the Laboratory, students shall have ability to**

C302.1	Measure the flow in pipe section using orificemeter and venturimeter	[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]

**Course Content: Laboratory**

S. No	List of Experiments	CO Mapping	RBT
1.	Flow Measurement in pipe using Venturimeter	C302.1	[AP]
2.	Flow Measurement in pipe using Orificemeter	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]

**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, 10 <sup>th</sup> Edition 2018.
3.	Versteeg, H. K.; Malalasekera, W.,” An Introduction to Computational Fluid Dynamics”, Pearson Publishers,2007

**Reference Books:**

1.	Subramanya K, “Flow in open channels”, Tata McGraw Hill publishing company 4 <sup>th</sup> Edition, 2015.
2.	Som S K, “Introduction to Fluid Mechanics and Fluid Machines”, McGraw Hill Education; 3 <sup>rd</sup> edition, 2017
3.	Yunus Cengel, “Fluid Mechanics in SI Units”, McGraw Hill Education; 3 <sup>rd</sup> edition, 2017
4.	Madan Mohan Das, Mimi Das Saikia, Bhargab Mohan Das , “Hydraulics and hydraulic machines”, PHI Learning Pvt Ltd, New Delhi,2013

**Web References:**

1.	<a href="https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-01-unified-engineering-i-ii-iii-iv-fall-2005-spring-2006/fluid-mechanics/">https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-01-unified-engineering-i-ii-iii-iv-fall-2005-spring-2006/fluid-mechanics/</a>
2.	<a href="https://nptel.ac.in/courses/105/105/105105203/">https://nptel.ac.in/courses/105/105/105105203/</a>
3.	<a href="https://cfdflowengineering.com/basics-of-cfd-modeling-for-beginners/">https://cfdflowengineering.com/basics-of-cfd-modeling-for-beginners/</a>
4.	<a href="https://www.simscale.com/blog/2016/03/what-everybody-ought-to-know-about-cfd/">https://www.simscale.com/blog/2016/03/what-everybody-ought-to-know-about-cfd/</a>

**Online Courses**

1.	<a href="https://nptel.ac.in/courses/112/104/112104118/">https://nptel.ac.in/courses/112/104/112104118/</a>
2.	<a href="https://www.coursera.org/learn/lectures-on-selected-topics-in-classical-and-fluid-mechanics">https://www.coursera.org/learn/lectures-on-selected-topics-in-classical-and-fluid-mechanics</a>
3.	<a href="https://www.learncax.com/courses/by-software/fundamentals-of-cfd-detail">https://www.learncax.com/courses/by-software/fundamentals-of-cfd-detail</a>
4.	<a href="https://onlinecourses.nptel.ac.in/noc20_ae11/preview">https://onlinecourses.nptel.ac.in/noc20_ae11/preview</a>

**Tentative Assessment Methods and Levels (based on Revised Bloom's Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

Revised Bloom's Taxonomy	Continuous Assessment				End Semester Examination (Theory) [40 Marks]
	Theory			Practical	
	CIA-I [10 marks]	CIA-II [10 marks]	CIA III [10 marks]	Rubric Based CIA [30 Marks]	
Remember	-	-	-	10	-
Understand	10	10	10	20	10
Apply	50	50	50	30	50
Analyse	40	40	40	40	40
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

**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	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
<b>Avg</b>	<b>2.7</b>	<b>2.2</b>	<b>1.6</b>	<b>2.2</b>	<b>2.5</b>		<b>1.0</b>			<b>1.0</b>	<b>1.0</b>	<b>1.0</b>	<b>1.7</b>	<b>1.8</b>	<b>1.8</b>

**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	PS O 1	PS O 2	PSO 3	
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	
<b>Avg</b>	<b>3.0</b>	<b>2.0</b>	<b>2.0</b>	<b>1.5</b>	<b>2.3</b>			<b>1.7</b>				<b>1.7</b>	<b>1.7</b>	<b>1.8</b>	<b>1.8</b>	
1	Reasonably agreed					2	Moderately agreed					3	Strongly agreed			

<b>20CE303</b>	<b>SURVEYING AND GEOMATICS</b>		<b>3/0/2/4</b>
<b>Nature of Course</b>	Theory Application		
<b>Pre requisites</b>	Nil		
<b>Course Objectives:</b>			
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		
<b>Theory Course Outcomes:</b>			
<b>Upon completion of the course, students shall have ability to</b>			
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 conventional surveying 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]
<b>Course Contents: Theory</b>			
<b>Module 1: Classic surveying methods</b>			<b>15 Hrs.</b>
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.			
<b>Module 2: Triangulation &amp; Modern surveying methods</b>			<b>15 Hrs.</b>
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.			
<b>Module 3: Hydrographic and GPS surveying</b>			<b>15 Hrs.</b>
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.			
<b>Total Hours:</b>			<b>45</b>
<b>Laboratory Course Outcomes:</b>			
<b>Upon completion of the course, students shall have ability to</b>			
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]
<b>Course Contents: Laboratory</b>			
S. No	List of Experiments	CO Mapping	RBT
1.	Computation of bearings and area by Compass Traversing	C303.1	[AP]
2.	Measurement of Horizontal angles by Repetition, Reiteration and 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 levelling – Longitudinal & Cross-sectional plotting using 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 vertical angles	C303.4	[AN]
10.	Setting out of simple and Transition curve.	C303.5	[AP]
11.	Determination of distances and elevation between two inaccessible 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]
<b>Text Books:</b>			
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		
<b>Reference Books:</b>			
1.	Aylmer Johnson, “Plane and Geodetic surveying”, 4 <sup>th</sup> edition, Crc Press, 2014		
2.	James M.Anderson and Edward M. Mikhail, “Surveying, Theory and Practice”, 7 <sup>th</sup> 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\\_5eneAhXRdCsKHQZH Bh0Q6AEILTAB#v=onepage&q&f=false](https://books.google.co.in/books?id=dF3oDzQ6KZgC&printsec=frontcover&dq=inauthor:%22C+Venkatramaiah%22&hl=en&sa=X&ved=0ahUKEwi3gfG_5eneAhXRdCsKHQZH Bh0Q6AEILTAB#v=onepage&q&f=false)

**Online Resources:**

1. <http://www.nptel.ac.in/courses/105107122>  
 2. <http://www.nptel.ac.in/courses/105104101>

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

**Summative assessment based on Continuous and End Semester Examination**

Revised Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 Marks]
	Theory			Practical	
	CIA – I (10 Marks)	CIA – II (10 Marks)	CIA – III (10 Marks)	Rubric based CIA (30 Marks)	
Remember	-	-	-	-	-
Understand	20	10	10	20	10
Apply	40	50	40	20	40
Analyze	40	40	50	60	50
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

**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	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
<b>Avg.</b>	<b>2.7</b>	<b>2.8</b>	<b>2.5</b>	<b>2.7</b>	<b>2.7</b>			<b>1.5</b>				<b>2.5</b>	<b>2.6</b>		<b>1.7</b>

**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
<b>Avg.</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2.5</b>			<b>2.6</b>				<b>3</b>	<b>3</b>		<b>2.3</b>

## SEMESTER 4

<b>20CE401</b>	<b>SOLID MECHANICS</b>	<b>2/1/0/3</b>
<b>Nature of Course</b>	Problem Analytical	
<b>Pre requisites</b>	Engineering Mechanics	
<b>Course Objectives:</b>		
1.	To apply the fundamental concepts of stress, strain and deformation of solids and thin cylinders	
2.	To compute and sketch the bending moment and shear force for different types of beams.	
3.	To analyse plane trusses using various methods.	
4.	To compute the stresses and deformations of beams	
5.	To compute the torsion on shafts and springs.	
<b>Course Outcomes:</b>		
<b>Upon completion of the course, students shall have ability to</b>		
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]
<b>Course Contents:</b>		
<b>Module 1: Simple Stresses, Strains and Thin cylinders</b>		<b>15 Hrs.</b>
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.		
<b>Module 2: Analysis of Beams and Trusses</b>		<b>15 Hrs.</b>
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		
<b>Module 3: Bending, Slope and Deflection of beams, Torsion on shafts</b>		<b>15 Hrs.</b>
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.				
<b>Total Hours</b>			<b>45</b>	
<b>Text Books:</b>				
1.	Bansal R.K, "Strength of Materials", Laxmi Publications Ltd, New Delhi, 2018.			
2.	<i>Rajput R K, "A Textbook of Strength of Materials (Mechanics of Solids)", 7e, S. Chand Publishing, 2018.</i>			
3.	<i>Beer, F.P., Johnston Jr., E.R., Dewolf, J.T. and Mazurek, D.F. "Mechanics of Materials", 8e, McGraw-Hill, 2020.</i>			
<b>Reference Books:</b>				
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			
<b>Web References:</b>				
1.	<a href="http://www.nesoacademy.org/civil-engineering/mechanics of solids">http://www.nesoacademy.org/civil-engineering/mechanics of solids</a>			
2.	<a href="http://web.mit.edu/emech/dontindex-build/">http://web.mit.edu/emech/dontindex-build/</a>			
<b>Online Resources:</b>				
1.	<a href="http://nptel.ac.in/course.php?disciplineId=105">http://nptel.ac.in/course.php?disciplineId=105</a>			
2.	<a href="http://nptel.iitk.ac.in/courses/Webcourse-contents/IIT Delhi/Mechanics%20Of%20Solids/index.htm">http://nptel.iitk.ac.in/courses/Webcourse-contents/IIT Delhi/Mechanics%20Of%20Solids/index.htm</a>			
<b>Tentative Assessment Methods &amp; Levels (based on Revised Bloom's Taxonomy)</b>				
<b>Formative assessment based on Capstone Model (Max. Marks:20)</b>				
Course Outcome	Revised Bloom's Level	Assessment Component	Marks	
C401.1& C401.2	Analyse	Online Quiz/ class room quiz	5	
C401.3	Analyse	Assignment	5	
C401.4	Analyse	Technical Presentation	5	
C401.5 & C401.6	Analyse	Tutorial	5	
<b>Summative assessment based on Continuous and End Semester Examination</b>				
Revised Bloom's Level	Continuous Assessment			End Semester Examination [50 marks]
	CIA-I [10 marks]	CIA-II [10 marks]	CIA-III [10 marks]	
Remember	10	10	10	10
Understand	30	20	10	10
Apply	30	30	30	30
Analyse	30	40	50	50
Evaluate	-	-	-	-
Create	-	-	-	-

<b>Course Articulation Matrix</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
<b>1</b>	3	2	2	2	-	-	-	-	-	-	-	3	3	-	3
<b>2</b>	3	2	2	2	-	-	-	-	-	-	-	3	3	-	3
<b>3</b>	3	3	2	2	-	-	-	-	-	-	-	3	3	-	3
<b>4</b>	3	3	2	2	-	-	-	-	-	-	-	3	3	-	3
<b>5</b>	3	2	2	2	-	-	-	-	-	-	-	3	3	-	3
<b>6</b>	3	3	2	2	-	-	-	-	-	-	-	3	3	-	3
<b>Avg</b>	<b>3</b>	<b>2.5</b>	<b>2</b>	<b>2</b>	-	-	-	-	-	-	-	<b>3</b>	<b>3</b>	-	<b>3</b>

<b>20MA401</b>	<b>PROBABILITY AND NUMERICAL METHODS (COMMON TO MECH/MCT/CIVIL)</b>	<b>2/1/2/4</b>
<b>Nature of Course</b>	Problem Analytical	
<b>Pre requisites</b>	Concepts of Differentiation and Integration.	
<b>Course Objectives:</b>		
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	
<b>Course Outcomes: Theory</b>		
<b>Upon completion of the course, students shall have ability to</b>		
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]
<b>Course Contents: Theory</b>		
<b>Module 1: Probability</b>		<b>15 Hrs</b>
Sample space, Axioms of Probability-Events-independent events-Conditional probability, Total Probability-Bayes'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 – Continuous distribution: Normal – Simple Problems.		
<b>Module 2: Statistics</b>		<b>15 Hrs</b>
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. 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.		
<b>Module 3: Numerical Methods</b>		<b>15 Hrs</b>
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.		
<b>Total Hours</b>		<b>45</b>
<b>Course Outcomes: Laboratory</b>		
<b>Upon completion of the course, students shall have ability to</b>		
C401.1	Analyze and interpret the distribution function for the given data.	[AP]
C401.2	Perform central tendency measures for the given data	[AP]
C401.3	Create 2D line plot for the given data.	[AP]

C401.4	Test the significance level of hypothesis	[AP]	
C401.5	Estimate the correlation and regression between the given data.	[AP]	
C401.6	Fit a polynomial for the given data by various interpolation formulas	[AP]	
<b>Course Contents: Laboratory</b>			
S.No	List of Experiments	CO Mapping	RBT
1.	To fit a binomial distribution for the given data by using R programming.	C401.1	[AP]
2.	To fit a Poisson distribution for the given data by using R programming.	C401.1	[AP]
3.	To fit a normal distribution for the given data by using R programming.	C401.1	[AP]
4.	To find measures of central tendency for the given data by using R programming.	C401.2	[AP]
5.	To create 2D line plot for the given data by using R programming.	C401.3	[AP]
6.	Applying F test to test the significance difference between the variance of two samples by using R programming.	C401.4	[AP]
7.	Applying Chi Square test to test the goodness of fit for the given samples by using R programming.	C401.4	[AP]
8.	To find the correlation and regression between the given data by using R programming.	C401.5	[AP]
9.	To find regression between the given data by using R programming.	C401.5	[AP]
10.	To fit a straight line and parabola for the given data by using MATLAB.	C401.6	[AP]
11.	To fit a polynomial for the given data and finding the unknown by Lagrange's interpolation formula by using MATLAB.	C401.6	[AP]
12.	To fit a polynomial for the given data by Newton's forward and backward formula by using MATLAB.	C401.6	[AP]
<b>Text Books:</b>			
1.	Peebles Jr. P.Z., —Probability Random Variables and Random Signal Principles, Tata McGraw-Hill Publishers, Fourth Edition, New Delhi, 2016		
2.	Gupta, S.C., & Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan Chand & sons, 12th edition , 2020		
3.	Grewal B.S., Numerical methods in Engineering and Science. 12th edition, Stylus Publishing, 2018.		
<b>Reference Books:</b>			
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", 4 <sup>th</sup> edition, 2017.
4.	Holly Moore, "MATLAB for Engineers" Fifth Edition – Pearson Publications, 2018.

**Web References:**

1.	<a href="http://nptel.ac.in/courses/111104079/">http://nptel.ac.in/courses/111104079/</a>
2.	<a href="http://www.nptelvideos.in/2012/12/probability-random-variables.html">http://www.nptelvideos.in/2012/12/probability-random-variables.html</a>
3.	<a href="http://freevideolectures.com/Course/2311/Digital-Communication/4">http://freevideolectures.com/Course/2311/Digital-Communication/4</a>

**Online Resources:**

1.	<a href="https://www.coursera.org/learn/probability-intro">https://www.coursera.org/learn/probability-intro</a>
2.	<a href="https://www.coursera.org/lecture/wharton-introduction-spreadsheets-models/3-1-random-variables-and-probability-distributions-Y3bCF">https://www.coursera.org/lecture/wharton-introduction-spreadsheets-models/3-1-random-variables-and-probability-distributions-Y3bCF</a>
3.	<a href="https://www.codewithc.com/newtons-interpolation-in-matlab/">https://www.codewithc.com/newtons-interpolation-in-matlab/</a>

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

**Summative assessment based on Continuous and End Semester Examination**

Revised Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory			Practical Rubric based CIA [30 Marks]	
	CIA – I [10 Marks]	CIA – II [10 Marks]	CIA – III [10 Marks]		
Remember	20	20	20	20	20
Understand	30	30	30	30	30
Apply	50	50	50	50	50
Analyse	-	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

**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	1	1	-	-	-	-	-	-	-	-	-	-	1	-	-
2	2	2	-	-	-	-	-	-	-	-	-	-	1	-	-
3	3	3	-	-	-	-	-	-	-	-	-	-		-	-
4	3	3	-	-	-	-	-	-	-	-	-	-	1	-	-
5	3	3	-	-	-	-	-	-	-	-	-	-		-	-
6	3	3	-	-	-	-	-	-	-	-	-	-	1	-	-
Avg	2.5	2.5	-	-	-	-	-	-	-	-	-	-	0.6	-	-
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	1	1	-	-	3	-	-	-	-	-	-	-	1	-	-
2	2	2	-	-	3	-	-	-	-	-	-	-	1	-	-
3	3	3	-	-	3	-	-	-	-	-	-	-		-	-
4	3	3	-	-	3	-	-	-	-	-	-	-	1	-	-
5	3	3	-	-	3	-	-	-	-	-	-	-		-	-
6	3	3	-	-	3	-	-	-	-	-	-	-	1	-	-
Avg	2.5	2.5	-	-	3	-	-	-	-	-	-	-	0.6	-	-
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed				

<b>20CE402</b>	<b>Engineering Geology and Concrete Technology</b>	<b>3/0/2/4</b>
<b>Nature of Course</b>	Theory Application	
<b>Pre-requisites</b>	Construction Materials and Techniques	
<b>Course Objectives:</b>		
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.	
<b>Course Outcomes: Theory</b>		
<b>Upon completion of the course, students shall have ability to</b>		
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 IS code	[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]
<b>Course Contents: Theory</b>		
<b>Module 1: Engineering Geology</b>		<b>15 Hrs.</b>
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		
<b>Module 2: Mix design and Concrete Properties</b>		<b>15 Hrs.</b>
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.		
<b>Module 3: Durability of Concrete and Special Concretes</b>		<b>15 Hrs.</b>
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 destructive 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.		
<b>Total Hours:</b>		<b>45</b>
<b>Course Outcomes: Laboratory</b>		
<b>Upon completion of the course, students shall have ability to</b>		
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]	
<b>Laboratory Component:</b>			
S. No.	List of Experiments	CO Mapping	RBT
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]
<b>Text Books :</b>			
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		
<b>Reference Books</b>			
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, Properties and Materials " 4th edition, Tata McGraw Hill Education Private Limited, 2017		
<b>IS Codes</b>			
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.		

<b>Web References:</b>															
1.	<a href="https://geology.com/">https://geology.com/</a>														
2.	<a href="https://www.indianconcreteinstitute.org/">https://www.indianconcreteinstitute.org/</a>														
<b>Online Resources:</b>															
1.	<a href="https://nptel.ac.in/courses/105/102/105102012/">https://nptel.ac.in/courses/105/102/105102012/</a>														
2.	<a href="https://onlinecourses.swayam2.ac.in/nou20_cs14/">https://onlinecourses.swayam2.ac.in/nou20_cs14/</a>														
<b>Tentative Assessment Methods and Levels (based on Revised Bloom's Taxonomy)</b>															
<b>Summative assessment based on Continuous and End Semester Examination</b>															
Revised Bloom's Level	Continuous Assessment												End Semester Examination (Theory) [40 Marks]		
	Theory									Practical					
	CIA-I [10 Marks]	CIA-II [10 Marks]	CIA-III [10 Marks]	CIA-III [10 Marks]			Rubric based CIA [30 Marks]								
Remember	10	10	10	10			10			-					
Understand	10	10	10	10			10			20					
Apply	30	20	40	40			40			30					
Analyse	50	60	40	40			40			50					
Evaluate	-	-	-	-			-			-					
Create	-	-	-	-			-			-					
<b>Course Articulation Matrix: Theory</b>															
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	-	-	-	-	-	-	-	1	2	-	2
2	3	1	-	1	-	-	-	-	-	-	-	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
<b>Avg</b>	<b>3</b>	<b>1.6</b>	<b>2</b>	<b>2.2</b>	<b>2.3</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1.6</b>	<b>2</b>	<b>-</b>	<b>2</b>
<b>Course Articulation Matrix: Laboratory</b>															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	3	3	2	2	2	-	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
<b>Avg</b>	<b>3</b>	<b>2.6</b>	<b>1.6</b>	<b>1.6</b>	<b>2.1</b>	<b>-</b>	<b>1.5</b>	<b>1.5</b>	<b>1.8</b>	<b>2</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>2</b>
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

20CE403	<b>ENVIRONMENTAL ENGINEERING</b>		<b>3/0/2/4</b>
<b>Nature of Course</b>	Theory and Practical Application		
<b>Pre requisites</b>	Environmental Science		
<b>Course Objectives:</b>			
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 a community.		
4.	To study the various techniques for sludge disposal and disposal into land or water bodies.		
<b>Course Outcomes : Theory</b>			
<b>Upon completion of the course, students shall have ability to</b>			
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 system for 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 from the 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]
<b>Course Content : Theory</b>			
<b>Module 1: Water quality characteristics and water supply system</b>			<b>15 Hrs.</b>
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			
<b>Module 2: Primary and Secondary treatment of sewage</b>			<b>15 Hrs.</b>
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.			
<b>Module 3: Sewage Disposal and Air Pollution</b>			<b>15 Hrs.</b>
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.			
<b>Total Hours:</b>			<b>45</b>
<b>Course outcomes: Laboratory</b>			
<b>Upon completion of the Laboratory, students shall have ability to</b>			
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 sophisticated analytical methods		[AP]
C403.5	Determine the elemental concentration in water using sophisticated analytical methods		[AP]
C403.6	Investigate the ambient air quality characteristics and calculate the air quality index		[AN]
<b>Course Content : Laboratory</b>			
S. No	List of Experiments	CO Mapping	RBT
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]
<b>Text Books:</b>			
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														
<b>Reference Books:</b>															
1.	Birdie G.S., Water supply Engineering, Dhanpat rai publishing company, 2014														
2.	Venugopal Rao P., "Textbook of Environmental Engineering", Prentice Hall of India Pvt.Ltd, 2013														
3.	Peavy, Rowe, Tchobanoglous, "Environmental Engineering", McGraw Hill Publishers, NewDelhi, 2013.														
4.	Basak N.N, "Environmental Engineering", McGraw Hill Education., 2017														
<b>IS Code References:</b>															
1.	IS 10500:2012 Water Quality Standards, New Delhi, 2012														
2.	IS SP 26 – Handbook on Water supply and Drainage.														
<b>Web References:</b>															
1.	<a href="http://mohua.gov.in/cms/Latest-Manual-part-a-Engineering.php">http://mohua.gov.in/cms/Latest-Manual-part-a-Engineering.php</a>														
2.	<a href="http://164.100.161.188/cms/Latest-Manual-Part-B-Operation-and-Maintenance-2013.php">http://164.100.161.188/cms/Latest-Manual-Part-B-Operation-and-Maintenance-2013.php</a>														
3.	<a href="http://mohua.gov.in/cms/Latest-Manual-Part-C-Management-2013.php">http://mohua.gov.in/cms/Latest-Manual-Part-C-Management-2013.php</a>														
4.	<a href="http://cpheeo.gov.in/cms/manual-on-municipal-solid-waste-management-2016.php">http://cpheeo.gov.in/cms/manual-on-municipal-solid-waste-management-2016.php</a>														
<b>Online Resources:</b>															
1.	<a href="https://www.mooc-list.com/course/water-and-wastewater-treatment-engineering-physicochemical-technology-edx">https://www.mooc-list.com/course/water-and-wastewater-treatment-engineering-physicochemical-technology-edx</a>														
2.	<a href="http://nptel.ac.in/courses/105106119/">http://nptel.ac.in/courses/105106119/</a>														
<b>Tentative Assessment Method &amp; Level (based on Revised Bloom's Taxonomy)</b>															
<b>Summative assessment based on Continuous and End Semester Examination</b>															
Revised Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 Marks]										
	Theory			Practical											
	CIA – I (10 Marks)	CIA – II (10 Marks)	CIA – III (10 Marks)	Rubric based CIA (30 Marks)											
Remember	10	10	10	10	10										
Understand	40	40	40	20	30										
Apply	50	50	40	40	30										
Analyze	-	-	10	30	30										
Evaluate	-	-	-	-	-										
Create	-	-	-	-	-										
<b>Course Articulation Matrix : Theory</b>															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	3	3	2	2	-	2	2	2	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
<b>Course Articulation Matrix : Laboratory</b>															
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	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

<b>3</b>	2	2	2	2	2	2	2	1	1	-	1	2	1	2	2
<b>4</b>	3	2	2	2	2	2	2	1	1	-	2	1	2	3	2
<b>5</b>	2	2	2	2	2	2	2	1	1	-	2	2	2	2	2
<b>6</b>	3	3	2	2	2	1	2	1	1	-	2	2	2	3	2
<b>Avg</b>	<b>2.5</b>	<b>2.2</b>	<b>2.0</b>	<b>2.0</b>	<b>2.0</b>	<b>1.7</b>	<b>2.0</b>	<b>1.0</b>	<b>1.0</b>	<b>-</b>	<b>1.7</b>	<b>1.7</b>	<b>1.7</b>	<b>2.5</b>	<b>2.0</b>
<b>1</b>	<b>Reasonably Agreed</b>				<b>2</b>	<b>Moderately Agreed</b>				<b>3</b>	<b>Strongly Agreed</b>				

<b>20CE404</b>	<b>GEOTECHNICAL ENGINEERING</b>		<b>3/0/2/4</b>
<b>Nature of Course</b>	Theory Application		
<b>Pre requisites</b>	Construction Materials and Techniques		
<b>Course Objectives:</b>			
1.	To study the fundamentals of soil mechanics and IS soil classification system.		
2.	To analyse the soil characteristics such as permeability, stress distribution and consolidation, 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.		
<b>Course Outcomes : Theory</b>			
<b>Upon completion of the course, students shall have ability to</b>			
C404.1	Examine the basic properties of soil and classify the soil according to IS soil 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]
<b>Course Contents : Theory</b>			
<b>Module 1: Soil Classification and its Characteristics</b>			<b>15 Hrs.</b>
Soil Classification: Soil formation and soil types - Civil engineering problems related to soils - Nature of 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.			
<b>Module 2: Shear Strength, Stability of Slopes and Soil Exploration Methods</b>			<b>15 Hrs.</b>
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			
<b>Module 3: Bearing Capacity, Shallow and Deep Foundations</b>			<b>15 Hrs.</b>
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 purpose and its soil water movement.	[AP]
C404.2	Report the compaction state of the soil and classify the index properties of the fine-grained soil.	[AP]
C404.3	Calculate the permeability property of soil with different size to estimate the 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, shear strength of the undrained soil, bearing capacity of the soil.	[AP]

**Course Contents: Laboratory**

S. No	List of Experiments	CO Mapping	RBT
1.	Determination of Specific Gravity and Moisture content of Soil.	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 using direct 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 penetration test	C404.6	[AP]

<b>Text Books:</b>			
1.	Arora, K. R. "Soil Mechanics and Foundation Engineering", Standard Publishers Distributors, New Delhi, 7 <sup>th</sup> Edition Reprint, 2019.		
2.	Gopal Ranjan and Rao A S R, "Basic and Applied Soil Mechanics", New Age International Pvt. Ltd., New Delhi, 2020.		
3.	Punmia B. C., Ashok K Jain and Arun K Jain, "Soil Mechanics and Foundation", Laxmi Publications, New Delhi, Sixteenth Edition, 2019.		
<b>Reference Books:</b>			
1.	Murthy V N S, "Textbook of Soil Mechanics and Foundation Engineering", CBS Publication, New Delhi, 2017.		
2.	Muni Budhu, "Soil Mechanics and Foundation Engineering", Wiley India Publication, New Delhi, 2016.		
3.	Purushothama Raj P, "Soil Mechanics and Foundation Engineering" Pearson Education India, 2014.		
4.	Alam Singh, "Modern Geotechnical Engineering", IBS Publications, New Delhi, 2010.		
<b>IS Code of Practice:</b>			
1.	IS 2720 (Reaffirmed 2006) Part 2 to 7, 10,13, 15, 28, 36, Method of test for soil – Code of Practice, Bureau of Indian Standards, New Delhi.		
2.	IS 1080 (1985), Design and construction of Shallow foundations in soils, Bureau of Indian Standards, New Delhi.		
3.	IS 1888 (1982), Method of load test on Soils – Code of Practice, Bureau of Indian Standards, New Delhi.		
4.	IS 1892 (1979), Code of practice for Subsurface Investigation for foundation, Bureau of Indian Standards, New Delhi.		
5.	IS 1904 (1986), Design and Construction of Foundations in Soils, General Requirements, Bureau of Indian Standards, New Delhi.		
6.	IS 2131 (1981), Method for Standard Penetration Test for Soils, Bureau of Indian Standards, New Delhi.		
7.	IS 6403 (1981), Code of Practice for determination of Bearing Capacity of Shallow Foundations, Bureau of Indian Standards, New Delhi.		
8.	IS 2911 Part 1 to 4, Design and Construction of Pile Foundations – Code of Practice, Bureau of Indian Standards, New Delhi.		
9.	IS 8000 Part 1 (1976), Code of Practice for calculation of settlements of foundations – Shallow foundations subjected to symmetrical static vertical loads, Bureau of Indian Standards, New Delhi.		
<b>Web References:</b>			
1.	<a href="https://freevideolectures.com/course/95/soil-mechanics">https://freevideolectures.com/course/95/soil-mechanics</a>		
2.	<a href="https://freevideolectures.com/course/2674/foundation-engineering">https://freevideolectures.com/course/2674/foundation-engineering</a>		
3.	<a href="https://lecturenotes.in/subject/534/geotechnical-engineering-2">https://lecturenotes.in/subject/534/geotechnical-engineering-2</a>		
4.	<a href="https://www.youtube.com/playlist?list=PLbRMhDVUMngeiZjKPTPEFI1CByXmYX3Kv">https://www.youtube.com/playlist?list=PLbRMhDVUMngeiZjKPTPEFI1CByXmYX3Kv</a>		
<b>Online Resources:</b>			
1.	<a href="https://nptel.ac.in/courses/105/105/105105168/">https://nptel.ac.in/courses/105/105/105105168/</a>		
2.	<a href="https://nptel.ac.in/courses/105/103/105103097/">https://nptel.ac.in/courses/105/103/105103097/</a>		
3.	<a href="https://nptel.ac.in/courses/105/107/105107120/">https://nptel.ac.in/courses/105/107/105107120/</a>		
4.	<a href="https://onlinecourses.nptel.ac.in/noc20_ce36/preview">https://onlinecourses.nptel.ac.in/noc20_ce36/preview</a>		
<b>Tentative Assessment Methods and Levels (based on Revised Bloom's Taxonomy)</b>			
<b>Summative assessment based on Continuous and End Semester Examination</b>			
Revised Bloom's	Continuous Assessment		End Semester
	Theory	Practical	

Taxonomy	CIA-I [10 marks]	CIA-II [10 marks]	CIA III [10 marks]	Rubric Based CIA [30 Marks]	Examination (Theory) [40 Marks]										
Remember	-	-	-	10	-										
Understand	10	10	10	20	10										
Apply	50	50	50	30	50										
Analyse	40	40	40	40	40										
Evaluate	-	-	-	-	-										
Create	-	-	-	-	-										
<b>Course Articulation Matrix : Theory</b>															
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	PS O 1	PS O 2	PSO 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	-
<b>Avg</b>	<b>2.7</b>	<b>2.5</b>	<b>-</b>	<b>1.8</b>	<b>2.0</b>	<b>1.2</b>	<b>1.0</b>	<b>1.3</b>	<b>1.0</b>	<b>2.0</b>	<b>-</b>	<b>1.0</b>	<b>2.3</b>	<b>1.5</b>	<b>1.0</b>
<b>Course Articulation Matrix : Laboratory</b>															
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	PS O 1	PS O 2	PSO 3
1	3	2	2	3	3	1	-	2	1	1	-	1	2	1	1
2	2	2	-	3	2	1	-	2	1	1	-	1	2	1	1
3	2	2	-	3	2	2	-	2	1	1	-	1	2	-	1
4	2	2	-	3	2	2	-	2	1	1	-	1	2	1	1
5	2	2	-	3	2	2	-	2	1	1	-	1	2	1	1
6	2	2	-	3	2	1	-	2	1	1	-	1	2	-	1
<b>Avg</b>	<b>2.2</b>	<b>2.0</b>	<b>2.0</b>	<b>3.0</b>	<b>2.2</b>	<b>1.5</b>	<b>-</b>	<b>2.0</b>	<b>1.0</b>	<b>1.0</b>	<b>-</b>	<b>1.0</b>	<b>2.0</b>	<b>1.0</b>	<b>1.0</b>
1	Reasonably agreed		2	Moderately agreed			3	Strongly agreed							

<b>20CE405</b>	<b>TRANSPORTATION ENGINEERING</b>		<b>3/0/2/4</b>
<b>Nature of Course</b>	Theory Application		
<b>Pre requisites</b>	Surveying and Geomatics		
<b>Course Objectives:</b>			
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.		
<b>Theory Course Outcomes:</b>			
<b>Upon completion of the course, students shall have ability to</b>			
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]
<b>Theory Course Content:</b>			
<b>Module 1: Highway planning, design and construction</b>			<b>15 Hrs.</b>
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.			
<b>Module 2: Railway planning, design, construction and maintenance</b>			<b>15 Hrs.</b>
Role of Indian Railways in National Development – Railway cross sectional elements - Functions - Geometric Design of railway tracks, superelevation, cant deficiency and excess, negative superelevation. Points and Crossings – Working Principle - Signaling, Interlocking and Track Circuiting, Track Drainage, Railway Stations and Yards, Level Crossings – LRT & MRTS – Calculation of capacity of traffic.			
<b>Module 3: Airport planning and design</b>			<b>15 Hrs.</b>
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			
<b>Total Hours:</b>			<b>45 Hrs.</b>
<b>Laboratory course outcomes:</b>			
<b>Upon completion of the course, students shall have ability to</b>			
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 design of railway tracks.		[AN]
C405.5	Design the airport runway orientation		[AP]

C405.6	Examine the suitability of bitumen for usage in field.	[AP]	
<b>Laboratory Course Content:</b>			
S.No	List of Experiments	CO Mapping	RBT
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]
<b>Text Books:</b>			
1.	Rangwala, "Airport Engineering", Charotar Publishing House, 2016.		
2.	Veeraragavan. A, Khanna S.K and Justo C E G, "Highway Engineering ", Nem Chand & Bros, 10 <sup>th</sup> edition, 2015.		
3.	Arora .S.P and Saxena .S.C, "A Textbook of Railway Engineering", CBS Publishers, 2017.		
<b>Reference Books:</b>			
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 Chhaborthy and Animesh Das, "Principles of Transportation Engineering", Tata McGraw Hill Co Ltd, New Delhi, 2012.		
4.	Norman J. Ashford, Saleh Mumayiz, Paul H. Wright, "Airport Engineering: Planning, Design, and Development of 21st Century Airports" Wiley; 4th edition, 2011		
<b>IS Code of Practice</b>			
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"		
<b>Web References:</b>			
1.	<a href="https://www.designingbuildings.co.uk/wiki/Railway_engineering">https://www.designingbuildings.co.uk/wiki/Railway_engineering</a>		
2.	<a href="https://www.brighthubengineering.com/building-construction-design/125227-highway-construction-and-engineering/">https://www.brighthubengineering.com/building-construction-design/125227-highway-construction-and-engineering/</a>		
<b>Online Resources:</b>			
1.	<a href="https://www.edx.org/course/railway-engineering-an-integral-approach-2">https://www.edx.org/course/railway-engineering-an-integral-approach-2</a>		

2.	<a href="https://www.mooc-list.com/tags/highway-engineering">https://www.mooc-list.com/tags/highway-engineering</a>														
<b>Tentative Assessment Methods &amp; Levels (based on Revised Blooms' Taxonomy)</b>															
<b>Summative assessment based on Continuous and End Semester Examination</b>															
<b>Revised Bloom's Level</b>	<b>Continuous Assessment</b>												<b>End Semester Examination (Theory) [40 marks]</b>		
	<b>Theory</b>									<b>Practical</b>					
	<b>CIA-I [10 marks]</b>	<b>CIA-II [10 marks]</b>	<b>CIA-III [10 Marks]</b>							<b>Rubric based CIA (30 Marks)</b>					
Remember	10	10	-							-	-				
Understand	20	20	20							-	20				
Apply	30	30	30							50	30				
Analyse	40	40	50							50	50				
Evaluate	-	-	-							-	-				
Create	-	-	-							-	-				
<b>course articulation matrix : Theory</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
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
<b>AVG</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1.2</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1.3</b>	<b>2</b>	<b>-</b>	<b>1</b>
<b>course articulation matrix : Laboratory</b>															
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
<b>AVG</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1.2</b>	<b>3</b>	<b>-</b>	<b>1</b>	<b>1.3</b>	<b>1.7</b>	<b>1.3</b>	<b>-</b>	<b>1</b>	<b>1.5</b>	<b>-</b>	<b>1.7</b>
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

## MANDATORY COURSES

<b>20MC101</b>	<b>INDUCTION PROGRAMME (FOR ALL BRANCHES OF B.E / B.TECH PROGRAMMES)</b>	<b>1/0/0/0</b>
<b>Nature of Course</b>	Induction Programme	
<b>Pre requisites</b>	Nil	
<b>Course Objectives:</b>		
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	
<b>Course Outcomes:</b>		
<b>Upon completion of the course, students shall have ability to</b>		
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]
<b>Course Contents:</b>		
<p><b>PHYSICAL ACTIVITY:</b> 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)</p>		
<p><b>CREATIVE ARTS (students can select any one of their choice):</b> 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)</p>		
<p><b>UNIVERSAL HUMAN VALUES:</b> 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)</p>		

**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)

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	3	3	3	3	3			1
2						3	3	3	3	3	3	3			1
3						3	3	3	3	3	3	3			1
<b>Avg</b>						3	3	3	3	3	3	3			1
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

<b>20MC102</b>	<b>ENVIRONMENTAL SCIENCES</b>		<b>2 /0 /0 /0</b>
<b>Nature of Course</b>	Theory Concept		
<b>Pre requisites</b>	Basics in Environmental Studies		
<b>Course Objectives:</b>			
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.		
<b>Course Outcomes:</b>			
<b>Upon completion of the course, students shall have ability to</b>			
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 global and 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]
<b>Course Contents:</b>			
<b>Module 1: Natural Resources</b>			<b>10 Hrs.</b>
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.			
<b>Module 2: Environmental Pollutions</b>			<b>10 Hrs.</b>
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.			
<b>Module 3: Social issues and the Environment</b>			<b>10 Hrs.</b>
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.			
			<b>Total Hours: 30</b>
<b>Text Books:</b>			
1	AnubhaKaushik and C P Kaushik “Perspectives in Environmental Studies”4 <sup>th</sup> Edition, Newage International (P) Limited, Publisher Reprint 2014. New Delhi		

2	Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press 2015.
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**Reference Books:**

1	Tyler Miller, Jr., "Environmental Science", Brooks/Cole a part of Cengage Learning, 2014.
2	William Cunningham and Mary Cunningham, "Environmental Science", 13 <sup>th</sup> Edition, McGraw Hill, 2015.
3	Gilbert M. Masters, "Introduction to Environmental Engineering and Science", Third Edition, Pearson Education, 2014.

**Web References:**

1	<a href="http://nptel.ac.in/courses/104103020/20">http://nptel.ac.in/courses/104103020/20</a>
2	<a href="http://nptel.ac.in/courses/120108002">http://nptel.ac.in/courses/120108002</a>
3	<a href="http://nptel.ac.in/courses/122106030">http://nptel.ac.in/courses/122106030</a>
4	<a href="http://nptel.ac.in/courses/120108004/">http://nptel.ac.in/courses/120108004/</a>
5	<a href="http://nptel.ac.in/courses/122102006/20">http://nptel.ac.in/courses/122102006/20</a>

**Online Resources:**

1	<a href="https://www.edx.org/course/subject/environmental-studies">https://www.edx.org/course/subject/environmental-studies</a>
2	<a href="http://www.environmentalscience.org">www.environmentalscience.org</a>

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

**Formative assessment based on Capstone Model (Max. Marks:40)**

Course Outcome	Bloom's Level	Assessment Component	Marks
C102.1	Remember	Quiz	5
C102.2	Understand	Mini project based on environmental aspect	15
C102.3	Understand	Class Presentation	10
C102.4 C102.5	Apply	Group Assignment	10

**Summative assessment based on Continuous Assessment**

Revised Bloom's Level	Term End Assessment 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	3	2	2			1	2		3		1	1	1		
2	3	2				1	3		2		1	1			
3	2	2	2			1	3		3		1	1	1		
4	3	2	2			1	3		3		1	1	1		
5	3	2	2			1	3		3		1	1	1		
<b>Avg</b>	3	2	2			1	3		3		1	1	1		
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

<b>20MC103</b>	<b>SOFT SKILLS</b>		<b>2/0/0/0</b>
<b>Nature of Course</b>	Theory Concept		
<b>Pre requisites</b>	Technical Communication Skills		
<b>Course Objectives:</b>			
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.		
<b>Course Outcomes:</b>			
<b>Upon completion of the course, students shall have ability to</b>			
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]
<b>Course Contents:</b>			
<b>Module 1: Professional Communication Skills</b>			<b>10 Hrs</b>
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.			
<b>Module 2: Interpersonal Communication</b>			<b>10 Hrs</b>
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**

**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.

**Reference Books:**

1.	Reason and professional ethics by Peter Davson-Galle. Ashgate Publishing, Ltd., 2009.
2.	Cross Cultural and Inter Cultural Communication. by William B. Gudykunst. Sage Publications India Pvt Ltd, New Delhi.2003.
3.	Corporate Communications: Theory and Practice. by Joep Cornelissen. Sage Publications India Pvt Ltd, New Delhi.2004.

**Web References:**

1	<a href="https://onlinecourses.nptel.ac.in/noc16_hs15/preview">https://onlinecourses.nptel.ac.in/noc16_hs15/preview</a>
2	<a href="https://www.getinternship.switchidea.com/NTAT/syllabus/Interpersonal-Communication.">https://www.getinternship.switchidea.com/NTAT/syllabus/Interpersonal-Communication.</a>
3	<a href="https://smude.edu.in/smude/programs/bca/soft-skills.html">https://smude.edu.in/smude/programs/bca/soft-skills.html</a>

**Online Resources:**

1	<a href="https://swayam.gov.in/course/4047-developing-soft-skills-and-personality">https://swayam.gov.in/course/4047-developing-soft-skills-and-personality</a>
2	<a href="https://www.clearias.com/interpersonal-skills-including-communication-skills-for-csat/">https://www.clearias.com/interpersonal-skills-including-communication-skills-for-csat/</a>
3	<a href="https://www.bizlibrary.com/soft-skills-training/">https://www.bizlibrary.com/soft-skills-training/</a>

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

**Formative assessment based on Capstone Model (Max. Marks:40)**

Course Outcome	Revised Bloom's Level	Assessment Component	Marks
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 Assessment															
Revised Bloom's Level		Tentative End Assessment 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
<b>Avg</b>						1	1	2	2	3	2	2			1
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

<b>20MC104</b>	<b>MANAGEMENT ORGANIZATIONAL BEHAVIOUR</b>		<b>2/0/0/0</b>
<b>Nature of Course</b>	Theory Concept		
<b>Pre requisites</b>	Nil		
<b>Course Objectives:</b>			
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.		
<b>Course Outcomes:</b>			
<b>Upon completion of the course, students shall have ability to</b>			
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]
<b>Course Contents:</b>			
<b>Module 1: Fundamentals of Management, Planning and Decision Making</b>		<b>10 Hrs</b>	
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.			
<b>Module 2: Individual, interpersonal and group behavior</b>		<b>10 Hrs</b>	
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.			
<b>Module 3: Organizational Development</b>		<b>10 Hrs</b>	
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.				
			<b>Total Hours: 30 Hrs</b>	
<b>Text Books:</b>				
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.			
<b>Reference Books:</b>				
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.	UdaiPareek, Sushama Khanna, "Organization Behavior", 3rd edition, Oxford Publishing, 2012.			
<b>Web References:</b>				
1.	<a href="https://iedunote.com/fundamental-concepts-of-organizational-behavior">https://iedunote.com/fundamental-concepts-of-organizational-behavior</a>			
2.	<a href="https://nscpolteksby.ac.id/ebook/">https://nscpolteksby.ac.id/ebook/</a>			
3.	<a href="https://ebooks.lpude.in/management/mba/term_1/DMGT402_MANAGEMENT_PRACTICES_AND_ORGANIZATIONAL_BEHAVIOUR.pdf">https://ebooks.lpude.in/management/mba/term_1/DMGT402_MANAGEMENT_PRACTICES_AND_ORGANIZATIONAL_BEHAVIOUR.pdf</a>			
4.	<a href="https://www.studocu.com/in/document/vellore-institute-of-technology/organizational-behaviour/lecture-notes/ob-notes/3208134/view">https://www.studocu.com/in/document/vellore-institute-of-technology/organizational-behaviour/lecture-notes/ob-notes/3208134/view</a>			
<b>Online Resources:</b>				
1.	<a href="https://nptel.ac.in/syllabus/110105034/">https://nptel.ac.in/syllabus/110105034/</a>			
2.	<a href="https://nptel.ac.in/courses/110/105/110105033/">https://nptel.ac.in/courses/110/105/110105033/</a>			
3.	<a href="https://freevideolectures.com/course/3502/organizational-behaviour-i">https://freevideolectures.com/course/3502/organizational-behaviour-i</a>			
4.	<a href="https://nptel.ac.in/courses/110/106/110106145/">https://nptel.ac.in/courses/110/106/110106145/</a>			
<b>Tentative Assessment Methods &amp; Levels (based on Revised Bloom's Taxonomy)</b>				
<b>Formative assessment based on Capstone Model (Max. Marks:20)</b>				
Course Outcome	Revised Bloom's Level	Assessment Component	Marks	
C104.1	Understand	Online Quiz	5	
C104.2	Apply			
C104.6				
C104.3	Analyze	Online Course	10	
C104.4	Apply	Technical Presentation	5	
C104.5				
<b>Summative assessment based on Continuous and End Semester Examination</b>				
Revised Bloom's Level	Continuous Assessment			Term End Assessment Examination (Theory) [50 Marks]
	CIA-I [10 marks]	CIA-II [10marks]	CIA III [10marks]	
Remember	40	30	20	20
Understand	20	20	20	30
Apply	10	20	30	30
Analyse	30	30	30	20
Evaluate	-	-	-	-
Create	-	-	-	-

<b>Course Articulation Matrix</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
<b>1</b>	1	2	3	1	1	3	2	3	3	3	3	1	1	3	2
<b>2</b>	3	3	3	2	2	2	2	3	3	3	3	2	2	3	3
<b>3</b>	2	2	3	3	3	3	2	3	3	2	3	1	1	3	2
<b>4</b>	3	2	2	3	3	2	2	3	3	3	3	2	2	3	3
<b>5</b>	2	3	3	3	3	3	2	3	3	2	3	2	2	3	2
<b>6</b>	2	2	3	3	2	2	2	3	3	3	3	2	2	3	1
<b>Avg</b>	<b>2.2</b>	<b>2.3</b>	<b>2.8</b>	<b>2.5</b>	<b>2.3</b>	<b>2.5</b>	<b>2.0</b>	<b>3.0</b>	<b>3.0</b>	<b>2.7</b>	<b>3.0</b>	<b>1.7</b>	<b>1.7</b>	<b>3.0</b>	<b>2.2</b>
1	Reasonably agreed				2	Moderately agreed				3	Strongly agreed				

<b>20MC105</b>	<b>GENERAL APTITUDE</b>		<b>2/0/0/0</b>
<b>Nature of Course</b>	Problem analytical		
<b>Pre requisites</b>	Basic Mathematical calculations		
<b>Course Objectives:</b>			
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.		
<b>Course Outcomes:</b>			
<b>Upon completion of the course, students shall have ability to</b>			
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]
<b>Course Contents:</b>			
<b>Module 1: Number Theory and Statistics</b>		<b>14 Hrs</b>	
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.			
<b>Module 2: Logic and Decision Making</b>		<b>8 Hrs</b>	
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.			
<b>Module 3: Reasoning</b>		<b>8 Hrs</b>	
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.			
<b>Total Hours:</b>			<b>30 Hrs</b>
<b>Text Books:</b>			
1	Aggarwal R. S. “Quantitative Aptitude” Revised Edition, S. Chand Publication.		
2	Abhijit Guha “Quantitative Aptitude” 5 <sup>th</sup> Edition, McGraw Hill Education.		
<b>Reference Books:</b>			

1	Edgar Thorpe “Mental Ability & Quantitative Aptitude” 3 <sup>rd</sup> Edition, McGraw Hill Education.															
<b>Web References:</b>																
1	<a href="https://www.wiziq.com/tutorial/815468-quantitative-aptitude-reasoning-data-interpretation-video-lectures">https://www.wiziq.com/tutorial/815468-quantitative-aptitude-reasoning-data-interpretation-video-lectures</a>															
2	<a href="https://learningpundits.com/contest?referrer=harsh.cse15@nituk.ac.in">https://learningpundits.com/contest?referrer=harsh.cse15@nituk.ac.in</a>															
3	<a href="https://nptel.ac.in/courses/114106041/8">https://nptel.ac.in/courses/114106041/8</a>															
4	<a href="https://nptel.ac.in/courses/111103020/2">https://nptel.ac.in/courses/111103020/2</a>															
<b>Online Resources:</b>																
1	<a href="http://aptitudetraining.in/home/index.php">http://aptitudetraining.in/home/index.php</a>															
2	<a href="https://www.udemy.com/vedicmaths/">https://www.udemy.com/vedicmaths/</a>															
3	<a href="https://www.youtube.com/channel/UCtmn-DsF4BhPug-ff9LiDAA?disable_polymer=true">https://www.youtube.com/channel/UCtmn-DsF4BhPug-ff9LiDAA?disable_polymer=true</a>															
<b>Tentative Assessment Methods &amp; Levels (based on Revised Bloom’s Taxonomy)</b>																
<b>Formative assessment based on Capstone Model (Max. Marks:40)</b>																
<b>Course Outcome</b>	<b>Revised Bloom’s Level</b>					<b>Assessment Component</b>						<b>Marks</b>				
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				
<b>Summative assessment based on Continuous and End Semester Examination</b>																
<b>Bloom’s Level</b>		<b>Term End Assessment Examination (Theory) [60 marks]</b>														
Remember		20														
Understand		40														
Apply		40														
Analyse		-														
Evaluate		-														
Create		-														
<b>Course Articulation Matrix</b>																
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	
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	-	-	
<b>Avg</b>	<b>3</b>	<b>2.5</b>	<b>1</b>	-	-	-	-	-	-	-	-	-	<b>2</b>	-	-	
1	Reasonably agreed					2	Moderately agreed					3	Strongly agreed			