CURRICULUM & SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

FOR

BACHELOR OF TECHNOLOGY (B.Tech.)

(4 Year Undergraduate Degree Programme)

IN

CIVIL ENGINEERING

(In Alignment with National Education Policy, 2020)

[w. e. f. 2024-25]

FACULTY OF ENGINEERING AND TECHNOLOGY

SRM UNIVERSITY DELHI-NCR, SONEPAT

Plot No.39, Rajiv Gandhi Education City, P.S. Rai, Sonepat

Haryana-131029

SRM UNIVERISTY DELHI-NCR, SONEPAT
FACULTY OF ENGINEERING AND TECHNOLOGY

ENGINEERING GRADUATES EMPLOYABILITY ATTRIBUTES (EGEAs):

Sound Knowledge and Skills of Basic Sciences & Engineering Sciences:

An Engineer should be able to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

Problem Formulation, Analysis & Solving:

An Engineer should be able to identify, formulate, review research literature, and analyze complex Engineering problems reaching substantiated conclusions using principles of mathematics, natural sciences, and engineering sciences.

Design and Development of a Solution:

An Engineer must be able to design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

Investigation:

An Engineer should use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Modern Tools Usage:

An Engineer should be able to create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

The Engineer and the Society:

An Engineer should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Engineering practice.

Effective Communication Skills:

An Engineer should be able to communicate effectively on complex Engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Individual and Teamwork:

An Engineer should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Lifelong Learning:

An Engineer must 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.

Environment and Sustainability:

An Engineer must understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Professional Ethics:

An Engineer should be able to apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.

Project Management and Finance:

An Engineer must demonstrate knowledge and understanding of the engineering and management principles and apply these to Engineering work environment, as a member and leader in a team, to manage projects and in multidisciplinary environments.

SRM UNIVERISTY DELHI-NCR, SONEPAT
FACULTY OF ENGINEERING AND TECHNOLOGY

FACULTY OF ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES (FEPEOs):

1. Advancement to a professional position by virtue of their knowledge, skills and attitude.
2. Recognition for solving engineering problems and developing design solutions that consider safety and sustainability.
3. Work as successful professionals in diverse engineering disciplines and enterprises.
4. Increasing responsibilities of technical and managerial leadership in their work organizations.
5. Professional development through a commitment to career-long learning.

FACULTY OF ENGINEERING PROGRAM LEARNING OUTCOMES (FEPLOs):

1. An ability to identify, formulate, and solve real-time engineering & socio-economic problems by applying principles of engineering, science, mathematics, humanities, and social sciences.
2. An ability to use the advanced skill enhancement techniques and modern engineering tools as per Industry 4.0 necessary for engineering practice.
3. An ability to apply engineering design to produce solutions that meet specified needs with realistic considerations of environmental, ethical, health & safety, and sustainability.
4. An ability to adapt and work with multidisciplinary teams and communicate effectively.
5. An ability to function effectively on a team whose members together provide leadership, to create a collaborative environment, establish goals, and execute plan tasks.
6. An understanding of professional and ethical responsibility.
7. An ability to acquire and apply new knowledge using appropriate learning strategies with an inner quest to learn, unlearn, and relearn.

MAPPING MATRIX OF FACULTY OF ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES AND FACULTY OF ENGINEERING PROGRAM LEARNING OUTCOMES

FACULTY OF ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES	FACILTY OF ENGINEERING PROGRAM LEARNING OUTCOMES
Advancement to a professional position by virtue of their knowledge, skills and attitude.	1. An ability to identify, formulate, and solve real time engineering and socio-economic problems by applying principles of engineering, science, mathematics, humanities and social sciences. 2. An ability to use the advanced skill enhancement techniques and modern engineering tools as per industry 4.0 necessary for engineering practice.
Recognition for solving engineering problems and developing design solutions that consider safety and sustainability	2. An ability to use the advanced skill enhancement techniques and modern engineering tools as per industry 4.0 necessary for engineering practice. 3. An ability to apply engineering design to produce solutions that meet specified needs with realistic considerations of environmental, ethical, health & safety and sustainability.
Work as successful professionals in diverse engineering disciplines	3. An ability to apply engineering design to produce solutions that meet specified needs with realistic considerations of

	environmental, ethical, health & safety and sustainability. 4. An ability to adapt and work with multidisciplinary teams and communicate effectively.
Increasing responsibilities of technical and managerial leadership in their work organizations;	4. An ability to adapt and work with multidisciplinary teams and communicate effectively. 5. An ability to function effectively on a team whose members together provide leadership, to create a collaborative environment, to establish goals and to execute plan tasks. 6. An understanding of professional and ethical responsibility.
Professional development through a commitment to career-long learning.	6. An understanding of professional and ethical responsibility. 7. An ability to acquire and apply new knowledge using appropriate learning strategies with inner quest to learn, unlearn and relearn.

TABLE 1: MAPPING MATRIX OF FACULTY OF ENGINEERING PROGRAM EDUCATIONAL OBJECTIVES AND FACULTY OF ENGINEERINGPROGRAM LEARNING OUTCOMES (TABULAR FORMAT)

MAPPING MATRIX	FEPLO 1	FEPLO 2	FEPLO 3	FEPLO 4	FEPLO 5	FEPLO 6	FEPLO 7
FEPEO 1	X	X					
FEPEO 2		X	X				
FEPEO 3			X	X			
FEPEO 4				X	X	X	
FEPEO 5						X	X

SRM UNIVERSITY, DELHI-NCR, SONEPAT
CIVIL ENGINEERING DEPARTMENT

CIVIL ENGINEERING GRADUATE EMPLOYABILITY ATTRIBUTES (CEGEAS):

The B. Tech program aims at providing a strong foundation in theoretical, practical, and design aspects of Civil Engineering (CE). The UG program is embraced by rigor and span to prepare a practicing engineer for a lifetime of creative work and ongoing technical learning. The curriculum covers all aspects of Civil engineering. The syllabus comprises theory and laboratory courses. The theory course can be either a professional core (major) or a professional elective course (minor). There are various specialized identified domains in emerging areas on which minor specializations are offered by the department. Theory courses with laboratory component is included which provides a balanced mix of quality teaching of theoretical concepts and experimental verification of the learned concepts.

Employability Attributes of a Civil Engineering Graduates will help them to attain the competencies or abilities required to gain success in the comparative market at all the employment level. The following Engineering Program Employability Attributes are required in a Civil Engineer:

Sound Knowledge and Skill	A Civil Engineer should be able to apply the sound knowledge and skills of basic science and engineering science and engineering specialization to the solution of complex civil engineering problems.
Problem Analysis	A Civil Engineer should be able to identify, formulate, analyze and solve complex civil engineering problems using principles of mathematics, natural sciences, and engineering sciences.
Design and Development of Solution	A Civil Engineer must be able to propose solutions for complex civil engineering problems and design components to meet the specified needs for the public health and safety, and the cultural, societal, and environmental considerations.
Investigation	A Civil Engineer should use research-based knowledge and methods including design of experiments, analysis and interpretation of data, and synthesis of the information validate conclusions.

Modern Tools Usage	A Civil Engineer should be able to use modern engineering and IT tools for modeling, designing and analyzing civil structures.
The Engineer and the Society	A Civil Engineer should be able to assess various issues while abiding professional civil engineering codes.
Environment and Sustainability	A Civil Engineer must apply knowledge to provide engineering solutions for sustainable development of construction materials and structures within the societal and environmental context.
Ethics	A Civil Engineer should be able to apply principles and professional ethics and follow civil engineering practice norms laid by the various governing bodies.
Effective Communication	A Civil Engineer should be able to communicate effectively, comprehend and write effective reports for the engineering community and society.
Project Management and Finance	A Civil Engineer must understand the engineering and management principles and apply them to manage projects and in multidisciplinary environments.
Lifelong Learning	A Civil Engineer should be able to engage in independent and life-long learning.

Department of Civil Engineering

PROGRAM EDUCATIONAL OBJECTIVES(PEOs)

The Program Educational Objectives (PEOs) for the Department of Civil Engineering are to prepare our students to:

PEO1. Actively engage in problem solving using engineering principles to address the evolving needs of the society.

PEO2. Be able to investigate, analyze, design and develop Civil Engineering materials solutions and structures.

PEO3. Demonstrate a commitment to service to the profession and society.

PEO4. Be able to succeed in positions in Civil Engineering practice or research or entrepreneurship.

PEO5. Acquire competence of adapting to the ever changing technologies and new developments.

PEO6. Professional development through a commitment to career-long learning.

PROGRAM LEARNING OUTCOMES (PLOs)

The curriculum and syllabus for B. Tech. (Civil Engineering) programs conform to outcome based on C-D-I-O Initiative. The framework provides students with an education stressing engineering fundamentals set in the context of Conceiving — Designing — Implementing — Operating (CDIO) real-world systems and products.

In general, the curriculum and syllabus have been structured in such a way that each of the courses meets one or more of these under-mentioned outcomes. Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program. Further each course in the program spells out clear educational objectives which are mapped to the student outcomes.

Civil Engineering Graduates will be able to:

PLO1 Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to

the solution of complex engineering problems.

PLO2 Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PLO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PLO4 Conduct Investigations of Complex Civil Engineering Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for complex problems.

PLO5 Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PLO6 The Engineer and the Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PLO7 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.

PLO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PLO9 Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PLO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and

receive clear instructions.

PLO11 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.

PLO12 Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change

TABLE 2: MAPPING MATRIX OF PROGRAM EDUCATIONAL OBJECTIVES (PEOs) AND PROGRAM LEARNING OUTCOMES(PLOs)

	Program Learning Outcomes (PLOs)											
Program	**PLO**	**PLO**	**PLO**	**PLO**	**PLO**	**PLO**	**PLO**	**PLO**	**PLO**	**PLO**	**PLO**	**PLO**
Educational Objectives	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
(PEOs)												
PEO1	x	x	x	x	x	x			x	x		
PEO2	x	x	x	x	x	x				x	x	x
PEO3	x	x	x	x	x	x	x	x				
PEO4	x			x	x				x	x	x	
PEO5	x	x	x	x	x	x	x	x				
PEO6		x	x	x	x		x	x	x	x		

B. TECH (CIVIL ENGINEERING) PROGRAMME STRUCTURE

The curriculum for a Bachelor of Technology in Civil Engineering is tailor-made so that the graduate must have a strong foundation in the discipline and in-depth knowledgeof the tools used to tackle both, conventional and new challenging problems. To earn a B.Tech. degree in Civil Engineering, a student should secure a minimum of 185 credits in the course of their study. The credit requirements for their program of study are comprised of the following Programme Structure:

- **Basic Applied Sciences (BAS) and Engineering Science (ES):**

  The purpose of Basic Applied Sciences in Engineering study is to lay a strong foundation of basic principles of various disciplines such as Mathematics, Physics, and Chemistry in the mind of the learners so that they proceed to the rest of their years of study with up to date knowledge and training of basic engineering skills. The Engineering Sciences requirementssupport multiple objectives: first, the courses provide a strong foundation in the basic tools and methodologies common to all engineering disciplines; second, all students are exposed to the basics of each discipline allowing for cross-disciplinary competencies; last, there is a multi-disciplinary project component where students from different engineering disciplinescome together on a design project, allowing for practice in collaborative teamwork.

- **Professional Core Courses (PC):** The Professional core courses are aimed at providing the student with a solid foundation in their chosen field of study as per Industry 4.0 skills and knowledge.

- **Practical (P):**

  The labs are fully furnished and well equipped with the latest software's to conduct practicals as per the requirement of the University Curriculum.

- **Professional Electives (PE) – Programme-Specific Specialization Electives:**

  The Professional electives, on the other hand, provide the student with an option to gain exposure to different specializations within the discipline, or an opportunity to study one of the subfields in some depth.

- **Ability Enhancement Courses (AEC)**

  Students are required to achieve competency in a Modern Indian Language (MIL) along with English language with special emphasis on language and communication skills. The courses aim to enable the students to acquire and demonstrate core linguistic skills, including critical

reading and academic writing skills. The focus is on imparting students with necessary skills to articulate their arguments and present their thoughts clearly and coherently and recognize the importance of language as a mediator of knowledge and identity.

- **Skill Enhancement Courses (SEC) – Technical & Soft Skills:**
  - **Technical Skills:** Under Technical Skills Broad categories of training to be imparted to Engineering Graduates of various disciplines with common nomenclature. The training is categorized into three categories: Elementary, Intermediate & Advanced keeping in view the interdisciplinary approach. (One CreditEach from 3rd semester to 7th semester)
  - **Soft Skills:** Under Soft skills training, six soft skill courses with defined nomenclature and course content common to all Engineering disciplines are introduced to inculcate Group Dynamics, Teamwork & Leadership Traits by engaging students in interactive sessions through Role Play, Group Discussions, and for improving presentation & Communication skills of engineering graduates. (One Credit Course from 3rd Semester to 7th semester).
- **Value Added Courses (VAC):**

  Course components relating to skills, attitudes, and values required to take appropriate actions for mitigating the effects of environmental degradation, climate change, and pollution, effective waste management, conservation of biological diversity, management of biological resources, forest and wildlife conservation, and sustainable development and living health and wellness seek to promote an optimal state of physical, emotional, intellectual, social, spiritual, and environmental well-being of a person, the constitutional obligations with special emphasis on constitutional values and fundamental rights and duties

- **Live Projects (LP) & Industrial Visits (IV) and Summer Internship (SI):**
- **Live Projects& Industrial Visits:**
  - ❖ Live Projects is being introduced for all Engineering disciplines from the 3rd semester onwards till the 6th Semester to develop an ability in engineering graduates to apply skillsand knowledge attained to solve real-life complex problems (One Credit each semester).
  - ❖ Apart from this, it will be mandatory to conduct at least 2 Industrial Visits each semester to provide students a proper industrial exposure.

- **Summer Internship (SI):**

  - ❖ Students will be monitored on periodic basis, both by the Faculty Mentor from the Industry and the Faculty in-charge from the department. The Faculty Mentor from the Industry will submit the Mid-Term and End-Term Evaluation report. However, the faculty in-charge from the department will take periodic presentation to keep a check on the progress of the Student.
  - ❖ Students are provided with the internship-related document which helps them to prepare a report. In addition to this, it provides detail to students aboutinternship/project evaluation parameters.

- **Multidisciplinary (Humanities and Social Sciences Courses) Courses (MDC)**

The open elective subject courses provide the student with wide latitude to pursue their interests, be it in humanities, management, arts, or their own chosen field of study in order to have a multidisciplinary approach.

TABLE 3: PROGRAM STRUCTURE FOR BACHELOR OF TECHNOLOGY (CIVIL ENGINEERING) DEGREE COURSE

SL. No.	Course Category	Course Code	Number of Courses
1	Basic Applied Sciences	BAS	7
2	Engineering Sciences	ES	10
3	Professional Core	PC	15
4	Professional Electives -Program Specific Specialized Elective Courses	PE	11
5	Ability Enhancement Courses	AEC	4
6	Skill Enhancement courses (Technical andSoft skills)	SEC	10
7	Value Added Courses	VAC	3
8	Practical / Workshop	P/W	9
9	Live Project & Industrial Visit and Summer Internship	LP/SI	6
10	Multidisciplinary (Humanities and Social Sciences Courses) Courses	MDC	3
TOTAL NUMBER OF COURSES			78

SRM UNIVERSITY DELHI-NCR, SONEPAT

TABLE 4: PROGRAM CREDIT STRUCTURE SEMESTER WISE FOR BACHELOR OF TECHNOLOGY (CIVIL ENGINEERING) DEGREE COURSE

SL. No	Course Category	Course Code	Credits Per Semester								Total Credits	% AGE
			I	II	III	IV	V	VI	VII	VIII		
1	Basic Applied Sciences	BAS	9	9	4	-	-	-	-	-	22	12
2	Engineering Sciences	ES	9	9	-	-	-	-	-	-	18	10
3	Professional Core	PC	-	-	13	13	12	6	7	-	51	28
4	Professional Electives -Program SpecificSpecialized Elective Courses	PE	-	-	-	3	6	12	12	-	33	18
5	Ability Enhancement Courses	AEC	5	2	-	-	-	-	-	-	7	4
6	Skill Enhancement courses (Technical andSoft skills)	SEC	-	-	2	2	2	2	2	-	10	5
7	Value Added Courses	VAC	2	2	2	-	-	-	-	-	6	3
8	Practical / Workshop	P/W	-	-	3	3	2	1	-	-	9	5
9	Live Project & Industrial Visit andSummer Internship	LP/SI	-	-	-	1	1	1	5	12	20	11
10	Multidisciplinary (Humanities and Social Sciences Courses) Courses	MDC	-	-	-	3	3	3	-	-	9	5
TOTAL			**25**	**22**	**24**	**25**	**26**	**25**	**26**	**12**	**185**	**100**

BACHELOR OF TECHNOLOGY (CIVIL ENGINEERING) DEGREE COURSE
TABLE 5: PROGRAM COURSE'S CREDIT STRUCTURE SEMESTER WISE

Semester-I

SL. No	Code	Category	Course Name	Hours per week				Credits
				L	T	P	Total Hours	
THEORY								
1	24AS101	(BAS)	Engineering Mathematics-I	3	1	0	4	4
2	24AS102/ 24AS103	(BAS)	Engineering Physics/ Engineering Chemistry	3	1	0	4	4
3	24EE101/ 24EC101	(ES)	Basic Electrical Engineering / Basic Electronics Engineering	3	0	0	3	3
4	23ME101/ 23CS101	(ES)	Engineering Mechanics / Fundamentals of Computer & C Programming	3	0	0	3	3
5	24HS101	(AEC)	Communicative English (*50% of students will be offered)	2*	0	0	2*	2*
6	24xx101/ 24FLGR 101-I/ 24FLFR101-I	(AEC)	Hindi-I/German-I/French-I	2	0	0	2	2
7	23ESEB101/ 23VAC102	(VAC)	Environmental Bioengineering / Indian Constitution and Polity	2	0	0	2	2
Total Credits (Theory)				**16/18**	**2**	**0**	**18/20**	**18/20**
PRACTICAL								
8	24AS152/24AS153	(BAS)	Engineering Physics Lab/Engineering Chemistry Lab	0	0	2	2	1
9	23EE151/24EC151	(ES)	Basic Electrical Engineering Lab / Basic Electronics Engineering Lab	0	0	2	2	1
10	23ME151/23 CS151	(ES)	Basic Mechanical Engineering Lab/ C Programming Lab	0	0	2	2	1
11	23ME152/23ME153	(ES)	Mechanical Workshop Lab/Engineering Graphics & Design Lab	0	0	2	2	1
12	24HS151*	(AEC)	Communicative English Lab (50% of students will be offered)	0	0	2*	2*	1*
Total Credits (Practical)				**0**	**0**	**8/10**	**8/10**	**4/5**
TOTAL CREDITS (THEORY + PRACTICAL)				**16/18**	**2**	**8/10**	**26/30**	**22/25**

** 1 credit practical i.e. 24CAM101- INDUSTRIAL SESSION – I will be offered to IBM Specialization students.
[L= Lecture, T = Tutorials, P = Practical's & C = Credits]

SEMESTER-II

SL. No	Code	Category	Course Name	Hours per week				Credits
				L	T	P	Total Hours	
THEORY								
1	24AS201	(BAS)	Engineering Mathematics-II	3	1	0	4	4
2	24AS202/ 24AS203	(BAS)	Engineering Physics/ Engineering Chemistry	3	1	0	4	4
3	24EE201/ 24EC201	(ES)	Basic Electrical Engineering / Basic Electronics Engineering	3	0	0	3	3
4	23ME201/ 23CS201	(ES)	Engineering mechanics / Fundamentals of Computer & C Programming	3	0	0	3	3
5	24HS201	(AEC)	Communicative English (*50% of students will be offered)	2*	0	0	2*	2*
6	24xx201/ 24FLGR 201-II/ 24FLFR201-II	(AEC)	Hindi-II/German-II/French-II	2	0	0	2	2
7	23ESEB201/2 3VAC 202	(VAC)	Environmental Bioengineering / Indian Constitution and Polity	2	0	0	2	2
Total Credits (Theory)				**16/18**	**2**	**0**	**18/20**	**18/20**
PRACTICAL								
8	24AS252/24AS253	(BAS)	Engineering Physics Lab/Engineering Chemistry Lab	0	0	2	2	1
9	23EE251/ 24EC251	(ES)	Basic Electrical Engineering Lab / Basic Electronics Engineering Lab	0	0	2	2	1
10	23ME251/23CS251	(ES)	Basic Mechanical Engineering Lab/ C Programming Language Lab	0	0	2	2	1
11	23ME251/2 3ME252	(ES)	Mechanical Workshop Lab/Engineering Graphics & Design Lab	0	0	2	2	1
12	24HS251*	(AEC)	Communicative English Lab (50% of students will be offered)	0	0	2*	2*	1*
Total Credits (Practical)				**0**	**0**	**8/10**	**8/10**	**4/5**
Total Credits (Theory + Practical)				**16/18**	**2**	**8/10**	**26/30**	**22/25**

** 1 credit practical i.e. 24CAM201- INDUSTRIAL SESSION –II will be offered to IBM Specialization students.

L= Lecture, T = Tutorials, P = Practical's & C = Credit

Semester-III

SL. No	Code	Category	Course	Hours per week				Credits
				L	T	P	Total Hours	
Theory								
1	23CE301	(PC)	Structural Analysis – I	3	1	0	4	4
2	23CE302	(PC)	Surveying – I	3	0	0	3	3
3	23CE303	(PC)	Fluid Mechanics	3	0	0	3	3
4	23CE304	(PC)	Environmental Engineering	3	0	0	3	3
5	24AS301	BAS	Engineering Mathematics - III	3	1	0	4	4
Total Credits (Theory)				15	2	0	17	17
Practical								
7	23CE352	(P)	Surveying – I Lab	0	0	2	2	1
8	23CE353	(P)	Fluid Mechanics Lab	0	0	2	2	1
9	23CE354	(P)	Environmental Engineering Lab	0	0	2	2	1
10	23VAC301	(VAC)	Sports, Yoga and Fitness	1	0	2	3	2
Total Credits (Practical)				1	0	8	9	5
Skill Enhancement								
11	24CS0201A/24CS0201B/24CS0201C/24CS0201D	(SEC)	Data Structure and Algorithms using C or C++/Industry Automation Level-I/ Digital Marketing/Fundamentals of CAD for Engineers	0	0	2	2	1
12	23SS351	(SEC)	Effective Communication Skills	0	0	2	2	1
Total Credits (Skill Enhancement)				0	0	4	4	2
Total Credits (Theory + Practical + Skill Enhancement)				16	2	12	30	24

[L= Lecture, T = Tutorials, P = Practical's & C = Credits]

Semester-IV

SL.No	Code	Category	Course	Hours per week				Credits
				L	T	P	Total Hours	
Theory								
1	24MDC401	(MDC)	Multidisciplinary Elective-I	3	0	0	3	3
2	24CE401	PC	Programming Using Python	3	0	0	3	3
3	23CE402	(PC)	Soil Mechanics	3	0	0	3	3
4	23CE403	(PC)	Design of Steel Structure	3	0	0	3	3
5	23CE404	(PC)	Structural Analysis – II	3	1	0	4	4
6	23CEPEXX	(PE)	Professional Elective - I	3	0	0	3	3
Total Credits (Theory)				18	1	0	19	19
Practical								
7	23CE451	(P)	Surveying – II Lab	0	0	2	2	1
8	23CE452	(P)	Soil Mechanics Lab	0	0	2	2	1
9	23CE453	(P)	Structural Analysis Lab	0	0	2	2	1
10	23CE454	(LP/SI)	Live Project – I (Steel Structures)## & Industrial Visits	0	0	1	1	1
Total Credits (Practical)				0	0	7	7	4
Skill Enhancement								
11	23SS452	(SEC)	Teamwork & Interpersonal Skills	0	0	2	2	1
12	24CS0202 A/24CS02 02B/24CS0 202C	(SEC)	Introduction to SPSS Tool/Design Thinking and Augmented Virtual Reality/Programming Using Python for Engineers	0	0	2	2	1
	Total Credits (Skill Enhancement)			0	0	4	4	2
Total Credits (Theory + Practical + Skill Enhancement)				18	1	11	30	25

[L= Lecture, T = Tutorials, P = Practical's & C = Credits]

##To be carried out after 3rd Semester during semester break. Evaluation to be carried out in 4th Semester

Semester – V

SL.No	Code	Category	Course Name	Hours per week				Credits
				L	T	P	Total Hours	
Theory								
1	24MDC501	(MDC)	Multidisciplinary Elective-II	3	0	0	3	3
2	23CE501	(PC)	Foundation Engineering	3	1	0	4	4
3	23CE502	(PC)	Design Of Reinforced Concrete Structure	3	1	0	4	4
4	23CE503	(PC)	Transportation Engineering	3	1	0	4	4
5	*23CEPEXX	(PE)	Professional Elective - II	3	0	0	3	3
6	*23CEPEXX	(PE)	Professional Elective - III	3	0	0	3	3
Total Credits (Theory)				18	3	0	21	21
Practical								
7	23CE551	(P)	Foundation Engineering Lab	0	0	2	2	1
8	23CE552	(P)	Transportation Engineering –Lab	0	0	2	2	1
9	23CE553	(LP/SI)	Live Project– II & Industrial Training	0	0	1	1	1
Total Credits (Practical)				0	0	5	5	3
Skill Enhancement								
10	23SS553	(SEC)	Presentation Skills	0	0	2	2	1
11	24CS0301A/24CS0301B/24CS0301C/24CS0301D/24CS0301E	(SEC)	Wearable Technology/Big Data Analytics, Tools and Techniques/Machine Learning using Python/Industry Automation Level-II/RCC Structure Drawing Training	0	0	2	2	1
Total Credits (Skill Enhancement)				0	0	4	4	2
Total Credits (Theory + Practical + Skill Enhancement)				18	3	9	30	26

[L= Lecture, T = Tutorials, P = Practical's & C = Credits]

Semester – VI

SL.No	Code	Category	Course	Hours per week				Credits
				L	T	P	Total Hours	
Theory								
1	24MDC601	(MDC)	Multidisciplinary Elective-III	3	0	0	3	3
2	23CE601	(PC)	Construction Techniques and Equipment	3	0	0	3	3
3	23CE602	(PC)	Advanced Surveying	3	0	0	3	3
4	*23CEPEXX	(PE)	Professional Elective-V	3	0	0	3	3
5	*23CEPEXX	(PE)	Professional Elective-VI	3	0	0	3	3
6	*23CEPEXX	(PE)	Professional Elective-VII	3	0	0	3	3
7	*23CEPEXX	(PE)	Professional Elective-VIII	3	0	0	3	3
Total Credits (Theory)				21	0	0	21	21
Practical								
8	23CE651	(P)	Material Testing Lab	0	0	2	2	1
9	23CE652	(LP/SI)	Live Project– III (RCC Structures)## & Industrial Visits	0	0	1	1	1
Total Credits (Practical)				0	0	3	3	2
Skill Enhancement								
10	23SS655	(SEC)	Professional Skills	0	0	2	2	1
11	24CS0302A/24CS03 02B/24CS0302C/24 CS0302D	(SEC)	Artificial Intelligence and Machine Learning/MATLAB for Engineers/ Structural Analysis using FEM-based Tools/Data Analytics Tools	0	0	2	2	1
Total Credits (Skill Enhancement)				0	0	4	4	2
Total Credits (Theory + Practical + Skill Enhancement)				21	0	7	28	25

[L= Lecture, T = Tutorials, P = Practical's & C = Credits]

***The XX part of the course code will depend upon the elective chosen by the student**
##Industry visit will be carried out during 6th semester.

Semester – VII

SL.No	Code	Category	Course	Hours per week				Credits
				L	T	P	Total Hours	
Theory								
1	*23CEPEXX	(PE)	Professional Elective -VIII	3	0	0	3	3
2	*23CEPEXX	(PE)	Professional Elective -IX	3	0	0	3	3
3	*23CEPEXX	(PE)	Professional Elective -X	3	0	0	3	3
4	*23CEPEXX	(PE)	Professional Elective -XI	3	0	0	3	3
5	23CE701	(PC)	Estimating, Costing & Evaluation	3	1	0	4	4
6	23CE702	(PC)	Prestressed Concrete Structures	3	0	0	3	3
Total Credits (Theory)				18	1	0	19	19
Practical								
7	23CE751	(LP/SI)	**Minor Project	0	0	8(4) **	4	4
8	24CE752	(LP/SI)	Live Project– IV (Highways)## & Industrial Training	0	0	1	1	1
Total Credits (Practical)				0	0	5	5	5
Skill Enhancement								
9	23SS756	(SEC)	Aptitude and Reasoning	0	0	2	2	1
10	24CS0401A/ 24CS04 01B/24CS04 01C/24 CS0401D	(SEC)	Building information modeling/PLC Programming/ FPGA for Embedded Systems/Essentials of Blockchain and IoT	0	0	2	2	1
Total Credits (Skill Enhancement)				0	0	4	4	2
Total Credits (Theory + Practical + Skill Enhancement)				18	1	9	28	26

[L= Lecture, T = Tutorials, P = Practical's & C = Credits]

***The XX parts of the course code will depend upon the elective chosen by the student.**

****To be monitored at the Institute Level. Teaching Load for ERP**
##To be carried out after 6th semester during semester break. Evaluation to be carriedout in 7th Semester.

Semester – VIII

SL.No	Code	Category	Course	Hours per week				Credits
				L	T	P	Total Hours	
Practical								
1	23CE851	(LP/SI)	*Major Project (Industrial Internship)	0	0	24	24(6) **	12
Total Credits (Practical)				0	0	24	24(6) **	12

* To Be Monitored at the Institute Level

** Teaching Load

Department Elective Courses in Degree of Civil Engineering

Code	Category	Course	L	T	P	C
23CEPE01	**(PE)**	Structural Dynamics	3	0	0	3
23CEPE02	**(PE)**	Introduction to Finite Element Method	3	0	0	3
23CEPE03	**(PE)**	Air and Noise Pollution and Control	3	0	0	3
23CEPE04	**(PE)**	Hydrology	3	0	0	3
23CEPE05	**(PE)**	Advanced Concrete Technology	3	0	0	3
23CEPE06	**(PE)**	Open Channel Hydraulics	3	0	0	3
23CEPE07	**(PE)**	Railway and Airport Engineering	3	0	0	3
23CEPE08	**(PE)**	Design of Wastewater Treatment Processes	3	0	0	3
23CEPE09	**(PE)**	Building Construction Materials	3	0	0	3
23CEPE10	**(PE)**	Disaster Management	3	0	0	3
23CEPE11	**(PE)**	Earthquake Analysis and Design	3	0	0	3
23CEPE12	**(PE)**	Bridge Engineering	3	0	0	3
23CEPE13	**(PE)**	Design of Advance Concrete Structures	3	0	0	3
23CEPE14	**(PE)**	Irrigation Engineering	3	0	0	3
23CEPE15	**(PE)**	Solid Waste Management and Landfills	3	0	0	3
23CEPE16	**(PE)**	Ground Improvement Techniques	3	0	0	3
23CEPE17	**(PE)**	Geotechnical Engineering	3	0	0	3
23CEPE18	**(PE)**	Rock Mechanics	3	0	0	3
23CEPE19	**(PE)**	Geosynthetics and Its Application	3	0	0	3

Department Elective Courses of Specialization in Degree of Civil Engineering

Specialization in Structural Engineering

Code	Category	Course	L	T	P	C
23CEPE01	**(PE)**	Structural Dynamics	3	0	0	3
23CEPE02	**(PE)**	Introduction To Finite Element Method	3	0	0	3
23CEPE05	**(PE)**	Advanced Concrete Technology	3	0	0	3
23CEPE09	**(PE)**	Building Construction Materials	3	0	0	3
23CEPE10	**(PE)**	Disaster Management	3	0	0	3
23CEPE11	**(PE)**	Earthquake Analysis and Design	3	0	0	3
23CEPE12	**(PE)**	Bridge Engineering	3	0	0	3
23CEPE13	**(PE)**	Design of Advance Concrete Structures	3	0	0	3
23CEPE14	**(PE)**	Prestressed Concrete Structures	3	0	0	3
23CEPE16	**(PE)**	Ground Improvement Techniques	3	0	0	3
23CEPE19	**(PE)**	Geosynthetics and Its Application	3	0	0	3
23CEPE20	**(PE)**	Advance Structural Analysis	3	0	0	3
23CEPE21	**(PE)**	Temporary Structures	3	0	0	3
23CEPE22	**(PE)**	Maintenance and Repair of Structures	3	0	0	3
23CEPE23	**(PE)**	Health Monitoring of Structures	3	0	0	3
23CEPE24	**(PE)**	Design and Detailing of Structures	3	0	0	3
23CEPE25	**(PE)**	Design of Masonry Structures	3	0	0	3

Ability Enhancement Courses

Code	Category	Course	L	T	P	C
24HS101/24HS201	**(AEC)**	Communicative English	2	0	0	2
24 HIN101-I/24FLGR-I/24FLFR-I	**(AEC)**	Hindi/ German/French (Phase-I)	2	0	0	2
24 HIN101-II/24FLGR-II/24FLFR-II	**(AEC)**	Hindi/ German/French (Phase-II)	2	0	0	2
24HS151/24HS251	**(AEC)**	Communicative English Laboratory	0	0	2	1

List of Skill Enhancement Courses

SubjectCode	Course	Category	L	T	P	Credits
Technical Training						
24CS0201A/24CS0201B/24CS0201C/24CS0201D	Data Structure and Algorithms using C or C++/Industry Automation Level-I/ Digital Marketing/Fundamentals of CAD for Engineers	SEC	0	0	2	1
24CS0202A/24CS0202B/24CS0202C	Introduction to SPSS Tool/Design Thinking and Augmented Virtual Reality/Programming Using Python for Engineers	SEC	0	0	2	1
24CS0301A/24CS0301B/24CS0301C/24CS0301D/24CS0301E	Wearable Technology/Big Data Analytics, Tools and Techniques/Machine Learning using Python/Industry	SEC	0	0	2	1

	Automation Level-II/RCC Structure Drawing Training					
24CS0302A/24CS0302B/24CS0302C/24CS0302D	Artificial Intelligence and Machine Learning/MATLAB for Engineers/ Structural Analysis using FEM-based Tools/Data Analytics Tools	SEC	0	0	2	1
24CS0401A/24CS0401B/24CS0401C/24CS0401D	Building information modeling/PLC Programming/ FPGA for Embedded Systems/Essentials of Blockchain and IoT	SEC	0	0	2	1
Soft Skill						
23SS351	Effective Communication Skills	SEC	0	0	2	1
23SS452	Teamwork & Interpersonal Skills	SEC	0	0	2	1
23SS654	Presentation Skills	SEC	0	0	2	1
23SS756	Aptitude and Reasoning	SEC	0	0	2	1

Value Added Courses

Total: 6 (2*3) Credits						
Code	**Category**	**Course**	**L**	**T**	**P**	**C**
23ESEB101/23ESEB201	(VAC)	Environment Bioengineering	2	0	0	2
23VAC101/23VAC201	(VAC)	Environment Protection and Sustainable Development	2	0	0	2
23VAC102/23VAC202	(VAC)	Indian Constitution and Polity	2	0	0	2
23VAC103	(VAC)	Sports, Yoga and Fitness	1	0	2	2
Note:						
All Courses are compulsory for the students.						
Students would be encouraged to opt NCC/NSS.						

Humanities & Social Sciences including Management Courses (Multi-Disciplinary Courses)

Total: 9 (3*3) Credits						
Code	**Category**	**Course**	**L**	**T**	**P**	**C**
23MDC101/24MDC101A /24MDC101B/24MDC10 1C/24MDC101D	(MDC-I)	Statistical Methods/Computer-Based Numerical and Statistical Technique/Probability and Random Process/Biostatistics/Numerical Methods	3	0	0	3
23MDC102		Environmental Geosciences & Disaster Management	3	0	0	3
23MDC301		IPR in Business	3	0	0	3
23MDC302		Library Information Sciences & Media Literacy	3	0	0	3
23MDC401		Management Process & Organizational Behaviour	3	0	0	3
23MDC103	(MDC-II)	Photonics	3	0	0	3
23MDC104		Chemistry & Society	3	0	0	3
23MDC303		Psychology and Emotional Intelligence	3	0	0	3
23MDC304		Indian Economy	3	0	0	3
23MDC402		Creating an Entrepreneurial Mind	3	0	0	3
24MDC 106A/24MDC 106B		Numerical Methods in BME/Discrete Mathematics	3	0	0	3
23MDC105	(MDC-III)	Life Sciences & Public Health	3	0	0	3
23MDC305		Electoral Literacy in India	3	0	0	3
23MDC403		Personal Financial Planning	3	0	0	3
23MDC404		Interior Design	3	0	0	3
24MDC107		Probability & Statistics	3	0	0	3

Note

1. These courses will be of introductory level and shall have 3 credits.
2. Student will not be allowed to choose or repeat the courses already gone through in class XII and present in Program core and specialization.
3. Student will have option to choose any 3 out of the pool.

*Course shall be based on applications, tools and techniques.

1st Year

ENGINEERING MATHEMATICS-I (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code:24AS101	**Continuous Evaluation:** 40 Marks
Credits: 4	**End Semester Examination:** 60 Marks
L T P : 3 1 0	
Prerequisite:12th Mathematics	

COURSE OBJECTIVES (COs)

1. To introduce the concept of Matrices and its applications
2. To introduce the concept of Differentiation-Ordinary & Partial differentiation and their applications.
3. To understand the calculation of Multiple Integrals with their Applications.
4. To get the knowledge that illustrate the concepts of Vector Calculus to understand solenoidal and irrotational vectors with inter dependence of line, surface and volume integral.
5. To familiarize with the concept of sequence & series and their convergence.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Develop the essential tool of matrices to compute inverse, eigenvalues and eigenvectors.
2. Apply the knowledge of differentiation, partial differentiation, Maxima and minima of two variables for analyzing engineering problems.
3. Apply the multiple integrals in engineering applications.
4. Understand differentiation and integration of vectors with knowledge of Green's, Gauss divergence and Stroke's theorems.
5. Demonstrate the convergence of sequence & series.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLO / CO	CLO-01	CLO-02	CLO-03	CLO-04	CLO-05
CO-01	✓				
CO-02		✓			
CO-03			✓		
CO-04				✓	
CO-05					✓

COURSE CONTENTS

Unit-1 : Matrices

Introduction, Types of Matrices, Elementary Transformations, Inverse of a square matrix by elementary transformation, Rank of a matrix (Echelon and Normal forms), Linear Dependence & Independence of vectors, Solution of system of linear equations (AX = 0 and AX = B) , Eigenvalues and Eigenvectors, Cayley Hamilton theorem, Diagonalization of Matrices, Simple applications.

Unit – 2: Differentiation

Successive differentiation, nth order derivatives of standard functions, Leibnitz's theorem, Partial Derivatives, Homogenous function, Euler's theorem for homogenous functions, Deductions from Euler's theorem, Total Derivatives, Chain Rule, Composite function of two variables, Differentiation of implicit functions, Applications of Partial Derivatives- Taylor's theorem for two variables, Maxima and minima for two variables, Jacobians.

Unit-3: Multiple Integral

Introduction, Evaluation of Double integrals, Change of Order of Integration, Double integration in polar coordinates, Change of Variables, Triple integrals - Evaluation of triple integrals over a given region, Simple Applications of Multiple Integrals – Area (Cartesian Coordinates). Beta and Gamma functions and their properties.

Unit-4: Vector Calculus

Introduction, Differentiation of vectors, Scalar and vector point functions, Gradient, Divergence, Curl, Directional derivatives, Vector Integration- Line, Surface and Volume integrals, Green's Theorem, Gauss' divergence theorem and Stroke's theorem (without proof), Simple Applications.

Unit-5: Sequence and Series

Introduction, Sequence & Series, Convergence, divergence and oscillation of a series, Geometric Series, General properties of series, Test of convergence – Comparison test, Integral test, Comparison of Ratios, D'Alembert's Ratio test, Cauchy root test.

TEXT BOOKS/ REFERENCE BOOKS

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 44th Edition, 2017.
2. Jain R. K., Iyengar S. R. K., Advanced Engineering Mathematics, 6th Edition, Narosa Publishing House, 2019.
3. Kreyszig. E, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons. Singapore, 2015.
4. Bali N.P., Goyal M, Advanced Engineering Mathematics, Laxmi Publications, New Delhi, 2018.
5. Dass H. K., Advanced Engineering Mathematics, Sultan Chand Publication, Delhi, 2018.

Elementary Mathematics-I (For BME only)	
Course Code:24AS104	Continuous Evaluation: 40 Marks
Credits: 2	End Semester Examination:60 Marks
L T P : 2 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To introduce the concept of Matrices and Determinants.
2. To introduce the concept of Differentiation.
3. To introduce the concept of Integration.
4. To get the knowledge that Differential Equations.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Develop the essential tool of matrices and determinants
2. Apply the knowledge of differentiation in computer science.
3. Apply the integrals in computer applications.
4. Understand the differential equations and their simple applications.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CO \ CLO	CLO-01	CLO-02	CLO-03	CLO-04
CO-01	✓			
CO-02		✓		
CO-03			✓	
CO-04				✓

COURSE CONTENTS

Unit-1: Matrices and determinants (6 Lectures)

Introduction of matrices, Types of Matrices, Operations on Matrices, Transpose of a Matrix, Symmetric and Skew-Symmetric Matrices, Elementary Operation of a Matrix, Invertible Matrices.

Introduction of Determinant, Properties of Determinants, Area of a triangle, Minor and Cofactors, Adjoint and Inverse of a Matrix,

Unit-2: Differential Calculus (6 Lectures)

Introduction, Continuity, Differentiability-Chain Rule, Derivatives of implicit functions, Derivatives of Trigonometric functions and Inverse trigonometric functions, Derivatives of Exponential and Logarithmic functions.

Unit-3: Integral Calculus (6 Lectures)

Introduction, Elementary Properties, Integration by method of Substitution, Integration using trigonometric identities, Integration by Partial fractions, Integration by parts.

Definite Integrals, Properties, Evaluation of definite Integrals.

Unit-4: Ordinary Differential Equations (6 Lectures)

Introduction, Order and Degree of Differentiation equation, Solution of first order differential equations by

method of variable separable, Homogeneous, Linear differential equation, Reducible to linear differential equation, Exact differential equation.

TEXT BOOKS/ REFERENCE BOOKS

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 44th Edition, 2017.
2. Jain R. K., Iyengar S. R. K., "Advanced Engineering Mathematics", 6th Edition, Narosa Publishing House, 2019.
3. Kreyszig. E, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons. Singapore, 2015.
4. Bali N.P., Goyal M, Advanced Engineering Mathematics, Laxmi Publications, New Delhi, 2018.
5. Dass H. K., Advanced Engineering Mathematics, Sultan Chand Publication, Delhi, 2018.

ELEMENTARY BIOLOGY (For BME only)	
Course Code: 24AS105	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 1 1 0	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To study the basic living structure and their functions.
2. To focus on different physiological processes and introduce the concept of cell signaling and their role in diseases.
3. To understand the fundamental concepts of genetics in prokaryotes and eukaryotes.
4. To learn about the various levels of organization that plants and animals have, as well as the various activities that they do.
5. To investigate biological topics using a scientific method and get well-informed findings.
6. To integrate biological and engineering knowledge.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Explain the complicated relationship between different cellular structures and their roles.
2. Employ experimental ways to solve genetic problems.
3. Explain how animals respond to changes in their environment.
4. When dealing with biological impediments and challenges, problem-solving abilities should be applied.
5. Analyse and interpret the data using appropriate biological methods.
6. Make connections between the various portions of the topics covered in the course.

MAPPING MATRIX OF COURSE OBJECTIVES (CO) & COURSE LEARNING OUTCOMES (CLO)

COURSE OBJECTIVES	COURSE LEARNING OUTCOMES					
	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6
CO1	✓					
CO2	✓	✓				
CO3		✓	✓			
CO4				✓	✓	
CO5				✓	✓	
CO6					✓	✓

COURSE CONTENTS:

UNIT I: NATURE OF LIVING THINGS

Definition of life, Miller's experiment, theories and evidences of origin of life, levels of biological organization, classification of living world, difference between prokaryotes and eukaryotes, Evolutionary processes: Lamarckism, Darwinism, role of mutations and isolating mechanisms, adaptive radiation.

UNIT II: MOLECULAR ORGANIZATION OF CELL

Difference between animal and plant cell, salient features of intracellular organelles, cell division and cell cycle. Basic idea for Cell division, Mitosis, Meiosis. Basic idea how Central Dogma of life, Introduction to major biomolecules Carbohydrates, fats and proteins.

UNIT III: FUNDAMENTALS OF GENETICS

Mendelian principles, pleiotropy, epistasis, linkage and crossing over, Mendel's laws - monohybrid - dihybrid inheritance- multiple alleles- structure and organization of chromosome in prokaryote and Eukaryotes. Linkage - types of linkage -crossing over and their types.

UNIT IV: PHYSIOLOGY

Animal Physiology: Hormones and their mode of action, types of asexual and sexual reproduction, stages of embryogenesis.

TEXT BOOKS:

1. Purves et al, Life: The Science of Biology
2. R. Dulbecco, The Design of Life
3. Samantha Fowler, Concepts of Biology, Publisher: OpenStax
4. J. M. Mwaniki, Fundamentals of Biology, Longhorn Publishers and Worldreader

REFERENCE BOOKS:

1. Keith Wilson & John Walker, "Practical Biochemistry - Principles & Techniques", Oxford University Press.
2. Thyaga Rajan S, Selvamurugan N, Rajesh M.P, Nazeer, Richard Thilagaraj R.A. Barathi. W.S and. Jaganathan, M.K "Biology for Engineers", W.H. Hill, New Delhi.
3. Robert Weaver, "Molecular Biology", MCGraw-Hill.
4. The Biomedical Engineering –Handbook, Joseph D. Bronzino, CRC press.
5. Fundamentals Of Biology -Haupt Arthur W Books Publisher: Read Books Genre: Science, ISBN: 9781406707397, 97814067073
6. Basic Concepts In Biology 6/E by Starr Cengage Learning Inc

ENGINEERING PHYSICS	
Course Code: 24AS102/24AS202	**Continuous Evaluation:** 40 Marks
Credits: 4	**End Semester Examination:** 60 Marks
L T P : 3 1 0	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To provide students with the knowledge of variety of important concepts of Physics and their applications in Engineering and Technology
2. To enhance the understanding of the concepts found in Mechanics, Harmonic Oscillations, wave Optics, Lasers, Fiber Optics.
3. To familiarize the quantum mechanical approach and its application in engineering.
4. To develop necessary understand on semiconductors and their applications in devices; Apply theory learnt to correlate with the environmental issues such as the use of solar cells

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. The student is expected to be familiar with broader areas of Physics such as mechanics of solids, optics, mechanical and electromagnetic waves oscillations and their relevance in Engineering.
2. An understanding of Physics also helps engineers understand the working and limitations of existing devices and techniques, which eventually leads to new innovations and improvements.
3. The student would be able to learn the fundamental concepts on Quantum behavior of matter in its micro state.
4. The course also helps the students to be exposed to the phenomena of electromagnetism and also to have exposure to semiconductor devices such as solar cell.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES:

Course Objectives	CLO 1	CLO 2	CLO 3	CLO 4
CO1	x		x	
CO2	x	x		
CO3			x	
CO4				x

COURSE CONTENTS

Unit- 0: Fundamentals: Newtonian mechanics, Moment of Inertia, Friction, Work-Power-Energy, Conservation Laws, Thermodynamic Laws, Electro-Magnetic Spectrum, Huygen wave theory, Intrinsic and Extrinsic semiconductors.

Unit-1: WAVES AND OSCILLATIONS:
Oscillations: Simple Harmonic Motion (SHM), Differential Equation of SHM and its Solutions, Conservation of Energy. Mass-string System. Damped Harmonic Oscillator-Overdamped, Critically Damped, Under Damped motions, Relaxation Time, Forced vibrations. Resonance & Quality Factor.

Unit-2 : ELECTROMAGNETIC THEORY AND FIBER OPTICS:
Mathematical Background: Gradient, Divergence, curl (Physical Significance), Irrotational & Solenoidal Field,

Gauss Divergence and Stoke's Theorem, Maxwell's Equation in Integral & Differential forms. Wave equation for Electromagnetic (EM) Waves-Propagation in free space, Characteristic Impedance, Poynting theorem (only definition). **Fiber optics:** Structure of optical Fiber, Principle of propagation and numerical aperture, acceptance angle and classification of optical fiber (single mode and multimode).

Unit-3: OPTICS AND LASER:

Interference: Superposition Principle, Division of Amplitude-Interference in Thin Films, Application: Interference in Wedge shaped Film, Application: Newton's Ring. Diffraction: Fraunhoffer Vs Fresnel Diffractions, Fraunhoffer Diffraction in Single & Multiple slits/Grating, Resolving power & Dispersive power of grating and prism. Laser: Spontaneous and stimulated emission, Einstein's coefficients, Characteristics of laser, Ruby Laser.

Unit-4: STATISTICAL MECHANICS AND QUANTUM MECHANICS:

Qualitative treatment of Maxwell-Boltzman, Fermi-Dirac and Bose-Einstein statistics**,** Black body problem, Photoelectric effect and Compton scattering (For concept), de Broglie Hypothesis of matter waves, de-Broglie waves-Phase & Group Velocities, Davison-Germer experiment, Uncertainty Principle, Application of Uncertainty Principle, Significance of Wave Functions, Postulates of Quantum Mechanics**,** Schrodinger equation-Time dependent and time independent equation Application: Particle in a box (1-D).

Unit-5 : SEMICONDUCTOR AND OPTOELECTRONIC DEVICES

Fermi level in intrinsic and extrinsic semiconductors, Effect of temperature and carrier concentration (qualitative), Direct and indirect bandgap semiconductor, LED, Photodiode, LDR, Photovoltaic effect, and Solar Cell. Hall Effect: Hall coefficient and its applications.

TEXT BOOKS

1. Beiser A, Concepts of Modern Physics, 5th Ed., McGraw Hill International, 2003.
2. AjoyGhatak, Optics, 5th Ed., Tata McGraw Hill, 2012.
3. David J. Griffiths, Introduction to Electrodynamics, Pearson Education Limited, London, 2015.
4. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker , Wiley
5. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
6. Engineering Mechanics (SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati , McGraw Hill

REFERENCE BOOKS

1. Arumugam, M., Engineering Physics, 2nd edition, Anuradha Publishers, KumbaKonam, 2003.
2. Gaur and Gupta, Engineering Physics, 7th edition, Dhandapani and Sons, New Delhi, 1997.
3. N. Subrahmanyam and Brij Lal, Waves and Oscillations.
4. David J. Griffiths, Introduction to Quantum Mechanics, Pearson Education Limited.

ENGINEERING CHEMISTRY	
Course Code: 24AS103 /24AS203	**Continuous Evaluation:** 40 Marks
Credits: 4	**End Semester Examination:** 60 Marks
L T P : 3 1 0	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. The knowledge of water quality parameters and the treatment of water.
2. Explain states of matter, phase diagram and related applications.
3. To learn various types of fuels and their properties, and to understand the basics of spectroscopy.
4. To understand the fundamental concepts of corrosion chemistry.
5. To learn an introductory idea about new materials.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand to identify the quality of water and how to improve the quality of water.
2. Explain states of matter, phase diagram, related applications and polymers.
3. Analyze the quantitative aspects of fuel combustion, spectroscopy
4. Explain the mechanism of corrosion.
5. Get preliminary understanding on introductory idea about nano materials.

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES:

COURSE LEARNING OUTCOME / COURSE OBJECTIVES	CLO 01	CLO 02	CLO 03	CLO 04	CLO 05
CO 01					
CO 02					
CO 03					
CO 04					
CO 05					

COURSE CONTENTS

Unit-0 : General Introduction: Importance and scope of Chemistry:
Atomic and molecular masses, mole concept and molar mass, percentage composition, redox reactions, Chemical and ionic equilibrium; Acid & bases.

Unit-1 : Water Technology -:
Reasons for hardness-units of hardness-determination of hardness and alkalinity-Water for steam generation-Boiler Troubles-Scale, Sludge formation, Boiler corrosion, Caustic Embrittlement-Internal Treatments-Softening of Hard water- Ion Exchange process -Water for drinking purposes-Purification-

Sterilization and disinfection: Chlorination, Reverse Osmosis and Electro Dialysis.

Unit-2: The Phase rule:
Statement of Gibb's phase rule and explanation of the terms involved, Phase diagram of one component system-water system, Condensed phase rule, Phase diagram of two component system-Eutectic, Pb-Ag system.
Polymer: Terminologies, Classification of polymer, Preparation of special polymer-Nylon 6, 6, Polyethylene, Polystyrene, Teflon, Polymethyl-methacrylate, Bakelite.

Unit-3 : Fuels:
Classification of fuels, calorific value. G.C.V. and N.C.V., Solid fuels, Analysis of coal. Liquid fuels: Classification of petroleum, refining of petroleum, Cracking, Knocking and anti-knocking, cetane and octane numbers.

UV Spectroscopy: Lambert Beer's Law, Principles and applications of UV-Visible Molecular Absorption Spectroscopy; Chromophores, effect of conjugation on chromophores.

Unit-4: Corrosion:
Electrochemical theory of corrosion, galvanic series, Types of corrosion; Differential metal corrosion, Differential aeration corrosion (Pitting and water line corrosion), Stress corrosion (caustic embrittlement in boilers), Factors affecting, metal coatings- Galvanizing and Timing, Corrosion inhibitors, protection.

Unit-5: New Materials:
Introduction to nanomaterials, classification (0D, 1D, 2D) with examples, size dependent properties, Top-down and Bottom-up approaches of nanomaterial synthesis. Introductory idea on synthesis of nanomaterials via green synthetic route.

TEXT BOOKS

1. Engineering Chemistry (NPTEL web-book) by B. L. Tembe, Kamaludddin and M. S. Krishan.
2. Fundamentals of Molecular Spectroscopy by Banwell, Tata McGraw Hill Education.
3. Textbook of nanoscience and Nanotechnology, McGraw Hill Education (India) Pvt. Ltd., 2012.
4. Engineering Chemistry by Jain and Jain, DhanpatRai Publication.
5. Engineering Chemistry by Prasanta Rath, Cenage Learning India Private Ltd., 2015.
6. A text book of Engineering Chemistry by Shashi Chawla, DhanpatRai& Co. 2020
7. Inorganic Chemistry by Donald A. Tarr, Gary Miessler, Pearson India, Third Edition.
8. Molecular Spectroscopy, Ira N. Levine, John Wiley and Sons.

REFERENCE BOOKS

1. Inorganic Chemistry by W. Overton, Rounk and Armstrong, Oxford Univesity Press, 6th edition.
2. Advanced Engineering Chemistry by M. R. Senapati, University Science Press, India.
3. A Text book of Engineering Chemistry by S.S. Dara, 10th Edition, S. Chand & Company Ltd., NewDelhi, 2003

BASIC ELECTRICAL ENGINEERING	
Course Code: 24EE101/24EE201	**Continuous Evaluation:** 40 Marks
Credits: 3	**End Semester Examination:** 60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

The objective of this Course is to provide the students with an introductory and broad treatment of the field of Electrical Engineering.

1. Students will gain knowledge regarding the various laws and principles associated with electrical systems.
2. Students will gain knowledge regarding electrical machines and apply them to practical problems.
3. Students will acquire knowledge in using the concepts in the field of electrical engineering.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of the course, students would be able to:

1. To explain the strong basics of electrical engineering and practical implementation of electrical fundamentals.
2. To identify different applications of commonly used electrical machinery.
3. To define various renewable resources available in the power generation.
4. To understand the basic concept of a poly-phase system.

Mapping Matrix of Course Objectives (CO) and Course Learning Outcomes (CLO)

SEM	SUB CODE	Course Name	Course Objectives	CLO1	CLO2	CLO 3	CLO4
I/II	**24EE 101/201**	BASIC ELECTRICAL ENGINEERING	CO1	x			
			CO2			x	
			CO3		x	x	x

COURSE CONTENTS

Unit-1: DC CIRCUITS AND ELECTROMAGNETISM (8 Hrs.)

Ohm's Law and Kirchhoff's Laws, Analysis of Series, parallel, and series-parallel circuits excited by independent voltage sources, Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum power transfer theorem. Faradays Laws, Lenz's Law, Fleming's Rules, Statically and dynamically induced EMF; Concepts of self-inductance, mutual inductance, and coefficient of coupling; Energy stored in magnetic fields

Unit-2: Single Phase A.C. Circuits:

Sinusoidal signal, instantaneous and peak values, RMS and average values, crest and peak factor, Concept of phase, representation-polar & rectangular, exponential and trigonometric forms, Analysis with phasor diagrams of R, L, C, RL, RC and RLC circuits; Real power, reactive power, apparent power and power factor, series, parallel and series-parallel circuits.

Unit-3: Transformers:
Principle of operation and construction of single-phase transformers (core and shell types). EMF equation, losses, efficiency, and voltage regulation.

Poly-phase System*:*
Advantages of 3-phase system, Generation of 3-phase voltages, Voltage, current, and power in a star and delta connected systems, 3-phase balanced and unbalanced circuits, Power measurement in 3-phase circuits.

Unit-4: Three-Phase Induction Motors:
Concept of rotating magnetic field; Principle of operation, types and constructional features, Slip and its significance; Applications of squirrel cage and slip ring motors; Necessity of a starter, star-delta starter.

Unit-5: Renewable Sources:
Sources of Electrical Power, Introduction to Wind, Solar, Fuel cell, Tidal, Geothermal, Hydroelectric, Thermal-steam, diesel, gas, nuclear power plants; Concept of cogeneration, and distributed generation, Introduction to Earthing

TEXT BOOKS

1. Fundamental of Electric Circuits by Charles K Alexander and Matthew N. O.Sadiku, TMH Publication.
2. Electrical Engineering Fundamentals by Vincent Del Toro, PHI Publication.
3. Basic Electrical Engineering by V N Mittal & Arvind Mittal, TMH Publication.
4. Basic Electrical Technology by A.E. Fitzgerald, McGraw Hill Publication.

REFERENCE BOOKS

1. Kothari D P and Nagrath I J**,** "Basic Electrical Engineering ", Tata McGraw Hill, 1991

BASIC ELECTRONICS ENGINEERING	
Course Code: 24EC101/24EC201	**Continuous Evaluation:** 40 Marks
Credits: 3	**End Semester Examination:** 60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To impart the knowledge of the passive and active electronic components
2. To understand the basic characteristics of Field Effect Transistors
3. To introduce the MOS devices
4. To gain knowledge of integrated circuit fabrication techniques
5. To introduce the digital logic gates and systems
6. To understand the principle of microprocessors

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in alignment with National Education Policy (NEP). After completion of the course, students would be able to:

1. To learn the fundamental concepts of semiconductor devices
2. An ability to apply the concept of diode in clipper and clamper circuits
3. Acquire the skills of constructing the different transistor configurations
4. To learn the basic concepts of integrated circuits
5. To Compile the different building blocks in digital electronics using logic gates and implement simple logic functions using basic universal gates
6. To acquire the knowledge of microprocessors.

Mapping Matrix of Course Objectives (CO) and Course Learning Outcomes (CLO)

SEM	SUB CODE	Course name	Course Objectives	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6
I/II	24EC101/201	Basic Electronics Engineering	CO1	x	x				
			CO2		x	x			
			CO3			x	x		
			CO4			x	x		
			CO5					x	
			CO6						x

COURSE CONTENTS

Unit – 1: Semiconductor Diodes and Applications: p-n junction diode, Characteristics and Parameters, Half-wave rectifier, Full-wave rectifier, center tap and Bridge rectifier, and clipper, clamper, Zener diode voltage regulators: Regulator circuit with no load, Loaded Regulator and Numerical examples as applicable.

Unit –2: Bipolar Junction Transistor: Transistor Operation, Current Equation in n-p-n & amplifier; p-n-p transistors, CB, CE, CC Configurations and their Characteristics, Load line Analysis, BJT as Switch and amplifier, DC Biasing (Fixed bias and Voltage Divider), stability Factor.

Unit –3: Field Effect Transistor: JFET-types and their parameters, Operations, and their Characteristics, MOSFETs- types, Operations and their Characteristics, Secondary effects in MOSFET operation and Numerical.

Unit –4: Introduction to Operational Amplifiers: Ideal OPAMP, Inverting, and Non-Inverting OPAMP circuits, OPAMP applications: voltage follower, addition, subtraction, integration, differentiation; Numerical examples as applicable.

Unit –5: Digital Electronic Principles: Introduction, Binary digits, Logic levels and Digital waveforms, Introduction to basic Logic operation, Number system, Decimal numbers, Binary numbers, Decimal-to-Binary conversion, Simple binary arithmetic, Logic Gates, Boolean algebra and Combinational Logic Circuits: Boolean operations and expressions, Laws and Rules of Boolean algebra, DeMorgan's theorem, Boolean analysis of logic circuits, Standard forms of Boolean expressions, Boolean expression and truth table. Basic combinational logic circuits, Implementation of combinational logic, the universal properties of NAND and NOR gates, Half Adder adders, and full Adder.

TEXT BOOKS

1. Electronic Devices and Circuit Theory - by Rober L. Boylestad 11th Edition, Pearson Publication, 2014
2. Digital Design by M. Morris Mano, 5th Edition, Pearson Publication, 2016
3. Floyd T.L., Buchla D.L., "Electronics Fundamentals: Circuits, Devices and Applications", 8th 2010 Edition
4. Stallings, W., "Computer Organization and Architecture", 5th Ed., 2001 Pearson Education

REFERENCE BOOKS

1. Millman J., Halkias C.C., Jit S., "Electronic Devices and Circuits", Tata McGraw-Hill, 2nd 2007 Edition
2. Muthusubramanian.R, Salivahanan.S, Muraleedharan.K.A, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw - Hill, 1999.
3. Microelectronic Circuits by A. S. Sedra and Kenneth C. Smith 7th Edition, Oxford University Press. 2017

ENGINEERING MECHANICS	
Course Code: 23ME101/23ME201	**Continuous Evaluation:** 40 Marks
Credits: 3	**End Semester Examination:** 60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To familiarize students with basic concepts of force and moments in equilibrium.
2. To impart students with the knowledge of mechanics for structural analysis.
3. To familiarize students with the centroids and MOI.
4. To make students aware of rigid body kinetics and kinematics.
5. To acquaint students with mechanics of deformable bodies.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in alignment with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the concepts of force and moments in equilibrium.
2. Apply principles of mechanics to real engineering problems.
3. Understand the basics of Centroids and MOI.
4. Grasp the elements of rigid body kinematics and kinetics.
5. Understand the mechanics of deformable bodies.

Mapping Matrix of Course Objectives (CO) and Course Learning Outcomes (CLO)

SEM	SUB CODE	Course name	Course Objectives	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5
I/II	23ME101/201	ENGINEERING MECHANICS	CO1	x				
			CO2		x			
			CO3			x		
			CO4				x	
			CO5					x

COURSE CONTENTS

UNIT-I FORCE SYSTEMS:

• Basic concepts: Definitions, Basic assumptions, Scalar & Vector quantities, Free, Forced and fixed vectors.

• Force System: Force, Classification & Representation, Force as a Vector, Composition of forces, Parallelogram Law, Resolution, Principle of Transmissibility of forces

• Moment of a force, Vector representation, Moment for coplanar force system, Varignon's theorem

• Couple, Vector representation, Resolution of a force into a force and a couple.

• Force Systems: Coplanar Concurrent Force system and Coplanar Non-Concurrent force systems, Resultant of coplanar force system.

• Equilibrium of coplanar force system, Free body diagrams, Determination of reactions, Equilibrium of a body under three forces, Lami's theorem.

FRICTION:

• Introduction, Wet and Dry friction, Theory of Dry friction, Angle of friction, Angle of Repose, Cone of friction, Coulomb's laws of friction.

UNIT –II: BASIC STRUCTURAL ANALYSIS

• Plane Truss, Difference between truss and frame, Perfect and imperfect truss, Assumptions and Analysis of Plane Truss, Method of joints, Method of section, Zero force members.

UNIT –III- CENTROID AND MOMENT OF INERTIA:

• Center of Gravity, Center of Mass and Centroid of curves, areas, volumes, Determination of centroid by integration, Centroid of composite bodies.

• Definition of Moment of inertia of area, Perpendicular axis theorem and Polar moment of Inertia, Parallel axis theorem, Moment of inertia of simple areas by integration, Moment of Inertia of Composite Areas.

• Moment of Inertia of masses, Parallel axis theorem for mass moment of inertia, Mass moment of inertia of simple bodies by integration, Mass moment of inertia of composite bodies.

UNIT –IV- KINEMATICS OF RIGID BODY:

• Introduction, Absolute motion, Plane rectilinear motion of rigid body, Plane curvilinear Motion of rigid body, x-y and n-t components, Rotation of rigid bodies, Relative Motion, Plane Motion of rigid bodies, Instantaneous center of zero velocity

UNIT- V - KINETICS OF RIGID BODY:

• Introduction, Force, Mass and Acceleration, Newton's law of motion, D'Alembert's Principles and Dynamic Equilibrium, Laws of motion applied to planar translation, rotation and plane motion.

• Work and Energy, Kinetic energy, Principle of work and energy, Conservative forces, Law of conservation of energy,

• Linear Impulse and Momentum, Conservation of linear momentum.

TEXT BOOKS

1. Engineering Mechanics : Statics and Dynamics", R. C. Hibbler, Pearson
2. Engineering Mechanics " , Thimoshenko & Young , 4ed, Tata McGraw Hill
3. Engineering Mechanics : Statics and Dynamics", Shames and Rao, Pearson
4. Engineering Mechanics " , Bhavikatti , New Age

FUNDAMENTALS OF COMPUTER & C PROGRAMMING	
Course Code: 23CS101/23CS201	**Continuous Evaluation:** 40 Marks
Credits: 3	**End Semester Examination:** 60 Marks
L T P : 3 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To familiarize and understand the basic concepts of digital computers and computer programming.
2. To impart adequate knowledge on the need of programming languages and problem solving techniques.
3. To analyse and construct effective algorithms.
4. To develop problem solving ability using programming.
5. To employ good programming practices such as incremental development, data integrity checking and adherence to style guidelines.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the fundamental concepts of computers, both hardware and software.
2. Learn and understand the major system software's that help in developing of an application.
3. Apply and analyse the basic programming constructs in context of C programming language.
4. Analyse and evaluate the derived datatypes (array) and the operations that can be performed on them,
   along with the concept of modularity through functions
5. Create and manipulate a database or data storage through files.
6. Learn a programming approach to solve problems.

Mapping Matrix of Course Objectives (CO) and Course Learning Outcomes (CLO)

Course Objectives	CLO 1	CLO 2	CLO 3	CLO 4	CLO5	CLO6
CO1	x	x				
CO2		x	x			
CO3			x	x		
CO4					x	
CO5						x

COURSE CONTENTS

UNIT-1: INTRODUCTION OF COMPUTER SYSTEM

Anatomy of a digital Computer, Different Units of Computer, System, Hardware & Software, Classification of Computer Systems, Number systems, Operating System: Definition, working & its functions, Basic concepts of Computer Networks, Network Topologies.

UNIT-2: INTRODUCTION TO SYSTEM SOFTWARE

Programming language- Definition, types; Syntax & Semantics, Type of programming errors,

Assembler, Linker, Loader, Compiler, Interpreter, debuggers, Algorithms, flowcharts and their symbols.

UNIT-3 : BASICS OF 'C' LANGUAGE

C Fundamentals, Basic data types, variables and scope, operators and expressions, formatted input/ output, expressions, selection statements, loops and their applications.

UNIT-4: ARRAY & FUNCTION

Arrays, functions, recursive functions, pointers and arrays. Strings literals, arrays of strings; applications. Storage Classes and Pre-processor Directives.

UNIT-5 : STRUCTURE & FILE SYSTEM

Structures, Declaring a Structure, Accessing Structure Elements, Storing Structure elements, Array of Structures, Unions and Enumerations.

File Input/Output, Data Organization, File Operations, Opening a File, Reading from a File, Closing the File, Writing to a File, File Opening Modes.

TEXT BOOKS

1. The C Programming Language by Dennis M Ritchie, Brian W. Kernigham, 1988, PHI.
2. Computer System & Programming in C by S Kumar & S Jain, Nano Edge Publications, Meerut.
3. Fundamentals of Computing and C Programming, R. B. Patel, Khanna Publications, 2010, New Delhi.
4. Let Us C, Yashwant Kanetkar, 14th Edition, BPB Publications.
5. Computer Fundamentals and Programming in C, Reema Theraja, Oxford

REFERENCE BOOKS

1. Information technology, Dennis P. Curtin, Kim Foley, Kunal Sen, Cathleen Morin, 1998, TMH.
2. Theory and problem of programming with C, Byron C Gottfried, TMH.

COMMUNICATIVE ENGLISH	
Course Code: 24HS101/24HS201	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 2 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To prepare the students for their career which will require them to listen to, read, speak, and write in English both for their professional as well as interpersonal communication
2. To empower the students to improve both abilities to communicate and their linguistic competence and boost their confidence.
3. To enable the students to properly communicate and express themselves in writing.
4. To enable students to identify the common mistakes made by most learners of English and not make those errors both in their writing and speaking.
5. To study, understand and implement each unit according to National Education Policy 2020 and Bloom's Taxonomy.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Recall and identify English vocabulary words and grammatical structures.
2. Analyse the structure and organization of written texts, identifying the introduction, body, and conclusion.
3. Examine how the use of specific language techniques impacts the effectiveness of communication.
4. Assess and critique public speeches and presentations based on clarity, coherence, and persuasiveness.
5. Evaluate one's own language skills and identify areas for improvement.

MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

Course Objective	Course Learning Outcomes				
	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5
CO 1	✓	✓	✓		
CO 2		✓		✓	
CO 3					
CO 4				✓	✓
CO 5					✓

COURE CONTENTS

Unit-I: Introduction to Communication

- Elements and Process of Communication, Types and Barriers to Communications, Grice Conversational Maxims and Cooperative Principles
- Verbal and non-verbal communication.
- Body Language: Proxemics, Chronemics and Haptics
- Identifying and rectifying common errors: Types of Sentences (Statements, interrogative, exclamatory, Optative, and imperative, Wh/How-questions, question-tags).
- Basic Grammar: - Articles, Prepositions, Cliches, Collocations and Punctuations

Unit-II: Workplace Communication

- Communication Challenges in Culturally Diverse Workplace; Ethics in Communication, Bias-free communication
- Effective Business Presentations: Importance in workplace communication; Planning, Preparing, Organizing, Rehearsing, and Delivering Oral presentations, Handling Questions; and Power Point Presentation.

Unit-III: Effective Writing

- Paragraph Writing: Topic Sentence, Guided composition, Free-writing
- Reading comprehension practice: Technical and General text, use of different techniques (skimming and scanning)
- Selection of Words; Coherence and Cohesion
- Use of discourse markers with respect to technical writing

Unit-IV: Business Writing at Work

- Cover Letters and Applications
- Writing notices and circulars
- Email Writing and Memorandum
- Writing reports

TEXT BOOKS

1. English Grammar in Use. Raymond Murphy. Cambridge UP. 4th Edition.
2. Business Communication by Carol M Lehman, Debbie D Dufrene and Mala Sinha. Cengage Learning. 2nd Edition.
3. A Textbook of English Phonetics for Indian Students by T. Balasubramanian [Macmillan]
4. Soft Skills: Key to Success in Workplace and Life by Meenakshi Raman and Shalini Upadhyay. Cengage Learning. 2018 Edition.

HINDI -I	
Course Code: 24HIN-101- I	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 2 0 0	
Prerequisite: Nil	

Course Description:

विश्वविद्यालय ने वर्ष 2024-25 सत्र से स्नातक स्तर पर हिन्दी विषय का पाठ्यक्रम तैयार किया है। हिन्दी विषय के प्रश्न पत्र की सामग्री में ज्ञान तथा शिक्षा के बदलते परिदृश्य को ध्यान में रखा गया है। हिन्दी के भक्तिकाल, रीतिकाल और आधुनिक काल के कवियों की कविताओं को पाठ्यक्रम में शामिल किया है। व्याकरण की विभिन्न कोटियों तथा भाषा के सम्प्रेषण से हिन्दी का प्रचार-प्रसार होगा। संचार कौशल के द्वारा छात्रों का ज्ञान परिमार्जित होगा। साहित्येतर छात्रों के ज्ञानवर्धन, भाषायी क्षमता एवम् अभिवृद्धि भी इस पाठ्यक्रम का लक्ष्य है।

(Course Content)

(Unit-A)
इस इकाई में हिंदी भक्तिकाल के प्रमुख कवि कबीरदास हैं।

कबीरदास- कबीरदास के दोहे (5 दोहे(

(Unit-B)

इस इकाई में हिंदी रीतिकाल के प्रमुख कवि बिहारीलाल हैं।
बिहारीलाल – दोहे)5 दोहे(

(Unit-C)

इस इकाई में हिंदी आधुनिक काल के प्रमुख कवि माखनलाल चतुर्वेदी हैं।
माखनलाल चतुर्वेदी- पुष्प की अभिलाषा)कविता(

(Unit-D)
यह इकाई संचार कौशल से सम्बन्धित है. इसमें

(i) हिंदी के प्रमुख मुहावरे और लोकोक्तियाँ

(ii) आत्म परिचय (self-introduction), साक्षात्कार कौशल (interview skills), कार्यक्रम संचालन/मंच प्रबंधन (event management)

Course Outcomes:-
पाठ्यक्रम परिणाम
(1.Knowledge Outcome)
1. ज्ञान का परिणाम
(At the end of the course, the student should be able to)
पाठ्यक्रम के अंत में छात्र सक्षम होना चाहिए
-हिन्दी क़े प्रमुख कवि जो पाठ्यक्रम में शामिल है, उनकी कविताओं की व्याख्या और काव्यगत विशेषताओं को छात्र समझेंगे ।
- छात्रों को काव्य में रस, अलंकार और छन्द का ज्ञान प्राप्त होगा|
-व्याकरण के अध्ययन से छात्रों को भाषा बोलने, लिखने और प पढने में सहायता प्राप्त होगी।

(2.Skill Outcome)
कौशल का परिणाम

(At the end of the course, the student should be able to)
पाठ्यक्रम के अंत में छात्र सक्षम होना चाहिए
-हिंदी कवियों व उनकी कविताओं से परिचित हो जाएंगे।
- छात्र दोहे और कविता समझने में सक्षम होंगे।
-व्याकरण के ज्ञान के साथ -साथ शब्दों के उच्चारण के बोध से अवगत होंगे।

(Methodology)

)पद्धति(
- कक्षा व्याख्यान
-व्याकरण के माध्यम से हिंदी शब्दों का उच्चारण व लेखन का अभ्यास किया जाएगा |
-समय-समय पर छात्रों को प्रदत्त कार्य दिया जाएगा |
-साप्ताहिक प्रश्नावली |

(Required Books and Materials)
आवश्यक पुस्तकें और सामग्री
-कबीर ग्रन्थावली, संपादक-श्यामसुन्दर दास, काशी नागरी प्रचारिणी सभा |
- बिहारी सतसई, साहित्य संस्थान प्रयाग|
-भाषा विज्ञान, डॉ. भोलानाथ तिवारी ,किताब महल इलाहाबाद |
-हिंदी व्याकरण, कामता प्रसाद गुरु, प्रभात प्रकाशन दिल्ली |

GERMAN-I	
Course Code: 24FLGR101- I	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 2 0 0	
Prerequisite: Basics of English Language	

COURSE OBJECTIVES (COs):

The objective of this course is to impart basic knowledge of German language to the students. The course intends to develop an ability for discussions, debates, research ventures, etc. Overall, the objective is to facilitate comprehension of the legal concepts better and develop the ability to write effective propositionsin legal contexts.

1. To develop oral and written skills of understanding, expressing and exchanging information in German language.
2. To develop awareness of the nature of language and language learning.
3. To develop the ability to construct sentences and frame questions.
4. To provide German language as a competitive edge in career choices.

COURSE LEARNING OUTCOMES (CLOs):

After completion of the course the students will have the ability to:

1. Read and write short, simple texts.
2. Have Fluency in reading and writing.
3. Understand the dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.
4. Know the culture of the countries where the German language is spoken.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE OBJECTIVES	Course Learning Outcome			
	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓			
CO02		✓	✓	
CO 03			✓	
CO 04				✓

COURSE CONTENTS

UNIT 1

- Information über Deutschland
- Buchstaben, Regeln der Aussprache, Wochentage, Monate
- Grüße, sich vorstellen, Einige nützliche Ausdrücke des Alltagslebens, Zahlen bis 100

UNIT 2

- Zahlen, Über Personen sprechen (Name, Herkunft, Adresse, Telefonnummer, Alter, Beruf,

Familie)

- Länder und Städte, Sprachen, Berufe, Bezeichnungen für Personen, Familienmitglieder
- Personalpronomen, Konjugation von Verben (heißen, wohnen, kommen, machen,lernen, arbeiten, studieren, sein)

UNIT 3

- Nomen (Genus, Singular-Plural), Bestimmter Artikel, Unbestimmter Artikel, Negation, W-Frage, Ja-Nein-Frage
- Über Sachen sprechen
- Sachen des Alltagslebens, Haushaltswaren, Adjektive, Gegenteile
- Satz Struktur

UNIT 4

- Akkusativ, Artikel und Personalpronomen im Akkusativ, Verben und Präpositionen mit Akkusativ,Konjugation und Verwendung von Verben (haben, kaufen, sehen, lieben, lesen, kennen, hören, verstehen, usw.)
- Kleidung, Farben, Wetter, Lebensmittel

TEXT BOOKS:

- Netzwerk Neu A1 (Kursbuch+Arbeitsbuch)

  Dengler, Stefanie, et al. Netzwerk neu: A1. Ernst Klett Sprachen., 2019.

REFERENCE BOOKS:

- Rusch, Paul, Helen Schmitz, and Humorvolle Zeichnungen. "Einfach Grammatik." *Übungsgrammatik Deutsch A1 bis B* 1 (2012): 329-330.Einfach Gramatik, Paul Rusch
- Carlson, Antje. "Lemcke, Christiane, Lutz Rohrmann, and Theo Scherling. Berliner Platz 1 Neu--German for Beginners." *Die Unterrichtspraxis/Teaching German* 44.1 (2011): 46-49.
- Dallapiazza, Rosa-Maria, Eduard Von Jan, and Sabine Dinsel. *Tangram: Deutsch als Fremdsprache. Lehrerbuch*. Vol. 1. Hueber Verlag, 1998.
- Wolfgang Hieber: Lernziel Deutsch, Teil 1,Max HueberVerlag, 1984.

WEBSITE PAGES:

- https://www.nthuleen.com/teach.html

FRENCH-I	
Course Code: 24FLFR101-I	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 2 0 0	
Prerequisite: Basics of English Language	

COURSE OBJECTIVE (COs)

1. To develop **listening, speaking, reading, and writing** requisites of a language.
2. To develop the ability **to construct sentences** and **frame questions**.
3. To equip the students with **cultural elements and communication strategies** that will help them **communicate in varied situations.**
4. To familiarize the students with the **French and Francophone culture.**

COURSE LEARNING OUTCOMES (CLOs)

1. After completion of this course, the student will be able **to express and interact in French** used in daily conversations.
2. The student will be able **to write short and simple texts.**
3. The student will be able to **initiate, understand and respond to the queries of cultural significance in various settings.**
4. The student can demonstrate **knowledge and understanding** of French and Francophone culture.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE OBJECTIVES	Course Learning Outcome			
	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓			
CO02		✓	✓	
CO 03			✓	
CO 04				✓

S. No	Unités	Objectifs de Communication	Grammaire	Lexique
1	**La Salutation et l'Introduction**	Saluer. Entrer en Contact. S'Excuser. Remercier. Se Présenter/Présenter Quelqu'un.	Les Pronoms Personnels Sujets. L'Alphabet. Les Articles Indéfinis. Les Verbes en -ER au Présent.	Salutations, Les Nombres. Les Objets de la Classe. La Nationalité.

2	**On Partage des Renseignements**	Demander de Se Présenter. Donner des Renseignements Personnels.	Etre et Avoir au Présent. Les Verbes en -ER au Présent. Les Adjectifs de Nationalités. L'Interrogation.	Les Adjectifs de Nationalité, Métiers et Secteurs Professionnels, L'Expression des Goûts et Intérêts
3	**Ma Ville et Mon Quartier**	Décrire et Qualifier une Ville ou un Quartier. Localiser. Demander et Donner la Directions.	Le Verbe Vivre. Les Articles Définis. Il y a/ Il n'y a pas. Les Prépositions. Les Adjectifs Qualificatifs. L'Impératif.	Les Prépositions de Localisation. Le Lexique des Sites. Etablissements et Service d'une Ville.
4	**Mes Intérêts et Goûts**	Parler de Ses Goûts et de Ses Loisirs. Donner Son Impression sur le Caractère de Quelqu'un.	Le Présent des Verbes en -ER, et du Verbe Faire. La Négation, Les Adjectifs Possessifs.	Avoir l'air. Loisirs. L'Expression des Goûts. Faire du/ de la. Ma Famille.

ENVIRONMENTAL BIOENGINEERING	
Course Code: 23ESEB101/23ESEB201	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 2 0 0	
Prerequisite: Nil	

Course Objectives (COs) - The Course is designed with the following objectives:

1. To provide a comprehensive understanding of the relationship between humans and the environment.
2. Aims to introduce students to the different components of the environment.
3. To develop the understanding of pollution, its causes, and their effects
4. To familiarize the students with the different biological concepts. Including artificial intelligence and its applications.

Course Learning Outcomes (CLOs) – The Syllabus has been prepared in accordance with the NEP-2020 and based on the UGC curriculum framework. Upon completion of this course, learners will be able to:

1. Analyse the environmental pollution and sensitize themselves to adverse health impacts of pollution.
2. Demonstrate to safeguard the Earth's environment and its resources.
3. Explain sustainable development, its goals, challenges, and global strategies.
4. Improve biological concepts using an engineering approach.

MAPPING COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

	COURSE LEARNING OUTCOMES (CLOs)			
COURSE OBJECTIVES (COs)	**CLO1**	**CLO2**	**CLO3**	**CLO4**
CO1	√			
CO2		√		
CO3			√	
CO4				√

COURSE CONTENTS

Unit-1: Human and Environment

Introduction to earth environment, Scope and importance. Components of the environment: Lithosphere, Hydrosphere, Biosphere, Atmosphere. The man- environment interaction, Population growth and natural resource exploitation, Industrial revolution, and its impact on the environment. Understanding of pollutant and pollution; Types of Pollution, Air pollution: Water pollution, Soil pollution and solid waste, Noise pollution, Thermal pollution and their impact on human health.

Unit-2: Natural Resources, Sustainable Development & Sustainable living

Overview of natural resources, Classification of natural resources, Resources: Forests, wetlands, Status and challenges. Water resources: Types of water resources, issues and challenges; Soil and mineral resources, Energy resources: renewable and non-renewable sources of energy. Biodiversity and its distribution, Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges, and strategies for SDGs. Ways to live in sustainable manner- Conservation of energy, water at home, plantation, waste segregation, kitchen gardening.

Unit-3: Introduction of Bioengineering:

Significance of biology, fundamental similarities, and differences between science and engineering- humans as the best machines, brain as a computer, comparison between eye camera, **Biomolecules**: molecules of the life –monomeric unit and polymeric structure, carbohydrates, proteins; nucleotides and lipids. Bio-engineering introduction and current status in Agriculture, Medicine (vaccine and biosensors) enzyme technology, and environment, and the role of artificial intelligence and robotics in human health monitoring.

Unit 4: Bioengineering in Environment Protection:

What is environmental bioengineering? Applications of bioengineering in the environment Protection.–Global environmental problems and bioengineering approaches for their management. sewage treatment, bio fertilizers, biofuels, bioreactors, bioremediation, and bioengineering for biomedical waste management. Role of artificial intelligence in handling biomedical waste.

RECOMMENDED TEXT BOOKS:

1. Masters, G. M., & Ela, W. P. (2008). Introduction to environmental engineering and science Englewood Cliffs, NJ: Prentice Hall.
2. Jackson, A. R., & Jackson, J. M. (2000). Environmental Science: The Natural Environment and Human Impact. Pearson Education.
3. Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press
4. Environmental Studies for Undergraduate Courses by Erach Bharucha, UGC New Delhi
5. Biology: a Gopal approach Campbell, N.A Reece, J.B Urry, Lisa; Cain M.L Wasserman, S.A Minorsky, P. V Jackson, R. B Person Education ltd.

REFERENCE BOOKS:

1. A.K De Environmental Chemistry New age Publisher, 2016.
2. "Ecology & Environment" P D Sharma, Rastogi Publications, 2009.
3. www.ipcc.org; https://www.ipcc.ch/report/sixth-assessment-report-cycle/.
4. Central Pollution Control Board Web page for various pollution standards. https://cpcb.nic.in/ standards.
5. Principles of Biochemistry (V Edition) by Nelson, D.L; and Cox, M. M. W. H Freeman and company.

INDIAN CONSTITUTION & POLITY	
Course Code: 23VAC102/23VAC202	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 2 0 0	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To acquaint the students with the fundamental concepts of democracy, diversity and the Constitution.
2. To make students understand the functioning of the three wings of the State
3. To make the students appreciate the purpose of decentralised administration under the Constitution and its functioning
4. To make students analyse and discuss various rights and duties under the Constitution of India

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in alignment with National Education Policy (NEP). After completion of course, students would be able to:

1. Explain the concept of democracy, diversity and the Constitutional Values
2. Describe the functioning of the three wings of the State
3. Sketch the functioning of decentralised administration under the Constitution of India and appreciate the political dimensions.
4. Examine the scope of various rights and duties under the Constitution of India.

Mapping Matrix of Course Objectives (CO) and Course Learning Outcomes (CLOs)

SEM	SUB CODE	Course name	Course Objectives	CLO 1	CLO 2	CLO 3	CLO 4
I/II	23VAC102/202	INDIAN CONSTITUTION & POLITY	CO1	x	x	x	
			CO2		x		x
			CO3			x	x
			CO4				x

COURSE CONTENTS

UNIT 1 DEMOCRACY, DIVERSITY AND THE CONSTITUTION:

- Concept of democracy and importance of right to vote
- Electoral Politics
- Concepts of diversity and discrimination on the grounds of gender, religion and caste
- Concept of democratic government
- Constitution design and salient features
- Preamble to the Constitution of India

UNIT 2 THE THREE WINGS OF THE STATE :

- The definition of State in Constitution of India

- Parliament, the State legislature and the making of laws
- Concept of cooperative federalism
- The Executive and Administration
- Role of Governor and the President of India
- The Judiciary

UNIT 3 LOCAL GOVERNMENT AND ADMINISTRATION:

- Panchayati Raj System
- Rural and Urban administration
- Social and Economic Justice for the marginalized
- Directive Principles of State Policy

UNIT 4 RIGHTS AND DUTIES:

- Fundamental Rights (Part III of the Constitution)
- Protection of Fundamental Rights – Writ petitions in High Court and Supreme Court of India
- Fundamental Duties
- The concept of Fraternity and secularism
- Public utilities and privatization

TEXT BOOKS:

1. D.D. Basu, *Introduction to the Constitution of India,* (LexisNexis, 26th Ed., 2022).
2. M. Laxmikant, *Indian Polity*(McGraw Hill, 7th Ed., 2023)
3. Subhash C. Kashyap, *Constitution of India* (Vitasta Publishing Pvt. Ltd, 1st Ed., 2019)

REFERENCE BOOKS:

1. M.P. Jain, *Indian Constitutional* Law (Lexis Nexis, 8th Ed., 2018).
2. H.M. Seervai, *Constitutional Law of India* (Law & Justice 4th Ed., 2023)
3. P.M. Bakshi, *The Constitution of India,* (Universal Law Publishing Co.,18th Ed., 2022)
4. J.N.Pandey, *Constitutional Law of India*(Central Law Agency, 59th Ed.,2022, Allahabad).

ENGINEERING PHYSICS LAB	
Course Code: 24AS152/24AS252	**Continuous Evaluation:** 60 Marks
Credits: 1	**End Semester Examination:** 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES

1. To gain practical knowledge by applying the experimental methods to correlate with the Physics theory
2. To learn the usage of electrical and optical systems for various measurements.
3. Apply the analytical techniques and graphical analysis to the experimental data

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Use the different measuring devices and meters to record the data with precision
2. Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results
3. Apply the mathematical concepts/equations to obtain quantitative results

MAPPING BETWEEN COURSE OBJECTIVES AND COURSE LEARNING OUTCOMES:

Course Objectives	CLO 1	CLO 2	CLO 3
CO1	x	x	
CO2		x	
CO3			x

LIST OF EXPERIMENTS

(Students are required to complete/perform any 10 experiments from the list below)

Experiment 1: To determine the moment of inertia of the disc and rigidity modulus of the wire by torsional pendulum.

Experiment 2: To determine the wavelength of sodium light by Newton's ring experiment.

Experiment 3: To determine the wavelength of the given laser source using standard grating.

Experiment 4: To determine the attenuation, numerical aperture and acceptance angle of the given optical fiber.

Experiment 5: To study the resonance characteristics of LCR series circuit.

Experiment 6: To determine Planck's constant.

Experiment 7: To study the I-V characteristics of a PN junction diode.

Experiment 8: To determine the energy band gap by four-probe method.

Experiment 9: To determine the Hall coefficient of the given n-type or p-type semiconductor.

Experiment 10: To study the solar cell characteristic.

Experiment 11: To determine the dispersive power of a given prism.

Experiment 12: To determine the width of a single slit by diffraction.

Experiment 13: To study the characteristic of LDR and finding the dark resistance.

Experiment 14: To determine the acceleration due to gravity by bar pendulum.

Experiment 15: To verify the laws of vibration of string using sonometer.

Experiment 16: To study the resonance characteristics of LCR parallel circuit

TEXT BOOKS

1. Chattopadhyay, D., Rakshit, P. C and Saha, B., "An advanced Course in Practical Physics", 2nd edition, Books & Allied Ltd, Calcutta, 1990.
2. Chauhan and Singh, "Advanced practical physics", Revised edition, Pragati Prakashan Meerut, 1985.

REFERENCE BOOKS

1. Thiruvadigal. J. D., Ponnusamy S. Vasuhi, P. S. and Kumar. C, "Hand Book of Practical physics", 5th edition, Vibrant Publication, Chennai, 2007.
2. Engineering Practical Physics, by S. Panigrahi and B. Mallick, (CENGAG ELearning).

ENGINEERING CHEMISTRY LAB	
Course Code: 24AS153/24AS253	**Continuous Evaluation:** 60 Marks
Credits: 1	**End Semester Examination:** 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

LIST OF EXPERIMENTS

(A Student is supposed to complete/perform minimum 8-10 of experiments)

1. Determination of total hardness of water by EDTA method.
2. Determination of dissolved oxygen in a sample of water.
3. Determination of percentage of available chlorine in a sample of bleaching powder.
4. Standardization of KMnO4 using sodium oxalate. Determination of ferrous iron in Mohr's salt by potassium permanganate.
5. Determination of Viscosity of addition polymer by Ostwald Viscometer.
6. Determination of amount of sodium hydroxide and sodium carbonate in a mixture.
7. Estimation of calcium in limestone.
8. Acid-Base Titration by Potentiometry.
9. Preparation of Silver/Iron nano particles.
10. Preparation of Bakelite.
11. Preparation of Urea formaldehyde resin.
12. To record UV-Spectrum of $KMnO_4$ and $K_2Cr_2O_7$.
13. Estimation of nickel in given sample solution
14. Estimation of nitrite in given sample solution.

BASIC ELECTRICAL ENGINEERING LAB	
Course Code: 23EE151/23EE251	**Continuous Evaluation:** 60 Marks
Credits: 1	**End Semester Examination:** 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES (CO)

1. To impart basic knowledge of electrical quantities such as current, voltage, power, energy etc.
2. To familiarize students with basic circuit components and their connections.
3. To explain working principle of transformer and electrical measuring instruments such as ammeter, voltmeter, wattmeter, energy meter, digital storage oscilloscope etc.

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in alignment with National Education Policy (NEP). After completion of course, students would be able to:

1. Verify fundamental laws like Ohm's Law, KCL, KVL, etc.
2. Understand the calibration of energy meter.
3. Understand open circuit and short circuit test of single-phase transformer.
4. Analyse RLC series and parallel circuits

Mapping Matrix of Course Objectives (CO) and Course Learning Outcomes (CLO)

SEM	SUB CODE	Course name	Course Objectives	CLO 1	CLO 2	CLO 3	CLO 4
I/II	23EE151/251	Basic Electrical Engineering Lab	CO1	x	x		x
			CO2	x			x
			CO3	x	x	x	x

COURSE CONTENTS

LIST OF EXPERIMENTS

(A Student is supposed to complete/perform minimum **10** experiments)

1. To verify Kirchhoff's voltage and Current Laws
2. To verify Superposition Theorem
3. To verify Thevenin's Theorem
4. To verify Maximum Power Transfer Theorem
5. To verify Norton's Theorem
6. To measure power and power factor in single phase AC circuit.
7. To verify Series and parallel RLC circuit
8. To conduct open circuit and short circuit test on a single-phase transformer
9. To perform Load test on single phase transformer
10. Calibration of Single Phase & Three Phase Energy Meter
11. To study Digital Storage Oscilloscope
12. To study the balanced three phase system for star and delta connected load
13. To study about earthing and their types.

TEXT BOOKS

1. Handbook of Laboratory Experiments in Electronics and Electrical Engineering by A M Zungeru, J M Chuma, H U Ezea
2. Electrical Measurements & Measuring Instruments by E.W. Golding & F.C. Widdis
3. Electronic Measurement & Instrumentation by H.S. Kalsi
4. Electrical & Electronic Measurement & Instrumentation by A.K. Sawhney ,E. Fitzgerald, C. Kingsley and S. Umans, Electric Machinery, McGraw-Hill Co. Inc.
5. D. P. Kothari and I. J. Nagrath, Electrical Machines, Tata McGraw-Hill.

REFERENCE BOOKS

1. M.G. Say, Alternating Current Machines, Pitman Publishing.
2. Alexander S. Langsdorf, Theory of Alternating Current Machinery, Tata McGraw-Hill.

BASIC ELECTRONICS ENGINEERING LAB	
Course Code: 24EC151/24EC251	**Continuous Evaluation:** 60 Marks
Credits: 1	**End Semester Examination:** 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To study the different types of electronic components and equipment
2. To observe the characteristics of electronic devices
3. To acquire the basic knowledge of digital logic levels and application of knowledge

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in alignment with National Education Policy (NEP). After completion of the course, students would be able to:

1. Measure the voltage, frequency, and phase of any waveform using CRO.
2. Generate sine, square, and triangular waveforms with required frequency and amplitude using function generator.
3. Analyze the characteristics of different electronic devices such as diodes, transistors, and operational amplifiers
4. To develop skills to build and verify digital circuits.

Mapping Matrix of Course Objectives (CO) and Course Learning Outcomes (CLO)

SEM	SUB CODE	Course name	Course Objectives	CLO 1	CLO 2	CLO 3	CLO 4
I/II	24EC151/251	Basic Electronics Engineering Lab	CO1	x	x		
			CO2			x	
			CO3				x

LIST OF EXPERIMENTS

1. (a). To study active and passive electronic components and function generators.
   (b). To study the Digital Cathode Ray Oscilloscope (CRO) and operation of multi-meters.
2. Study of the V-I characteristics of P-N junction diode & Calculate DC & AC resistance.
3. Study of the V-I characteristics of Zener diode.
4. Construction of half-wave rectifier (with & without filter) and calculation of efficiency and ripple factor.
5. Construction of full wave rectifier circuits (with & without filter) and calculation of efficiency and ripple factor.
6. Design of inverting amplifiers using Op-Amp for a given gain with the help of a breadboard and distinct components.
7. Design of non-inverting amplifiers using Op-Amp for a given gain with the help of breadboard

and distinct components.

8. Design of summer amplifiers using Op-Amp for a given gain with the help of a breadboard and distinct components.

9. Study of the input and output characteristics of Transistor.

10. Study and realization of digital logic gates with truth table verification

TEXT BOOKS

1. "Electronics Lab Manual", K.A. Navas ,Volume 1, Fifth Edition. 2015 by PHI Learning Private Limited, Delhi.

REFERENCE BOOKS

1. Electronic Devices and Circuit Theory - by Rober L. Boylestad 11th Edition, Pearson Publication, 2014
2. Millman J., Halkias C.C., Jit S., "Electronic Devices and Circuits", Tata McGraw-Hill, 2nd 2007 Edition

BASIC MECHANICAL ENGINEERING LAB	
Course Code: 23ME151/23ME251	**Continuous Evaluation:** 60 Marks
Credits: 1	**End Semester Examination:** 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To acquaint students with the laws of parallelogram and equilibrium of forces acting on anobject.
2. To make students understand the concepts and principles of friction.
3. To apply engineering sciences through learning-by-doing project work.
4. To provide a framework to encourage creativity and innovation. To develop team work and communication skills through group-based activity.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP).
After completion of course, students would be able to demonstrate:

1. The principle of equilibrium of forces and parallelogram.
2. The effects of friction on the motion.
3. The working and application of engineering components.
4. Develop group working, including task sub-division and integration of individual contributions from the team.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE OBJECTIVES	COURSE LEARNING OUTCOMES			
	CLO1	CLO2	CLO3	CLO4
CO1			✓	
CO2	✓			
CO3				✓
CO4		✓		

LIST OF EXPERIMENTS

1. To verify the law of parallelogram of forces.
2. To study the equilibrium of a body under three forces.
3. To find reaction at the supports of a simply supported beam with different types of loading using Computation method.
4. To determine the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane.
5. To study functioning of belt pulley systems.
6. To find the coefficient of friction between belt and pulley using belt pulley system.
7. To find forces in members of a truss for different load conditions.

8. To determine the mass moment of inertia of a rotating disc
9. To find center of gravity of different geometrical objects using computation method.
10. To verify the law of conservation of energy.
11. Demonstration for centrifugal forces.
12. Engineering Design Project- Students in groups of 4/5 will do a project related to the course.

Note: At least ***8 experiments*** must be carried out.

TEXT BOOKS

1. Laboratory Manual

REFERENCE BOOKS

1. Strength of Materials. Thimoshenko & Young
2. Engineering Mechanics: Statics and Dynamics, R. C. Hibbler, Pearson
3. Mechanics of Solids, A. Mubeen, Pearson

C PROGRAMMING LAB	
Course Code: 23CS151/23CS251	**Continuous Evaluation:** 60 Marks
Credits: 1	**End Semester Examination:** 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To develop problem solving ability using programming.
2. To impart adequate knowledge on the need of programming languages and problem solving techniques.
3. To develop a methodological way of problem solving
4. To learn a programming approach to solve problems.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in alignment with National Education Policy (NEP). After completion of course, students would be able to:

1. Understand the Typical C Program Development Environment, compiling, debugging, Linking and executing.
2. Introduction to C Programming using Control Statements and Repetition Statement
3. Apply and practice logical formulations to solve some simple problems leading to specific applications.
4. Design effectively the required programming components that efficiently solve computing problems in real world.
5. Employ good programming practices such as incremental development, data integrity checking and adherence to style guidelines.

Mapping Matrix of Course Objectives (CO) and Course Learning Outcomes (CLO)

SEM	SUB CODE	Course name	Course Objectives	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5
I/II	23CS151/ 251	C Programming Lab	CO1	x				
			CO2		x	x		
			CO3				x	
			CO4					x

LIST OF EXPERIMENTS

1. Write a program to find the largest of three numbers. (if-then-else)
2. Write a program to find the largest number out of ten numbers (for-statement)
3. Write a program to find the average mail height & average female heights in the class (input is in form of sex code, height).
4. Write a program to find roots of quadratic equation using functions and switch statements.
5. Write a program using arrays to find the largest and second largest no. out of given 50 nos.
6. Write a program to multiply two matrices.
7. Write a program to sort numbers using the sorting Algorithm.
8. Represent a deck of playing cards using arrays.
9. Write a program to check that the input string is a palindrome or not.
10. Write a program to read a string and write it in reverse order.

11. Write a program to concatenate two strings.
12. Write a program which manipulates structures (write, read, and update records).
13. Write a program which creates a file and writes into it supplied input.

Write a program which manipulates structures into files (write, read, and update records).
Note: At least 5 to 10 more exercises to be given by the teacher concerned.

TEXT BOOKS

1. The C Programming Language by Dennis M Ritchie, Brian W. Kernigham, 1988, PHI.
2. Computer System & Programming in C by S Kumar & S Jain, Nano Edge Publications, Meerut.
3. Fundamentals of Computing and C Programming, R. B. Patel, Khanna Publications, 2010, New Delhi.

REFERENCE BOOKS

1. Let Us C, Yashwant Kanetkar, 14th Edition, BPB Publications.
2. Computer Fundamentals and Programming in C, Reema Theraja, Oxford
3. Information technology, Dennis P. Curtin, Kim Foley, Kunal Sen, Cathleen Morin, 1998, TMH.

MECHANICAL WORKSHOP LAB	
Course Code: 23ME152/23ME252	**Continuous Evaluation:** 60 Marks
Credits: 1	**End Semester Examination:** 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. Study and practice on machine tools and their operations.
2. Practice on manufacturing of components using workshop trades includingfitting,
3. To study basics of carpentry, foundry and welding.
4. Identify and apply suitable tools for machining processes including turning, facing.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Use different manufacturing (Fitting, carpentry, sheet metal, welding, smithy working etc.) processes required to manufacture a product from the raw materials.
2. Use different measuring, marking, cutting tools used in the workshop.
3. Be aware of the safety precautions while working in the workshop.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE OBJECTIVES	COURSE LEARNING OUTCOMES		
	CLO1	CLO2	CLO3
CO1	✓	✓	✓
CO2	✓	✓	✓
CO3	✓	✓	
CO4			✓

LIST OF EXPERIMENTS

Fitting Practice:

Use of hand tools in fitting, preparing a male and female joint of M.S. or making a paperweight of M.S.

Carpentry Practice:

Study of Carpentry Tools, Equipment and different joints.

Practice of Cross Half lap joint, Half lap Dovetail joint and Mortise Tenon Joint

Smithy

Tools and Equipments –Simple exercises base on smithy operations such as upsetting, drawing down, punching, bending, fullering & swaging, Making simple parts like hexagonal headed bolt, chisel

Welding Practice (Basic Theory to be explained prior topractice):

Gas Welding& Electric Arc welding Practice.

A joint such as a Lap joint, a T-joint or a Butt joint is to be prepared or to make furniture.

Machining (Basic Theory to be explained prior to practice):
(i) Stepped cylindrical Turning of a job and Thread-cutting in lathe. (ii) Shaping (iii) Milling

TEXT BOOKS

1. Laboratory Manual
2. Gopal, T.V., Kumar, T., and Murali, G., "A first course on workshop practice –Theory, practice and workbook", Suma Publications, 2005

REFERENCE BOOKS

1. Kannaiah,P. & Narayanan,K.C. ―Manual on Workshop Practice", Scitech Publications, Chennai, 1999.
2. Venkatachalapathy, V.S. ―First year Engineering Workshop Practice", Ramalinga Publications, Madurai, 1999

ENGINEERING GRAPHICS & DESIGN LAB	
Course Code: 23ME153/23ME253	**Continuous Evaluation:** 60 Marks
Credits: 1	**End Semester Examination:** 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. Draw orthographic projections of lines, planes and solids.
2. Construct isometric scale, isometric projections and views.
3. Draw sections of solids including cylinders, cones, prisms and pyramids.
4. Draw projections of lines, planes, solids, isometric projections

COURSE LEARNING OUTCOMES (CLOs)

Once the course is completed, the students will be able to

1. Understand orthographic projections of points and lines in any position through AutoCAD.
2. Imagine and convert isometric view into orthographic projections and vice versa.
3. Should be able to understand the simple machine components and draw its projections
4. Familiarize with projections of lines, planes, solids, isometric projections.

Mapping Matrix of Course Objectives (CO) and Course Learning Outcomes (CLO)

SEM	SUB CODE	Course name	Course Objectives	CLO 1	CLO 2	CLO 3	CLO4
I/II	23ME153/252	Engineering Graphics & Design Lab	CO1	**x**			
			CO2		**x**		
			CO3			**x**	
			CO4				**x**

COURSE CONTENTS:

S.No	LIST OF EXPERIMENTS
1	**Introduction**: **Auto CAD** Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning Line Conventions layout of the software, standard tool bar/menus and description of most commonly used toolbars, navigational tools. Co-ordinate system and reference planes. Definitions of HP, VP, RPP &LPP. Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation of Lines, Coordinate points, axes, poly lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror,rotate, trim, extend, break, chamfer, fillet, curves, constraints. 2 – Sheets
2	**Orthographic Projections:** Introduction, Definitions - Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes.2 – Sheets

3	**Orthographic Projections of Plane Surfaces (First Angle Projection Only):** Introduction,Definitions–projections of plane surfaces–triangle, square, rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change of position method, **only 1-Sheet**
4	**Projections of Solids (First Angle Projection Only):** Introduction, Definitions – Projections of right regular tetrahedron, hexahedron (cube),prisms, pyramids, cylinders and cones in different positions. 2-Sheets
5	**Sections and Development of Lateral Surfaces of Solids** Introduction, Section planes, Sections, Section views, Sectional views, Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP. 2 – Sheet
6	**Isometric Projection (Using Isometric Scale Only):** Introduction, Isometric scale, Isometric projection of simple plane figures, Isometricprojection of tetrahedron, hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres, cut spheres. 2-Sheets

TEXT BOOKS:

1. Engineering Drawing - N.D. Bhatt & V.M. Panchal, Charotar Publishing House,Gujarat.
2. Computer Aided Engineering Drawing - S. Trymbaka Murthy, 4th Ed, University Press
3. Engineering Drawing by N.S.Parthasarathy and Vela Murali Oxford University Press

REFERENCE BOOKS

1. Engineering Graphics - K.R. Gopalakrishna, Subash Publishers Bangalore.
2. Graphics for Design and Production-Luzadder Warren J., Duff John M., EasternEconomy Edition, Prentice-Hall of India Pvt. Ltd., New Delhi.
3. Computer Aided Engineering drawing, Prof. M. H. Annaiah, New Age InternationalPublisher, New Delhi

REFERENCE BOOKS

1. Technical Communication, Principle and Practice by Meenakshi Raman & Sangeeta Sharma, Oxford University Press.
2. Communication skill by Sanjay Kumar & Puspa Lata, Oxford University Press 2nd Edition.
3. Business Communication Today by Courtland L Bovee and Thill, Pearson.

COMMUNICATIVE ENGLISH LAB	
Course Code: 24HS151/24HS251	**Continuous Evaluation:** 60 Marks
Credits: 1	**End Semester Examination:** 40 Marks
L T P : 0 0 2	
Prerequisite: Nil	

COURSE OBJECTIVES (COs)

1. To prepare the students for their career which will require them to listen to, read, speak, and write in English both for their professional as well as interpersonal communication.
2. To empower the students to improve both abilities to communicate and their linguistic
3. Competence and boost their confidence.
4. To enable the students to properly communicate and express themselves in writing.
5. To enable students to identify the common mistakes made by most learners of English and not make those errors both in their writing and speaking.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After Completion of course, students would be able to:

1. Summarize conversations, demonstrating understanding of the content.
2. Apply communication strategies to maintain conversations and express ideas clearly.
3. Critique and assess various spoken interactions to identify strengths and areas for improvement in communication.
4. Create engaging dialogues or role-plays that demonstrate real-life communicative scenarios.
5. Develop and present persuasive arguments or opinions on various topics in English.

MAPPING MATRIX OF COURSE OBJECTIVES & COURSE LEARNING OUTCOMES

Course Objective	Course Learning outcomes				
	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5
CO 1	✓	✓	✓		
CO 2		✓		✓	
CO 3			✓	✓	
CO 4				✓	
CO 5					✓

COURSE CONTENTS

Unit-1

- Listening and Speaking
- Practicing Sounds of English
- Accent in speech (British and American)

Unit-2

- Role-play
- Extempore
- Public Speaking and Rhetoric

Unit-3

- Presentations
- Interview Simulations
- Group Discussions and Debates

Unit-4

- Guided composition
- Free-writing
- Reading comprehension practice: Technical and General text

TEXT BOOKS

1. English Grammar in Use. Raymond Murphy. Cambridge UP.4th Edition.
2. Business Communication by Carol M Lehman, Debbie D Dufrene and Mala Sinha. Cengage Learning. 2nd Edition.
3. A Textbook of English Phonetics for Indian Students by T. Balasubramanian [MACMILLAN].
4. Soft Skills: Key to Success in Workplace and Life by Meenakshi Raman and Shalini Upadhyay. Cengage Learning. 2018 Edition.

REFERENCE BOOKS

1. Technical Communication, Principle and Practice by Meenakshi Raman & Sangeeta Sharma,
2. Oxford University Press.
3. Communication skill by Sanjay Kumar & Puspa Lata, Oxford University Press. 2nd Edition.
4. Business Communication Today by Courtland L Bovee and Thill, Pearson

SEMESTER II

ENGINEERING MATHEMATICS-II (COMMON TO ALL BRANCHES EXCEPT BIO MEDICAL ENGINEERING)	
Course Code: 24AS201	**Continuous Evaluation:** 40 Marks
Credits: 4	**End Semester Examination:** 60 Marks
L T P : 3 1 0	
Prerequisite: Engineering Mathematics-I	

COURSE OBJECTIVES (COs):

1. To enable students to have skills that will help them to solve real-world problems based on different types differential equations.
2. To familiarise the students for the Special function-Series Solutions, Bessel's & Legendre's Differential Equations and their properties.
3. To describe Laplace and inverse Laplace transforms with their properties.
4. To understand Analytic functions, Construction of Analytic Functions and Conformal Mapping.
5. To equip the students with concept of Complex Integration, Tayler's and Laurent's Expansions, Residues and Singularities.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Demonstrate various physical models through higher order differential equation and solve such linear ordinary differential equation.
2. Obtain series solution of differential equation and explain applications of Bessel's and Legendre's Differential Equations.
3. Apply Laplace transforms to find the solution of initial value and boundary value problems.
4. Demonstrate the concept of Analytic functions & its constructions, Conformal Mapping
5. Evaluate Complex Integration, Taylor's and Laurent's Expansion, Singularities and Residues.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLO / CO	CLO-01	CLO-02	CLO-03	CLO-04	CLO-05
CO-01	✓				
CO-02		✓			
CO-03			✓		
CO-04				✓	
CO-05					✓

COURSE CONTENTS

Unit-1: Linear Differential Equations
Linear differential equation with constant Coefficient , Complimentary Functions, Particular Integrals, Euler – Cauchy differential equations, Second order linear differential equations –One part of CF is known, Reduction to Normal form, Variation of Parameters & Method of undetermined coefficient.

Unit-2: Series Solutions
Power series method, validity of series method, Frobenius Method. Bessel's Equation, Bessel's function, Generating Function, Recurrence Relations, Orthogonal properties of Bessel's functions, Transformation of Bessel's Equation., Legendre's Equation, Legendre Polynomials, Generating Function, Recurrence Relations, Rodrigue's formula, Orthogonal properties of Legendre's polynomials.

Unit-3: Laplace Transforms

Laplace Transforms, Existence theorem, Standard Properties, Laplace transforms of Derivatives and Integrals, Unit Step Function, Laplace Transform of Periodic functions, Inverse Laplace Transforms, Convolution theorem, Simple Applications of Laplace transforms for solving IVP.

Unit-4: Complex Variable - I
Introduction, Limit, continuity, Differentiability and Analyticity of functions, Cauchy-Riemann Equations (Cartesian and polar), Harmonic functions, Construction of Analytic Function, Determination of Harmonic conjugate, Milne-Thomson's method.

Unit-5: Complex Variable - II
Line integral, Cauchy's Integral Theorem, Cauchy's Integral Formula, Cauchy's Integral Formula for Derivatives, Cauchy's Inequality, Taylor's and Laurent's Expansions (statements only), Singularities, Poles and Residues, Cauchy's residue Theorem and Simple Applications.

TEXT BOOKS/REFERENCE BOOKS

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 44th Edition, 2017
2. J.W. Brown and R.V. Churchill, Complex Variables and Applications, McGraw Hill, 9^{th} edition, 2013.
3. E. Kreyszig, Advanced Engineering Mathematics, Wiley-India, 10th Edition, 2017
4. Kandasamy P et al. Engineering Mathematics, S. Chand & Co., New Delhi, revised edition.
5. Dass H. K., Advanced engineering Mathematics, Sultan Chand Publication, Delhi, 2013.

ELEMENTARY MATHEMATICS-II (For BME only)	
Course Code:24AS204	**Continuous Evaluation:** 40 Marks
Credits: 4	**End Semester Examination:** 60 Marks
L T P : 3 1 0	
Prerequisite: Elementary Mathematics-I	

COURSE OBJECTIVES (COs)

1. To introduce the concept of Differentiation of several variables.
2. To introduce the concept of Vector Calculus, Gradient, Divergence and Curl.
3. To introduce the concept of Second order differential equations and their applications.
4. To get the knowledge that illustrate the complex numbers.
5. To familiarize with the concept of complex variables.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Develop the essential tool of differentiation of several variables.
2. Apply the knowledge of vector calculus in real life applications.
3. Apply the knowledge of Second order differential equations in solving simple problems.
4. Understand the complex number system and their uses.
5. Apply the knowledge to construct analytic functions.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CO \ CLO	CLO-01	CLO-02	CLO-03	CLO-04	CLO-05
CO-01	✓				
CO-02		✓			
CO-03			✓		
CO-04				✓	
CO-05					✓

COURSE CONTENTS

Unit-1: Complex Numbers

Complex numbers and their properties, Complex plane, Polar form of complex numbers, Powers and Roots, Sets of Points in the Complex plane, De-Moivre's theorem and its simple applications.

Unit-2: Successive Differentiation
Successive differentiation, n^{th} order derivatives of standard functions, Leibnitz theorem (without proof).

Unit-3: Differential Calculus of Several Variables
Introduction, Limit & Continuity, Partial derivatives, Homogeneous functions and Euler's theorem, Total derivatives, Jacobians, Properties of Jacobians.

Unit-4: Vector Calculus
Introduction, Scalar and vector point functions, differentiation formulae, Level surface, Gradient, Divergence, Curl, Directional derivatives, Simple Applications.

Unit-5: Linear Differential Equations
Linear differential equation with constant Coefficient, Complimentary Functions, Particular Integrals, Euler – Cauchy differential equations, Second order linear differential equations – Variation of Parameters & Method of undetermined coefficient.

TEXT BOOKS/ REFERENCE BOOKS

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 44^{th} Edition, 2017.
2. Jain R. K., Iyengar S. R. K., "Advanced Engineering Mathematics", 6^{th} Edition, Narosa Publishing House, 2019.
3. Bali N.P., Goyal M, Advanced Engineering Mathematics, Laxmi Publications, New, Delhi.2018.
4. Dass H. K., Advanced Engineering Mathematics, Sultan Chand Publication, Delhi, 2018.

HINDI-II	
Course Code:24HIN201-II	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 2 0 0	
Prerequisite: Nil	

LAGHU KATHAEN AUR SANCHAR KAUSHAL

Course Description:

विश्वविद्यालय ने वर्ष 2024-25 सत्र से स्नातक स्तर पर हिंदी विषय का पाठ्यक्रम तैयार किया है | हिंदी विषय के प्रश्न पत्र की सामग्री निर्धारण में ज्ञान तथा शिक्षा के बदलते परिप्रेक्ष्य को ध्यान में रखा गया है| इस सत्र में हिंदी लघु कथाओं को सम्मिलित किया गया है| छात्रों की मौखिक अभिव्यक्ति की क्षमता का विकास करने में निहित मूल्यों का महत्वपूर्ण योगदान होता है , इससे विद्यार्थियों की कल्पना शक्ति के विकास के साथ-साथ मनोरंजन भी होता है| संचार कौशल में मुहावरे, लोकोक्तियां, पत्र लेखन और अपठित गद्यांश की समझ के द्वारा हिंदी का प्रचार-प्रसार होगा| इस प्रकार साहित्य के ज्ञान की अभिवृद्धि वैश्वीकरण के संदर्भ में प्रासंगिकता और उपयोगिकता सिध्द करती है |

Course Content

(Unit-A)

इस इकाई में हिंदी लघु कथाओं का संक्षिप्त परिचय दिया गया है –

1 हिंदी लघु कथा का सामान्य परिचय |

2 हिंदी लघु कथा के प्रमुख प्रकार |

(Unit-B)

इस इकाई में हिंदी की दो लघु कथाएं सम्मिलित की गई हैं-

1 अंगूर की बेल

2. किसान और ठग

(Unit-C)

इस इकाई में हिंदी की दो लघु कथाएं सम्मिलित की गई हैं-

1 बुराई का फल

2 चार विद्वान ब्राह्मण

(Unit-D)

यह इकाई संचार कौशल से सम्बंधित है, इसमें

(i) प्रेस रिपोर्ट, विज्ञापन, अनुवाद

(ii) हिंदी पत्र लेखन और अपठित गद्यांश को समझना व तर्कसंगत उत्तर देना अपेक्षित है|

(Course Outcome)

पाठ्यक्रम परिणाम

(1.Knowledge Outcome)

1 ज्ञान का परिणाम

(At the end of the course, the student should be able to)

पाठ्यक्रम के अंत में छात्र सक्षम होना चाहिए

हिंदी लघु कथाओं के मूल उद्देश्य को समझने में विद्यार्थी निपुण हो जाएंगे| लघु कथाओं से क्या शिक्षा मिलती है? इसका ज्ञान छात्रों को होगा| व्याकरण के अध्ययन से विद्यार्थियों को भाषा बोलने, लिखने और पढ़ने में सहायता प्राप्त होगी |

(2.Skill Outcome)

2 कौशल का परिणाम

(At the end of the course, the student should be able to)

-पाठ्यक्रम के अंत में छात्र सक्षम होना चाहिए

-हिंदी लघु कथाओं से मनोरंजन भी होगा |

-विद्यार्थी लघु कथाओं के मूल कथ्य को समझेंगे|

-विचार तत्व के बोध से अवगत होंगे|

-हिंदी में पत्र लेखन और अपठित गद्यांश को समझने में सक्षम होंगे |

(Methodology)

)पध्दति**)**

- कक्षा व्याख्यान

-व्याकरण के माध्यम से हिंदी शब्दों का उच्चारण व लेखन का अभ्यास किया जाएगा|

-समय-समय पर छात्रों को प्रदत्त कार्य दिया जाएगा|

-दैनिक प्रश्नावली|

(Required Books and Materials)

आवश्यक पुस्तकें और सामग्री

-पाठ्यक्रम में निर्धारित लघु कथाओं का संकलन |

-भाषा विज्ञान, डॉ. भोलानाथ तिवारी ,किताब महल इलाहाबाद |

-हिंदी व्याकरण, कामता प्रसाद गुरु, प्रभात प्रकाशन

GERMAN-II	
Course Code: 24FLGR201- II	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 2 0 0	
Prerequisite: Basics of English Language	

COURSE OBJECTIVES (COs):

The objective of this course is to impart basic knowledge of German language to the students. The courseintends to develop an ability for discussions, debates, research ventures, etc. Overall, the objective is to facilitate comprehension of the legal concepts better and develop the ability to write effective propositionsin legal contexts.

1. To develop oral and written skills of understanding, expressing and exchanging information in German language.
2. To develop awareness of the nature of language and language learning.
3. To develop the ability to construct sentences and frame questions.
4. To provide German language as a competitive edge in career choices.

COURSE LEARNING OUTCOMES (CLOs):

After completion of the course the students will have the ability to:

1. Read and write short, simple texts.
2. Have Fluency in reading and writing.
3. Understand the dialogue between two native speakers and to take part in short, simple conversations using the skills acquired.
4. Know the culture of the countries where the German language is spoken.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE OBJECTIVES	Course Learning Outcome			
	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓			
CO02		✓	✓	
CO 03			✓	
CO 04				✓

COURSE CONTENTS

UNIT- 1

- Zeit-Ausdrücke, Tagesteile, Uhrzeit
- Präpositionen mit Akkusativ/Dativ, Ordinalzahlen
- Wegbeschreibung, Reisen, Verkehrsmittel
- Das Haus

UNIT- 2

- Modalverben
- Essen und Trinken, Mahlzeiten, Tagesablauf, Messeinheiten, Einkaufen
- Körperteile und Krankheiten
- Futur

UNIT- 3

- Dativ, Artikel und Personalpronomen im Dativ, Verben und Präpositionen mit Dativ, Konjugation und Verwendung von Verben (geben, kaufen, schenken, gratulieren, gehören, gefallen, gehen, fahren, fliegen, usw.)
- Possessiv-Artikel
- Trennbare Verben, Untrennbare Verben

UNIT 4

- Perfekt
- E- Mail Schreiben/ SMS Schreiben
- Vergangenheit erzählen, Das Wochenende, Lebenslauf

TEXT BOOKS :

- Netzwerk Neu A1 (Kursbuch+Arbeitsbuch)
  Dengler, Stefanie, et al. Netzwerk neu: A1. Ernst Klett Sprachen., 2019.

REFERENCE BOOKS:

- Rusch, Paul, Helen Schmitz, and Humorvolle Zeichnungen. "Einfach Grammatik." Übungsgrammatik Deutsch A1 bis B 1 (2012): 329-330.Einfach Gramatik, Paul Rusch
- Carlson, Antje. "Lemcke, Christiane, Lutz Rohrmann, and Theo Scherling. Berliner Platz 1 Neu--German for Beginners." Die Unterrichtspraxis/Teaching German 44.1 (2011): 46-49.
- Dallapiazza, Rosa-Maria, Eduard Von Jan, and Sabine Dinsel. Tangram: Deutsch als Fremdsprache. Lehrerbuch. Vol. 1. Hueber Verlag, 1998.
- Wolfgang Hieber: Lernziel Deutsch, Teil 1,Max HueberVerlag, 1984.

WEBSITE PAGES:

- https://www.nthuleen.com/teach.html

FRENCH-II	
Course Code: 24FLFR201-II	**Continuous Evaluation:** 40 Marks
Credits: 2	**End Semester Examination:** 60 Marks
L T P : 2 0 0	
Prerequisite: French-I	

COURSE OBJECTIVE (COs)

1. To develop **listening, speaking, reading and writing** requisites of a language.
2. To develop the ability **to construct sentences** and **frame questions**.
3. To equip the students with **cultural elements and communication strategies** which will help them **communicate in varied situations.**
4. To familiarise the students with the **French and Francophone culture.**

COURSE LEARNING OUTCOMES (CLOs)

1. After completion of this course, the student will be able **to express and interact in French** used in daily conversations.
2. The student will be able **to write short and simple texts.**
3. The student will be able to **initiate, understand and respond to the queries of cultural significance in various settings.**
4. The student can demonstrate **knowledge and understanding** of French and Francophone culture.

MAPPING MATRIX OF COURSE OBJECTIVES (COs) & COURSE LEARNING OUTCOMES (CLOs)

COURSE OBJECTIVES	Course Learning Outcome			
	CLO 01	CLO 02	CLO 03	CLO 04
CO 01	✓			
CO02		✓	✓	
CO 03			✓	
CO 04				✓

COURSE CONTENT

S. No	Unités	Objectifs de Communication	Grammaire	Lexique
1	**Journée Typique**	Parler de Nos Habitudes, Exprimer l'Heure, S'Informer sur l'Heure, le Moment et la Fréquence.	Les Verbes Pronominaux au Présent. Les Verbes Aller et Sortir	L'Heure, Les Moments de la Journée. Les Activités Quotidiennes. Les Adverbs. La Météo.
2	**Achats**	S'informer sur un Produit. Acheter et Vendre un Produit. Donner Son Avis. Parler du Temps qu'il Fait	Les Adjectifs Interrogatifs. Les Adjectifs Démonstratifs. Le Genre et le Nombre. Le Verbe Prendre.	Les Vêtements. Les Couleurs. Les Fruits et Les Légumes.
3	**Alimentation**	Parler des Plats et des Aliments. Commander un Menu dans un Restaurant. Situer une Action dans le Futur	Le Future Proche: Aller +Infinitif. Les Partitifs. Les Pronoms COD. Le Future.	Les Aliments. Le Lexique des Quantités.
4	**expérience vécue**	Parler de faits passés. Parler de Nos expériences. Parler de ce que nous savons faire.	Le Passé Composé. L'Imparfait.	Les Verbes Savoir, Pouvoir et Connaître. Les Adjectifs Qualificatifs. Le Lexique des Savoirs et Compétences. Le Récit de Vie.

TEXT BOOK

- Version Originale 1, Livre de l'élève: Denyer M. & Agustin Garmendia A. & Olivieri M L L., éd. Maisons des Langues, Paris. 2013.

REFERENCE BOOKS

- Alter Ego 1, Livre d'élève, Berthet A. & Hugo C. & Kizirian M. V. & Sampsonis B. & Waendendries M., éd Hachette, Paris, 2006.

- Connexions 1, Loiseau Y. & Mérieux R., éd. Didier, Paris, 2004.
- Le Nouveau Sans Frontiers, Vol. 1, P. Dominique, J. Girardet et al, CLE International, Paris, 2013.
- Le Robert & Nathan Conjugation, Paperback, Le Robert Nathan, 2011.

2nd Year

III - Semester

Structural Analysis – I	
Course Code: 23CE301	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: 23CE301	

COURSE OBJECTIVES (COs)

1. To understand concept of shear force and Bending Moment Diagram.
2. To analyze the deflection of beams.
3. To evaluate the stresses due to combined loading analytically as well as graphically.
4. To understand the behaviour of different kind of columns under axial as well as eccentric loading.
5. To analyze cables and suspension bridges.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will learn to draw SFD and BMD.
2. Students will analyze the beam.
3. Students will learn evaluation of stresses by various methods.
4. Students will learn behaviour of column by various load condition.
5. Students will cables and suspension bridges.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

Unit-1: Shear Force and Bending Moment Diagram

Concept of shear force diagram and bending moment diagram. Relation between shear force, bending moment and intensity of loading. Shear force and bending moment diagrams for cantilevers and simple beams due to concentrated, uniformly distributed, uniformly varying loads and couples in beams.

Unit-2: Deflections of Beams

Introduction, Slope and deflections in beams by differential equations, moment area method, conjugate beam method, unit load method, principle of virtual work, Maxwell's Law of Reciprocal Deflections.

Unit-3: Principal Stresses and Strains

Concept of principal planes and principal stresses, Normal and shear stresses on an oblique plane, magnitude and orientation of principal stresses and maximum shear stress, Mohr's circle for plane stresses. Combined effect of axial stress, moment and shear. Theories of failure: maximum normal stress, maximum shear stress and maximum strain theory.

Unit-4: Axially and Eccentrically Loaded Columns

Slenderness ratio, end connections, short columns, Euler's critical buckling loads, eccentrically loaded short columns, cylinder columns subjected to axial and eccentric loading.

Unit-5: Cables and Suspension Bridges

Introduction, shape of a loaded cable, Cable carrying point loads and UDL, cables with ends at different level, cable subjected to temperature stresses, Suspension bridge with two hinged and three hinged stiffening girders.

TEXTBOOKS/ REFERENCE BOOKS/NPTEL RESOURCES

1. Mechanics of Materials By B.C. Punmia ; Laxmi Publications.
2. Advanced Structural Analysis, A.K. Jain, Nem Chand & Bros., Roorkee.
3. Indeterminate Structures, R.L. Jindal, S. Chand & Co., New Delhi.
4. Theory of Structures, Vol. I, S.P. Gupta & G.S.Pandit, Tata Mc Graw Hill, New Delhi.

Surveying – I	
Course Code: 23CE302	Continuous Evaluation: 40 Marks
Credits: 03	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: 23CE302	

COURSE OBJECTIVES (COs)

1. To understand the importance of surveying in Civil engineering.
2. To study the basic of linear/angular/directions measurements using chain/ tacheometer/ compass and theodolite and their applications.
3. To study the method of determination of height of points using various leveling method and Tacheometer.
4. To study the significance of Plane Table surveying in preparation of map and setting of different types of curves.
5. To study the determination of coordinates using satellite-based method.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will learn importance and basics of surveying.
2. Students will learn measurements by various methods.
3. Students will learn about leveling and Tacheometer.
4. Students will learn about Plane table surveying and curve setting.
5. Students will learn Coordinates by satellite-based method.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3	CLO4	CLO4
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

Unit-1: Basics of Surveying

Definition, objects, classification- fundamental principles - methods of fixing stations - concept of Geoid and reference spheroids.

Linear measurement: Direct measurement - instruments for measuring distance - instruments for making stations - chaining of line - errors in chaining - tape corrections examples - Chain traversing.

Direction Measurement: Bearings and angles - Compass surveying - magnetic bearings - prismatic and surveyor compass – declination - local attraction errors and adjustments - Methods of compass traversing -checks in traversing - adjustment of closed traverse.

Unit-2: Angle Measurement

Theodolite: Theodolites - temporary adjustment of theodolite – measurement of horizontal and vertical angles - theodolite traverse.

Leveling: Definition of terms used in leveling – types of levels and staff - temporary adjustment of levels - principles of leveling spirit and trigonometric levelling – reduction of levels – booking of staff readings - plane and geodetic trigonometric levelling – correction due to curvature and refraction – axis signal correction.

Contouring: contour, characteristics of contours lines- locating contours - interpolation of contours - use of contours.

Unit-3: Plane Table Surveying

Plane Table Surveying: Plane table accessories, various methods of plane table surveying, two-point problems with advantages and Disadvantages - three-point problems - sources of error - advantages and disadvantages.

Curves: Classification of curves, elements of simple circular curve, location of tangent points-chain and tape methods, instrumental methods - Examples of simple curves Transition Curves - Length and types of transition curves length of combined curve – examples - Vertical Curves: Necessity and types of vertical curves - setting out of a vertical curve by tangent correction - chord gradient and sight distance method.

Unit-4: Tacheometry

Tacheometry: Principle of tacheometry - stadia and tangential method of tacheometry.

GNNS: Global Navigation Satellite System (GNSS): basic concepts - History of GPS - GPS design objectives details of segments: space, control and user - Brief of different GPS systems, including, NAVSTAR GPS, GLONASS, GALILEO, IRNSS, BeiDou etc, - Advantages and limitations of GPS - GPS Signal structure: Carrier's frequencies- GPS codes: C/A, P, navigational message - GPS receiver: Types. Principles of GPS position fixing - Pseudo ranging and carrier phase, GPS errors.

TEXTBOOKS/ REFERENCE BOOKS/NPTEL RESOURCES

1. Surveying volume II: B C Punmia.
2. Engineering Surveying (Sixth Edition): W. Schofield.
3. Text Book of Surveying: C.Venkataramiah.
4. Introduction to GPS: The Global Positioning System: Ahmed El-Rabbany.

Fluid Mechanics	
Course Code: 23CE303	Continuous Evaluation: 40 Marks
Credits: 03	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: 23CE303	

COURSE OBJECTIVES (COs)

1. To study theories those, explain the behavior and performance of fluid when the fluid is at rest and motion.
2. To study theories those, explain the behavior and performance of fluid when the fluid is flowing through the pipe.
3. To study the features and function of various devices used to measure the pressure of fluid.
4. To study the features and function of various devices used to measure the velocity and discharge of fluid.
5. To understand the utilization of dimensional analysis as a tool in solving problems in the field of fluid mechanics.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will learn behavior and performance of fluid at rest and motion.
2. Students will learn about behavior of flowing fluid through pipe.
3. Students will learn about various devices used to measure fluid pressure.
4. Students will learn about various devices used to measure fluid velocity and discharge.
5. Students will understand dimensional analysis utilization.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

Unit-1: Introduction

Fluid properties, mass density, specific weight, specific volume and specific volume and specific gravity, surface tension, capillarity, pressure inside a droplet and bubble due to surface tension, compressibility viscosity, Newtonian and Non-newtonian fluids, real and ideal fluids.

Unit-2: Kinematics of Fluid Flow

Stready & unsteady, uniform and non-uniform, laminar & turbulent flows, one, two & three dimensional. flows, stream lines, streak lines and path lines, continuity equation in differential form, rotation and circulation, elementary explanation of stream function and velocity potential, rotational and irrotational flows.

Unit-3: Fluid Statics

Pressure-density-height relationship, gauge and absolute pressure, simple differential and sensitive manometers, two liquid manometers, pressure on plane and curved surfaces, center of pressure, Buoyancy, stability of immersed and floating bodies, determination of metacentric height, fluid masses subjected to uniform acceleration, free and forced vortex.

Unit-4: Dynamic of Fluid Flow

Euler's equation of motion along a streamline and its integration, limitation of Bernoulli’s equation, Pitot tubes, venturimeter, Orficemeter, flow through orifices & mouth pieces, sharp crested weirs and notches.

Unit-5: Laminar Flow & Flow through Pipes

Laminar Flow: Navier Stoke's equation, Laminar flow between parallel plates, laminar flow through pipes-Hagen Poiseuille law, laminar flow around a sphere-Stokes'law.

Flow through Pipes: Reynold's experiment, shear stress in turbulent flow, velocity distribution for turbulent flow in smooth and rough pipes, resistance to flow of fluid in smooth and rough pipes, Darcy's weisbach equation, other energy losses in pipes, loss due to sudden expansion, hydraulic gradient and total energy lines, pipes in series and in parallel, equivalent pipe, branched pipe, pipe networks, Hardy Cross method, water hammer.

TEXTBOOKS/ REFERENCE BOOKS/NPTEL RESOURCES

1. Theory and application of fluid Mechanics including Hydraulic Mechanics by K Subramanya.
2. Introduction to Fluid Mechanics by Robert N.Fox & Alan T.Macnold.
3. Hydraulic and Fluid Mechanic by P.N.Modi & S.M.Seth.
4. Introduction to Fluid Mechanics by Robert W.Fox & Alan T.Mc Donald.
5. Engineering Fluid Mechanics by R.J.Ga rde & A.G.Mirajgaoker.

Environmental Engineering	
Course Code: 23CE304	Continuous Evaluation: 40 Marks
Credits: 03	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: 23CE303	

COURSE OBJECTIVES (COs)

1. To make the students conversant with sources of water and types of water demand.
2. To understand the basic characteristics of water and its determination.
3. To expose the students to understand components of water supply scheme.
4. To provide adequate knowledge about the water treatment processes and its design.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will learn about water sources and demand of water analysis.
2. Students will learn characteristics of water.
3. Students will understand various schemes of water supply.
4. Students will design water treatment plant.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS

Unit-1: Water Quantity

Importance and necessity of water supply scheme, Components of water supply scheme, water demands and its variations, Population forecasting, estimation of total quantity of water requirement, quality and quantity of surface and ground water sources, selection of a source for water supply, types of intakes.

Unit-2: Water Quality

Sources of impurities - type of impurities in water and their sanitary significance - Physical analysis of water - chemical analysis of water - bacteriological analysis of water - water quality standards.

Unit-3: Water Treatment

Objectives - treatment processes and their sequence in conventional water treatment plant – aeration - sedimentation – plain and aided with coagulation - types, features and design aspects - mixing basins and flocculation units - Filtration – mechanisms - types of filters - slow and rapid sand filtration units (features and design aspects) - disinfection – theory - methods and practices - specific water treatment methods.

Unit-4: Water Conveyance and Distribution

Hydraulic design of pressure pipe - pipe materials - types of distribution system – gravity system - pumping system - dual system - layout of distribution system – dead end system - grid iron system -their merits and demerits ring system - radial system - their merits and demerits - distribution reservoir - functions and determination of storage capacity.

TEXTBOOKS/ REFERENCE BOOKS/NPTEL RESOURCES

1. Water Supply and Sewerage: E.W. Steel.
2. Water Supply Engineering: S.R. Kshirsagar.
3. Water Supply Engineering: S.K. Garg
4. Water Supply Engineering: B.C. Punmia.
5. Introduction to Environmental Engineering: Davis M. L. and Cornwell D. A.

Surveying – I Lab	
Course Code: 23CE352	Continuous Evaluation: 60 Marks
Credits: 01	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: 23CE352	

COURSE OBJECTIVES (COs)

1. Use conventional surveying tools such as chain/tape, compass, plane table, levels in the field for various civil engineering applications.
2. Enter observation in field book, adjusting and plotting a traverse.
3. Use plane table to prepare map of a small area.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will use all type of survey instruments.
2. Students will learn about field book and instrument adjustment.
3. Student will prepare map of small area.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3
CO1	✓		
CO2		✓	
CO3			✓

COURSE CONTENTS

1. Chain Traversing.
2. Compass Traversing.
3. Differential Leveling.
4. Fly Levelling.
5. Cross Sectioning.

6. Profile levelling.
7. Plane Table surveying: Radiation and Intersection.
8. Resection- 2 and 3-point problem with plane Table Working with digital level.

TEXTBOOKS/ REFERENCE BOOKS/NPTEL RESOURCES

1. Laboratory Manual.

Fluid Mechanics Lab	
Course Code: 23CE353	Continuous Evaluation: 60 Marks
Credits: 01	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: 23CE353	

COURSE OBJECTIVES (COs)

1. To learn the aim, working principle, components, function of hydraulic equipment's.
2. To get hand-on experience in the operation of hydraulic equipment.
3. To study to take observations while the equipment is in operation.
4. To interpret the results obtained to arrive a conclusion.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will learn about working principle and function of hydraulic equipment's.
2. Students will get hands on training on all type of hydraulic equipment.
3. Students will learn to take observations while in operation.
4. Students will learn to interpret the results.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS

1. To determine metacentric height of the ship model.
2. To verify the Bernoulli's theorem.
3. To determine coefficient of discharge for an Orifice meter/venturi meter.
4. To determine coefficient of discharge for an Orifice under variable head.
5. To calibrate a given notch.
6. To study velocity distribution in a rectangular open channel.
7. To determine the coefficient of drag by Stoke's law for spherical bodies.
8. To study the phenomenon of cavitation in pipe flow.
9. To determine the critical Reynold's number for flow through commercial pipes.
10. To determine the coefficient of discharge for flow over a broad crested weir.
11. To study the characteristics of a hydraulic jump on a horizontal floor and sloping glacis including friction blocks.
12. To study the momentum characteristics of a given jet.
13. To determine head loss due to various pipe fittings.

TEXTBOOKS/ REFERENCE BOOKS/NPTEL RESOURCES

1. Laboratory Manual.

Environmental Engineering Lab	
Course Code: 23CE354	Continuous Evaluation: 60 Marks
Credits: 01	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: 23CE354	

COURSE OBJECTIVES (COs)

1. To analyze the physical and chemical characteristics of wastewater/sewage.
2. To familiarize the methods to estimate the organic strength of wastewater/sewage.
3. To study the growth of microorganisms and its quantification.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will analyze physical and chemical characteristics of waste water.
2. Students will estimate the organic strength of waste water.
3. Students will learn growth of microorganisms.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3
CO1	✓		
CO2		✓	
CO3			✓

COURSE CONTENTS

1. To determine the acidity of a wastewater/sewage sample.
2. To determine the alkalinity of a wastewater/sewage sample.
3. To determine the pH of a wastewater/sewage sample.
4. To determine hardness of given water sample.
5. To determine total, suspended, dissolved and settable solids in a wastewater sample.
6. To determine the dissolved oxygen in a sample of water wastewater/sewage sample.
7. To determine the chloride concentration in a wastewater/sewage sample.
8. To determine the sulphate concentration in a wastewater/sewage sample.
9. To determine the B.O.D. of a given wastewater/sewage sample.

TEXTBOOKS/ REFERENCE BOOKS/NPTEL RESOURCES

1. Laboratory Manual.

IV - Semester

Soil Mechanics	
Course Code: 23CE402	Continuous Evaluation: 40 Marks
Credits: 03	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: 23CE402	

COURSE OBJECTIVES (COs)

1. To explain how three phase system is used in soil and how are soil properties estimated using three phase system.
2. To explain the role of water in soil behavior and how soil stresses, permeability and quantity of seepage including flow net are estimated.
3. To emphasis the importance of soil stress distribution and stress influence due to varies loads.
4. To explain how soil shear parameters are affected by drainage conditions.
5. To explain mechanism of compaction, factors affecting and effects of compaction on soil properties.
6. To estimate the magnitude and time-rate of settlement due to consolidation.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will understand the concept of three phase system in soil.
2. Student will learn the role of water in soil and seepage system.
3. Student will learn about soil stress distribution and stress influence.
4. Students will learn soil parameters in drainage conditions.
5. Students will understand the mechanism of compaction and its effect.
6. Students will estimate the settlement of soil due to consolidation.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

Unit-1: Basic Soil Properties

Introduction - soil and rock -three phase system - weight- volume relationships – soil grain properties – soil - grain size analysis - sieve analysis - sedimentation analysis - grain size distribution curves - consistency of soils - consistency limits and their determination - relative density of sands.

Classification of soils: Purpose of classification - Indian Standard Classification System.

Unit-2: Permeability of Soils and Effective Stress Concept

Permeability of Soils: Introduction - Darcy's law and its validity - discharge velocity and seepage velocity - factors affecting permeability – laboratory determination of coefficient of permeability - determination of field permeability.

Effective Stress Concept: Principle of effective stress - effective stress under hydrostatic conditions - effective stress under steady state hydro - dynamic conditions - seepage force - quick condition - critical hydraulic gradient - two-dimensional flow - Laplace's equation.

Unit-3: Compaction and Vertical Stress below Applied Loads

Compaction: Introduction - role of moisture and compactive effect in compaction - Laboratory determination of optimum moisture content - moisture density relationship - compaction in field - field control of compaction.

Vertical Stress Below Applied Loads: Introduction, Boussinesq's equation, vertical stress beneath loaded areas - approximate stress distribution methods for loaded areas - Westergaard's analysis - contact pressure.

Unit-4: Compressibility, Consolidation and Shear Strength

Compressibility and Consolidation: Introduction - components of total settlement – consolidation process - one-dimensional consolidationtest - Typical void ratio-pressure relationships for sands and clays - normally consolidated and over consolidated clays - Casagrande's graphical method of estimating pre- consolidation pressure - Terzaghi's theory of one-dimensional primary consolidation - determination of coefficients of consolidation.

Shear Strength: Introduction, Mohr stress circle, Mohr-Coulomb failure-criterion, relationship between principal stresses at failure, shear tests - direct shear test, unconfined compression test, triaxial compression tests - drainage conditions and strength parameters, Vane shear test.

Unit-5: Earth Pressure

Introduction - earth pressure at rest - Rankine's active & passive states of plastic equilibrium - Rankine's earth pressure theory.

TEXTBOOKS/ REFERENCE BOOKS/NPTEL RESOURCES

1. Gopal Ranjan, ASR Rao, Basic and Applied Soil Mechanics, New Age International (P) Ltd.Publishers - N.Delhi, Edition No. - 3rd, 2016.
2. Alam Singh, Soil Engg. In Theory and Practice, Vol. I, Fundamentals and Genera l Principles, CBS Pub., N.Delhi.
3. S.K.Gulati, Engg.Properties of Soils, Tata-Mcgraw Hill, N.Delhi.
4. P.Purshotam Raj, Geotechnical Engg, Tata Mcgraw Hill, N.Delhi, Edition No.- I, 1995.
5. B.M.Das, Principles of Geotechnical Engineering, PWS KENT, Boston.

Design of Steel Structure	
Course Code: 23CE403	Continuous Evaluation: 40 Marks
Credits: 03	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: 23CE403	

COURSE OBJECTIVES (COs)

1. Design a Welded and Riveted connection.
2. Design Tension Members, Lug Angles and Splices.
3. Design Compression Members, Built-Up Compression Members.
4. Design Plate Girders and Gantry Girders.
5. Design Roof trusses, Purlin, joints and end bearings of Steel Structures.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will design various types of connections.
2. Students will design tension member.
3. Students will design compression members.
4. Students will design various types of girders.
5. Students will design roof truss and purl in with various bearing conditions.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

Unit-1: Elementary Limit Analysis, Design and Connections

Introduction, Scope of plastic analysis - ultimate load carrying capacity of tension members – ultimate load carrying capacity of compressionmembers - flexural members - shape factor – mechanisms - plastic collapse analysis - plastic analysis applied to steel beams and simple portal frames and design.

Connections: Importance - various types of connections - simple and moment resistant - riveted, bolted and welded connections.

Unit-2: Design of Tension Members and Compression Members

Design of Tension Members: Introduction, types of tension members - net sectional areas - design of tension members - lug angles and splices.

Design of Compression Members: Introduction, effective length and slenderness ratio - various types of sections used for columns - built up columns – necessity - design of built-up columns - laced and battened columns including battens, the design of lacing-design of eccentrically loaded compression members.

Unit-3: Design of Beams and Plate Girder

Design of Beams: Introduction, types of sections, general design criteria for beams - design of laterally supported and unsupported beams - design of built-up beams - web buckling - web crippling and diagonal buckling.

Plate Girder: Introduction, elements of plate girder - design steps of a plate girder, necessity of stiffeners in plate girder - various types of stiffeners - web and flange splices (brief introduction), Curtailment of flange plates - design beam to column connections: Introduction, design of framed and seat connection.

Unit-4: Column Bases and Footings

Introduction -Types of column bases – design of slab base and gusseted base - design of gusseted base subjected to eccentrically loading - design of grillage foundations.

Beam Column: Introduction - bending about one axis - bending about both axes boundary constraints - design considerations.

UNIT -5 Roof Trusses

Types and components of roof truss - estimation of wind load - design of purlin with and without sag rod - lateral bracing and design of roof truss Cold Formed Sections: Introduction and brief description of various type of cold formed sections - local buckling - concepts of effective width and effective sections - elements with stiffeners - design of compression and bending elements.

TEXTBOOKS/ REFERENCE BOOKS/NPTEL RESOURCES

1. Design of Steel Structures, A.S.Arya & J.L.Ajmani, Nem chand & Bros., Roorkee.
2. Design of Steel Structures, M.Raghupati, TMH Pub., New Delhi.
3. Design of Steel Structures, S.M.A.Kazmi & S.K.Jindal, Prentice Hall, New Delhi.
4. Design of Steel Structures, S.K.Duggal, TMH Pub., New Delhi.

Structural Analysis-II	
Course Code: 23CE404	Continuous Evaluation: 40 Marks
Credits: 04	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisite: 23CE404	

COURSE OBJECTIVES (COs)

1. To analysis the structures using different displacement methods.
2. To understand the behavior of structure under unsymmetrical bending.
3. To understand influence line diagram and be able to draw influence lines for various functions of determinate and indeterminate structures.
4. To analyze the arches.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will analyze the structure using different displacement method.
2. Student will understand the behavior of structure under bending.
3. Students will draw the influence diagram of determinate and indeterminate structures.
4. Students will analyze the different types of arches.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

Unit-1: Fixed and Continuous Beams

Introduction, types of supports-reaction components - external redundancy - statically indeterminate beams and frames - degree of redundancy - Bending moment diagrams for

fixed beams with different loadings - effect of sinking of supports - Clapeyron's theorem of three moments - various cases of load and geometry of continuous beams.

Unit-2: Slope Deflection & Moment Distribution Method

Slope Deflection Introduction & Fundamental equations - Applications to continuous beams and portal frames - side sway in portal frames - Moment Distribution Method Basic propositions - stiffness of a member - distribution theorem - carry-over theorem - relative stiffness - distribution factors - Applications to continuous beams - portal frames with and without side sway.

Unit-3: Rolling Loads and Influence Lines Diagrams

Introduction - Single concentrated load - uniformly distributed load longer than span - shorter than span - two-point loads - Several point loads - Max. B.M. and S.F - Absolute Max. B.M – Introduction - influence lines for three hinged and two hinged arches - Load position for Max. S.F. and B.M. at a section in the span - Muller-Breslau Principle, I.L. for B.M. & S.F. for continuous Beams.

Unit-4: Analysis of Arches

Three Hinge Arches: Horizontalthrust - shear force and Bending Moment diagram - Two Hinge Arches: Parabolic and circular arches – Bending Moment Diagram for various loadings - temperature effects - web shortening - Axial thrust and Radial Shear force diagrams - Fixed Arches - Expression for Horizontal thrust – Bending Moment at a section - elastic Centre.

TEXTBOOKS/ REFERENCE BOOKS/NPTEL RESOURCES

1. Indeterminate Structures, R.L.Jindal S.Chand & Co.,New.Delhi.
2. Advanced Structural Analysis-A.K.Jain, Nem Chand & Bros., Roorkee.
3. Structural Analysis-A Unified Approach, D.S.Prakash Rao,, University Press , Hyderabad.
4. Structural Analysis-A unified classical & Matrix Approach, A.Ghali & A.M.Neville, Chapman & HallLondon.
5. Theory of Structures, - Vol. I&II, - S.P.Gupta & G.S.Pandit, Tata Mc Graw Hill, New Delhi.

Surveying – II Lab	
Course Code: 23CE451	Continuous Evaluation: 60 Marks
Credits: 01	End Semester Examination: 40 Marks
L T P : 0 0 1	
Prerequisite: 23CE451	

COURSE OBJECTIVES (COs)

1. Use the theodolite for measuring angles and using tacheometer to determine distance and elevation.
2. Use a total station to measure distance, elevation and coordinates.
3. Use total station to plot a map of given area with software.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will get training on theodolite of basic measurements.
2. Students will get hand on training on total station of basic measurements.
3. Students will plot a map of small area by total station with software.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / Cos	CLO1	CLO2	CLO3
CO1	✓		
CO2.		✓	
CO3			✓

COURSE CONTENTS

1. Study of theodolite.
2. Measurement of horizontal / Vertical angle with theodolite.
3. Measurement of Tacheometric constants.
4. Calculating horizontal distance and elevations using tacheometer.
5. Study of Total Station.
6. Measurements of distance, elevation, coordinate with total station.

7. Plan and contour map with a total station and software (including AutoCAD).

TEXTBOOKS/ REFERENCE BOOKS/NPTEL RESOURCES

1. Laboratory manual.

Soil Mechanics Lab	
Course Code: 23CE452	Continuous Evaluation: 60 Marks
Credits: 01	End Semester Examination: 40 Marks
L T P : 0 0 1	
Prerequisite: 23CE452	

COURSE OBJECTIVES (COs)

1. To estimate index properties of soils.
2. To estimate consistency limits of fine-grained soils.
3. To estimate shear strength of soil by direct shear test, triaxial shear test & unconfined compressive test.
4. To estimate the engineering properties of the soils by density tests & permeability test.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will estimate index properties of soil.
2. Students will get hands on training on consistency calculation.
3. Students will estimate shear strength of soil by various test.
4. Students will get hands on training on density test and permeability test.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS

1. Water content determination (Oven drying method).
2. Determination of Specific gravity by Pycnometer and density bottle method.
3. Grain size analysis - sieve analysis.
4. Determination of Liquid and Plastic limit (Casagrande method).
5. Field density determination by Sand replacement method.
6. Field density determination by Core cutter method.
7. Standard Proctor compaction test.
8. Coefficient of permeability of soils.

TEXTBOOKS/ REFERENCE BOOKS/NPTEL RESOURCES

1. Gopal Ranjan, ASR Rao, Basic and Applied Soil Mechanics, New Age International (P) Ltd. Publishers- N.Delhi, Edition No. - 3rd, 2016.
2. P.Purshotam Raj, Geotechnical Engg, Tata Mcgraw Hill, N.Delhi, Edition No. - I, 1995.
3. Lab manual.

Structural Analysis Lab	
Course Code: 23C453	Continuous Evaluation: 60 Marks
Credits: 01	End Semester Examination: 40 Marks
L T P : 0 0 1	
Prerequisite: 23CE453	

COURSE OBJECTIVES (COs)

1. Theorem and moment area theorem.
2. Analysis of truss and curved members.
3. Analysis of three hinge arches.
4. Determine elastic properties of beam and analysis of struts.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will learn reciprocal and moment area theorem.
2. Students will analyze truss and curved member.
3. Students will analyze hinged arches.
4. Students will determine elastic properties of beam and truss.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS

1. Verification of reciprocal theorem of deflection using a simply supported beam.
2. Verification of moment area theorem for slopes and deflections of the beam.
3. Deflections of a truss- horizontal deflections & vertical deflections of various joints of a pin- jointed truss.

4. Elastic displacements (vertical & horizontal) of curved members.
5. Experimental and analytical study of 3 hinged arch and influence line for horizontal thrust.
6. Experimental and analytical study of behavior of struts with various end conditions.
7. To determine elastic properties of a beam.
8. Experiment on a two hinged arch for horizontal thrust & influence line for Horizontal thrust.
9. Experimental and analytical study of a 3-bar pin jointed Truss.
10. Experimental and analytical study of deflections for unsymmetrical bending of a Cantilever beam.
11. Experimental and analytical study of an elastically coupled beam.
12. To study the cable geometry and statics for different loading conditions (Demo).

TEXTBOOKS/ REFERENCE BOOKS/NPTEL RESOURCES

1. Laboratory Manual.

3rd Year

V – Semester

FOUNDATION ENGINEERING	
Course Code: 23CE501	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisite: 23CE402	

COURSE OBJECTIVES (COs)

1. To understand the concept of Sub-Surface Exploration.
2. To understand the Concept of shallow Foundation.
3. To understand the concept of pile Foundation.
4. To get the knowledge of cassion Foundation.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Student will be able to understand basic knowledge of the concept of Sub-Surface Exploration.
2. Students will learn about shallow Foundation and its concepts
3. Students will learn about the pile Foundation and its concepts
4. Students will learn about Cassion Foundation

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS

Unit-1: (SUB-SURFACE EXPLORATION)

Purpose, stages in soil exploration, depth and lateral extent of exploration, guidelines for various types of structures excavation and boring methods, Soil sampling and disturbance, major types of samplers, Sounding methods-SCPT, DCPT, SPT and interpretation. Geophysical methods.

Unit-2: (SHALLOW FOUNDATION)

Design criteria for structural safety of foundation (i) location of footing, (ii) shear failure criterion, (iii) settlement criterion, ultimate bearing capacity, modes of shear failure, Rankine's analysis, Tergazi's theory, Skempton's formula, effect of fluctuation of G.W.T., I.S Code Recommendations, Factors affecting bearing capacity, methods of improving bearing capacity, various causes of settlement of foundation, Plate load test and its interpretation, bearing capacity from penetration tests.

Unit-3: (PILE FOUNDATION)

Introduction, necessity of pile foundations, classification of piles, load capacity, static analysis, analysis of pile capacity in sands and clays, dynamic analysis, pile load tests, negative skin friction, batter piles, under- reamed pile, Group action in piles, pile spacing, pile group capacity, negative skin friction of pile group, uplift resistance of pile group lateral resistance, batter pile group.

Unit-4: (CAISSONS)

Caissons- Types, construction procedure, well foundations-shapes, depth of well foundations Components, factors affecting well foundation, design lateral stability, Construction procedure, sinking of wells, rectification of tilts and shifts, recommended values of tilts & shifts as per I.S.3955.

TEXTBOOKS/REFERENCE BOOKS/NPTEL RESOURCES

1. Punmia, B.C., Soil Mechanics and Foundation Engineering, Laxmi Publications Pvt. Ltd., New Delhi, 1995.
2. Murthy, V.N.S, A text book of Soil Mechanics and Foundation Engineering, UBS Publishers & Distributors Pvt. Ltd., New Delhi 1999
3. Gopa l Ranjan, ASR Rao, Basic and Applied Soil Mechanics, New Age International (P) Ltd. Publishers- Delhi, Edition No. - 3rd, 2016
4. Nainan P Kurian, Design of foundation Systems Principles and Practices, Narosa, 2011.
5. Donald P. Coduto, Man-Chu Ronald Yeung and William A. Kitch, Geotechnical Engineering, Principles and Practices, PHI Learning Private limited, 2011
6. Braja M. Das, Principles of Foundation Engineering, Thomson Asia Pvt. Ltd., Singapore.

DESIGN OF REINFORCED CONCRETE STRUCTURE	
Course Code: 23CE502	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisite: None	

COURSE OBJECTIVES (COs)

1. Know various design philosophies for Structural Design
2. Design a Beam structure
3. Design one way and two-way slabs
4. Know various design considerations for design of column and footing
5. Design the combined footing and pile foundation

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will learn various design philosophies
2. Students will design a beam structure
3. Students will design a slab structure
4. Students will design short column, long column and footing
5. Students will design footing and pile foundation

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

Unit-1: DESIGN PHILOSOPHIES IN REINFORCED CONCRETE

Working stress and limit state methods - Limit state v/s working stress method - Building code - Normal distribution curve - characteristic strength and characteristics loads - design values - Partial safety factors and factored loads stress -strain relationship for concrete and steel.

Unit-2: DESIGN OF FLEXURAL MEMBER: LIMIT STATE METHOD

Basic assumptions - Analysis and design of singly reinforced rectangular sections - doubly reinforced rectangular sections - T-beams - continuous beams.

Unit-3: DESIGN OF SLABS

One way and Two Ways Slabs: General considerations - Design of one-way slabs for distributed and concentrated loads - Two ways slabs for distributed and concentrated loads - non-rectangular slabs - openings in slabs

Unit-4: COLUMNS AND FOOTINGS

Effective length - Minimum eccentricity - short columns under axial compression - Uniaxial and biaxial bending - slender columns - Isolated and wall footing

Unit-5: FOUNDATIONS

Combined footings - raft foundation - design of pile cap and piles - under-reamed piles

TEXTBOOKS/REFERENCE BOOKS/NPTEL RESOURCES

1. Design of Reinforced Concrete Structures,P.Dayaratnam,Oxford & IBH Pub.,N.Delhi
2. Reinforced Concrete-Limit State Design, A.K.Jain, Nem Chand & Bros.,Roorkee.
3. Reinforced Concrete, I.C. Syal & A. K. Goel, A.H,Wheeler & Co. Delhi.
4. Reinforced Concrete Design, S.N. Sinha, TMH Pub., New Delhi
5. SP-16(S&T)-1980, 'Design Aids for Reinforced Concrete to IS: 456, BIS, New Delhi.
6. SP-34(S&T)-1987 'Handbook on Concrete Reinforcement and Detailing', BIS, New Delhi

TRANSPORTATION ENGINEERING	
Course Code: 23CE503	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisite: None	

COURSE OBJECTIVES (COs)

1. To understand the importance of transportation, characteristics of road transport, highway planning, alignment and surveys
2. To know the geometric design of highways
3. To study the traffic characteristics, traffic control devices and principles of signal /intersection design
4. To learn the characteristics, properties and testing procedures of aggregate and bituminous materials
5. To know about granular and bituminous mixes and their designs

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will Understand the concepts and standards adopted in Planning, alignment and surveys
2. Students will Understand the concepts and standards adopted Design and construction of Highways
3. Students will Understand the traffic characteristics, traffic control devices and principles of signal /intersection design
4. Students will know about that the characteristics, properties and testing procedures of aggregate and bituminous materials
5. Students will knowledge about bituminous mixes and their designs

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

COs \ CLOs	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

Unit-1: (INTRODUCTION)

Transportation and its importance. Different modes of transportation. Brief review of history of road development in India and abroad. Road patterns. PMGSY and other Highway projects.
Highway Plans, Highway Alignment and Surveys: Road Development plans in India, Classification of roads, Requirements of an ideal highway alignment, Factors affecting alignment, engineering surveys for highway alignment.

Unit-2: (GEOMETRIC DESIGN OF HIGHWAY)

Cross section elements, Camber, IRC recommended values. Sight distance: stopping sight distance, overtaking sight distance, overtaking zones, intermediate sight distance, sight distance at intersections, Critical locations for sight distance, Design of super elevation. Providing super elevation in the field. Radius of circular curves. Extra -widening. Length of transition curves, Gradient, Summit and Valley curves, their design criteria.

Unit-3: (HIGHWAY MATERIALS)

Soil and Aggregate, Subgrade soil evaluation- CBR test, plate bearing test, Desirable properties of aggregates, and various tests for suitability of aggregates. Types of bituminous materials: bitumen, tar, cutback and emulsions. Various tests for suitability of bitumen, Bituminous mix, desirable properties, Marshall's method of mix design.

Unit-4: (DESIGN OF FLEXIBLE AND RIGID PAVEMENT)

Components of flexible pavement and their functions, Factors affecting design of pavements, Difference between Flexible and rigid pavements, Design of a flexible pavement by CBR method (as per latest IRC guidelines), Westergaard's theory, critical locations of loading, load and temperature stresses, Critical combination of stresses, IRC guidelines for determination of thickness of a rigid pavement. Joints: requirements, types, patterns. Spacing of expansion and contraction joints. Functions of dowel and tie bars.

Unit-5: (ELEMENTARY TRAFFIC ENGINEERING)

Traffic volume, speed, O & D study, Parking and Accident studies. Fundamental diagram of traffic flow, Level of service, PCU, Capacity for non- urban roads, Road accidents, Traffic signs, signals, markings and islands. Design of an isolated fixed time signal by IRC method.

TEXTBOOKS/REFERENCE BOOKS/NPTEL RESOURCES

1. Khanna, S.K. and Justo, C.E.G., Veeraragavan A., "Highway Engineering", Nem Chand & Bros.
2. Khanna, S.K. and Justo, C.E.G., "Highway Material Testing Manual", Nem Chand & Bros.
3. Kadiyali, L.R., "Traffic Engineering and Transportation Planning", Khanna Publishers.
4. Jotin Khisty, C. and Kent Lall, B., "Transportation Engineering – An Introduction", Prentice Hall.
5. G.V. Rao, Principles of Transportation and Highway Engg, Tata McGraw Hill Pub
6. Principles of Transportation Engg, P. Chakroborty & Animesh Dass, Prentice Hall of India, 2003.

FOUNDATION ENGINEERING LAB	
Course Code: 23CE551	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: None	

COURSE OBJECTIVES (COs)

1. To estimate index properties of soils
2. To estimate consolidation parameters of clayey soil.
3. To estimate shear strength parameters of soil by triaxial shear test.
4. To estimate the relative density and maximum dry density of soils.
5. To have a feel of plate load test.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Student will Know about the estimate index properties of soils
2. Student will know about the estimate consolidation parameters of clayey soil.
3. Student will know about the estimate shear strength parameters of soil by triaxial shear test.
4. Student will know about the estimate the relative density and maximum dry density of soils.
5. Student will get knowledge about plate load test

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

1. Grain Size Analysis-Hydrometer method.
2. Determination of Shrinkage limit of soil.
3. Modified Proctor compaction Test.
4. Relative Density of Granular Soils.
5. Undisturbed Sampling.
6. Unconfined compressive strength test.
7. Direct shear test on granular soil sample. (Demo)
8. Unconsolidated undrained (UU) triaxial shear test of fine-grained soil sample. (Demo)

TEXTBOOKS/ REFERENCE BOOKS/NPTEL RESOURCES

1. Gopal Ranjan, ASR Rao, Basic and Applied Soil Mechanics, New Age International (P) Ltd.Publishers- Delhi, Edition No. - 3rd, 2016
2. P. Purshotam Raj, Geotechnical Engg, Tata McGraw Hill, Delhi, Edition No.- I, 1995.

TRANSPORTATION ENGINEERING LAB	
Course Code: 23CE552	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: None	

COURSE OBJECTIVES (COs)

1. Understand the characterization of highway materials
2. To know the procedure for testing of aggregate and bituminous materials
3. To know the standard specifications of IS/IRC/MoRTH for judging suitability of these materials

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Student will get knowledge about the characterization of highway materials
2. Student will familiar with testing of aggregate and bituminous materials
3. Student will familiar with standard specifications

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

COs \ CLOs	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

1. Aggregate Impact Test
2. Los-Angeles Abrasion Test on Aggregate
3. Crushing Strength Test on Aggregate
4. Flakiness and Elongation Index of aggregates
5. Penetration Test on Bitumen
6. Ductility Test on Bitumen
7. Viscosity Test on Bituminous Material
8. Softening Point Test on Bitumen
9. Flash and Fire Point Test on Bitumen

TEXTBOOKS/ REFERENCE BOOKS/NPTEL RESOURCES

1. Laboratory Manual.

LIVE PROJECTS – II (SURVEY CAMP) & INDUSTRIAL VISITS	
Course Code: 23CE553	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 1	
Prerequisite: 21CE453	

INDUSTRIAL INTERNSHIP OBJECTIVES (IIOs):

1. To understand the concept of RL
2. To understand the concept of Contour

INDUSTRIAL INTERNSHIP LEARNING OUTCOMES (IILOs):

1. Students will be able to establish RL.
2. Students will be able to fix stations for Surveying.
3. Students will be able to draw contours on the drawing sheet

MAPPING MATRIX OF THE IIOs AND IILOs:

INDUSTRIAL INTERNSHIP OBJECTIVES	INDUSTRIAL INTERNSHIP LEARNING OUTCOMES		
	IILO 1	IILO 2	IILO 3
IIO 1	✓	✓	
IIO 2			✓

VI - Semester

CONSTRUCTION TECHNIQUES AND EQUIPMENTS	
Course Code: 23CE601	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs)

1. To learn the principles of construction of building components
2. To know about prefabricated construction and building services
3. To study the different repair and rehabilitation technique
4. To understand the planning and operation of various construction equipment

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Supervise and execute all the construction jobs with the knowledge of the different construction techniques
2. Identify the building defects and apply suitable repair techniques to rectify them
3. Evaluate the costs of equipment and make proper selection of the suitable construction equipment
4. Ensure the proper completion of a construction task using particular construction equipment

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS

Unit-1: (PRINCIPLES OF CONSTRUCTION)

Bonding, Reinforced brick work, Stone masonry, Hollow block masonry Composite masonry, Cavity walls, Flooring, Formwork, Centring and Shuttering sheet piles, Slip and moving forms, Roofs and roof covering, Joints in Concrete, Plastering and Pointing, Shoring and Scaffolding, under pinning, Submerge Structures.

Unit-2: (PREFABRICATED STRUCTURES AND BUILDING SERVICES)

Prefabricated panels & structures, Production, Transportation and Erection of structures, Sound insulations, Ventilations, Fire resisting construction, Damp proofing, Termite proofing.

Unit-3: (CONSTRUCTION DAMAGES & REPAIR TECHNIQUES)

Causes of damage and deterioration in masonry and concrete structures, Symptoms & Diagnosis, Types of repair and rehabilitation techniques

Unit-4: (CONSTRUCTION EQUIPMENT & MACHINERY)

Factors affecting the selection of equipment, economic life of equipment, cost of equipment, maintenance of equipment, Earthwork equipment, Hoisting and lifting equipment, Material handling equipment, Concrete equipment, dewatering equipment.

TEXTBOOKS

1. Arora, S.P. and Bindra, S.P. A Text Book of Building Construction, Dhanpat Rai Publications, New Delhi, 2005
2. Varghese, P.C., Building Constructions, Prentice Hall, 2007
3. Sharma & Kaul, Building Construction, S. Chand & Company Pvt, New Delhi, 1998
4. Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 2013

REFERENCE BOOKS/NPTEL RESOURCES

1. Peurifoy, R.L., Schexnayder, J.C., and Shapira, A, Construction Planning, Equipment and Methods, Tata McGraw Hill, New Delhi, 2010.

ADVANCED SURVEYING	
Course Code: 23CE602	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: 23CE302	

COURSE OBJECTIVES (COs)

1. To understand the principle of surveying on very large scale by locating precise horizontal controls
2. To learn about different types of errors in measurements and their adjustment
3. To learn about determining absolute positions of a point using celestial measurements
4. To learn about surveying applications in setting out works and photogrammetry
5. To introduce the basic concept of Remote sensing, and GIS

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will learn principle of surveying on very large scale
2. Students will learn different types of errors and adjustment in measurement
3. Students will determine absolute positions of a point
4. Students will learn setting out works and photogrammetry
5. Students will learn concepts of remote sensing and GIS

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

COs \ CLOs	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

Unit-1: TRIANGULATION SURVEYING

Triangulation and Trilateration: Triangulation systems – classification - strength of figure - selection of triangulation stations - grade of triangulation - field work of triangulation - triangulation computations- Trilateration – Principle – Methods - advantages and disadvantages - introduction to total station - Survey layout/setting out: Introduction - controls for layout - examples of laying out

Unit-2: SURVEY ADJUSTMENTS

Survey Adjustment and computations: Definitions - types of error - weight of an observation - law of weights - most probable values - principle of least squares - method of correlates - normal equation - adjustment of triangulation - figures by method of least squares - Astronomy: Definitions of astronomical terms – celestial coordinate systems - Napier's rule of circular parts - star at elongation - star at prime vertical - star at horizon - star at culmination - Astronomical triangle - Time: definitions of sidereal – apparent - solar and mean solar time - equation of time.

Unit-3: PHOTOGRAMETTRIC SURVEYING

Elements of Photogrammetry: Introduction - types of photographs - Terrestrial and aerial photographs – aerial – camera - scale and height displacements of vertical Photographs - Stereoscopic vision and stereoscopes - height determination from parallax measurement - flight planning - principle of photo interpretation

Unit-4: REMOTE SENSING

Introduction to remote sensing: Definition of Remote Sensing – types of remote sensing - remote sensing system and components - EMR source and characteristics - active and passive remote sensing - EMR propagation through medium - Role of atmosphere - Atmospheric windows – EMR interaction with objects – Spectral signature - EMR interaction with vegetation - soil and water - Satellite orbits and platforms: Geostationary and sun synchronous – satellites Resolution, Applications of remote sensing in civil engineering

Unit-5: GIS

Geographical Information System (GIS): Definition - Objectives - Components of GIS - Spatial data models: Raster and Vector - Data inputting in GIS - Linkage between spatial and non-spatial data - Spatial data analysis: Vector and raster based spatial data analysis - Integration of RS and GIS data - Digital Elevation Model –
GIS Software Packages

TEXTBOOKS/REFERENCE BOOKS/NPTEL RESOURCES

1. Chang.T.K. 2002: Geographic Information Systems, Tata Mc Graw Hill
2. Punmia, B.C. 2005: Surveying I and II, Laxmi Publications
3. Charles D. Ghilani: Adjustment Computations: Spatial Data Analysis (Fifth Edition)
4. Paul R Wolf: Elements of Photogrammetry
5. G S Srivastava: An introduction to Geoinformatics
6. Basudeb Bhatta: Remote Sensing and GIS
7. G. L. Hosmer: Text-book on Practical Astronomy
8. Various Online resources including NPTEL

MATERIAL TESTING LAB	
Course Code: 23CE651	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	
Prerequisite: None	

COURSE OBJECTIVES (COs)

1. To learn the properties of cement, concrete and its testing procedure.
2. To learn about the design mix as per BIS and ACI.
3. To learn about properties of fresh concrete.
4. To learn about testing of concrete cube and cylinder.
5. To learn about testing of concrete beam. To learn about NDT of concrete.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will understand the properties of cement, concrete and its testing procedure.
2. Students will understand and carry out design mix as per BIS and ACI.
3. Students will study and understand properties of fresh concrete.
4. Students will carry out testing on concrete cube and cylinder.
5. Students will carry out testing on concrete beam & understand and perform NDT of concrete.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

DESCRIPTION OF EXPERIMENTS

1. Specific Gravity of cement.
2. Standard Consistency of cement
3. Initial and Final Setting Time of cement
4. Design Mix as per IS 10262:2009.
5. Prepare the mix designed and cast cubes for 28 days compressive strength testing.
6. Design Mix as per ACI code
7. Prepare the mix designed and cast cubes for 28 days compressive strength testing.
8. Workability of cement concrete by (a) Slump test, (b) Compaction factor test, (c) Flow table test
9. Compressive strength of concrete by (a) Cube test, (b) Cylinder test
10. Indirect tensile strength of concrete-split cylinder test.
11. Modules of rupture of concrete by flexure test
12. Bond strength between steel bar and concrete by pull-out test
13. Non-destructive testing of concrete

TEXTBOOKS

1. M L Gambhir, " Concrete Lab Manual", Dhanpat Rai & Sons

LIVE PROJECTS – III (RCC STRUCTURES) & INDUSTRIAL VISITS	
Course Code: 23CE652	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 1	
Prerequisite: 23CE403, 23CE502	

INDUSTRIAL INTERNSHIP OBJECTIVES (IIOs):

1. To understand the Importance of RCC structure
2. To understand the problem faced at the RCC Structure site

INDUSTRIAL INTERNSHIP LEARNING OUTCOMES (IILOs):

1. Students will learn about the basics of RCC Structures.
2. Students will learn about the method of erecting a RCC structure.
3. Students will learn about the precautions to be taken at the site of a RCC structures.

MAPPING MATRIX OF THE IIOs AND IILOs:

INDUSTRIAL INTERNSHIP OBJECTIVES	INDUSTRIAL INTERNSHIP LEARNING OUTCOMES		
	IILO 1	IILO 2	IILO 3
IIO 1	✓	✓	
IIO 2		✓	✓

4th Year

VII – Semester

Estimating, Costing and Evaluation	
Course Code: 23CE701	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisite: None	

COURSE OBJECTIVES (COs)

1. To learn the roles and responsibilities of a project manager.
2. To learn about schedule of activities in a construction project.
3. To learn about tender and contract document for a construction project.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will understand the roles and responsibilities of a project manager.
2. Students will prepare schedule of activities in a construction project.
3. Students will prepare tender and contract document for a construction project

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3
CO1	✓		
CO2		✓	
CO3			✓

COURSE CONTENTS

Unit-1: Network Techniques in Construction Management

CPM: Introduction, network techniques, work break down, classification of activities, rules for developing networks, network development-logic of network, allocation of time to various activities, Fulkerson's rule for numbering events, network analysis , determination of project schedules, critical path, ladder construction, float in activities, shared float, updating, resources allocation, resources smoothing and resources levelling.

PERT: Probability concept in network, optimistic time, pessimistic time, most likely time, lapsed time, deviation, variance, standard deviation, slack critical path, probability of achieving completion time, central limit theorem.

COST-TIME ANALYSIS: Cost versus time, direct cost, indirect cost, total project cost and optimum duration, contracting the network for cost optimisation, steps in time cost optimisation, illustrative examples.

Unit-2: Construction Contracts & Specifications

Introduction, types of contracts, contract document, specifications, important conditions of contract, arbitration.

Necessity of specifications, types of specifications, general specifications, specification for bricks, cement, sand, water, lime, reinforcement; Detailed specifications for Earthwork, Cement, concrete, brick work, floorings, D.P.C., R.C.C., cement plastering, white and colour washing, distempering, painting.

Unit-3: Inspection & Quality Control

Introduction, principles of inspection, enforcement of specifications, stages in inspection and quality control, testing of structures, statistical analysis.

a. Estimate

Principles of estimation, units, items of work, different kinds of estimates, different methods of estimation, estimation of materials in single room building, two roomed building with different sections of walls, foundation, floors and roofs, R.B. and R.VC.C. works, Plastering, White-washing, Distempering and painting, doors and windows, lump sum items, Estimates of canals, roads etc.

b. Rate Analysis

Purpose, importance and requirements of rate analysis, units of measurement, preparation of rate analysis, procedure of rate analysis for items:- Earthwork, concrete works, R.C.C. works, reinforced brick work, plastering, painting, finishing(white-washing, distempering.

TEXTBOOKS/ REFERENCE BOOKS/NPTEL RESOURCES

1. Statically Indeterminate Structures, C.K. Wang, Mc Graw Hill Book Co., New York.
2. Advanced Structural Analysis, A.K. Jain, Nem Chand & Bros., Roorkee.
3. Indeterminate Structures, R.L. Jindal, S. Chand & Co., New Delhi.
4. Theory of Structures, Vol. I, S.P. Gupta & G.S.Pandit, Tata Mc Graw Hill, New Delhi.

Prestressed Concrete Structures	
Course Code: 23CE702	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs)

1. To understand the basic concept of prestressing, stress concepts and material used in prestressing.
2. To Understand the Different losses in prestress, deflection in structures.
3. To Understand the design of Prestressed Concrete for flexure, shear and torsion.
4. To Understand the Concept of transfers of prestress & end zone reinforcement.
5. To understand the Design of Prestressed Concrete Sections.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students know the basic concept of prestressing, stress concepts and material used in prestressing.
2. Students will have adequate knowledge on Different losses in prestress,deflection in structures.
3. Students know the design of Prestressed Concrete for flexure, shear and torsion.
4. Students know the Concept of transfers of prestress & end zone reinforcement.
5. Students know the Design of Prestressed Concrete Sections.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

COs \ CLOs	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS

Unit-1: Introduction – Theory and Behaviour

Basic concepts – Advantages and disadvantages – Materials required – Systems and methods of prestressing – Basic assumptions - Analysis of sections – Stress concept - -Resistant stresses at a section - pressure line, and concept of land balancing, stresses in grading moment.

Unit-2: Losses and Deflection

Losses of Prestress: Nature of losses, different types of losses and their assessment.

Deflections: Introduction, Factors influencing deflections – Short term deflections of uncracked members – Prediction of long term deflections due to creep and shrinkage – Check for serviceability limit states.

Unit-3: Design for Flexure, Shear & Torsion

Basic assumptions of flexural design – Permissible stresses in steel and concrete as per I.S.1343 Code – Different Types of sections – Check for flexural capacity based on I.S. 1343 Code shear and principal stresses, ultimate shear resistance of pressed concrete members, prestressed concrete members in torsion-Analysis for shear & torsion.

Unit-4: Transfers of Prestress & End Zone Reinforcement

Transmission Length, bond structures, Transverse tensile stress End-zone reinforcement, stress distribution in end block.

Unit-5: Design of Prestressed Concrete Sections

Design of section for Flexure- Design of Beam – Slab Design - Design of sections for axial Tension.

TEXTBOOKS/ REFERENCE BOOKS/NPTEL RESOURCES

1. Krishna Raju. N., Pre-stressed Concrete - Problems and Solutions, CBS Publishers and Distributors, Pvt. Ltd., New Delhi, 2014.
2. Praveen Nagarajan, Advanced Concrete Design, Person, 2013
3. P. Dayaratnam, Prestressed Concrete Structures, Oxford & IBH.
4. Design of Prestressed Concrete Structures, T.Y. Lin, John Wiley & Sons., Delhi.
5. IS: 1343: Indian Standard code of practice for Prestressed concrete, BIS, New Delhi.
6. IS: 3370-Indian Standard code of practice for concrete structures for storage of liquids, BIS, New Delhi.

Minor Project	
Course Code: 23CE751	Continuous Evaluation: 60 Marks
Credits: 4	End Semester Examination: 40 Marks
L T P : 0 0 8(4)	
Prerequisite: None	

COURSE OBJECTIVES (COs)

1. To carry out a small-scale research work related to civil engineering subjects.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Have concluded a small-scale research work related to field of their interest.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1
CO1	✓

Live Project – IV (Highways) & Industrial Training	
Course Code: 24CE752	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 1	
Prerequisite: None	

COURSE OBJECTIVES (COs)

1. To understand the Importance of Highway project.
2. To understand the problem faced at the Highway Project site.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will have basic knowledge of Highway Construction.
2. Students will learn about the various construction practices followed at Highway Construction.
3. Students will have in-depth knowledge of the precautions to be taken at the site of Highway.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3
CO1	✓	✓	
CO2		✓	✓

VIII - Semester

Major Project (Industrial Internship)	
Course Code: 23CE851	Continuous Evaluation: 60 Marks
Credits: 12	End Semester Examination: 40 Marks
L T P : 0 0 24 (6)	
Prerequisite: 23CE751, 23CE752, 23CE652, 23CE553, 23CE454	

COURSE OBJECTIVES (COs)

1. Student should be competent in execution of civil engineering project.
2. Student should be conduct meaningful research.

COURSE LEARNING OUTCOMES (CLOs)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

1. Students will learn about the various requirements at the site.
2. Students will learn about the safety requirements at the site.
3. Students will understand about management of both material and human resource.
4. Students will be competent in execution of a civil engineering site.
5. Students will learn about the concepts of research.
6. Students will have a more research-oriented mindset.
7. Students will be competent to carry out research in field of civil engineering.

MAPPING BETWEEN COURSE OBJECTIVES (COs) AND COURSE LEARNING OUTCOMES (CLOs)

CLOs / COs	CLO1	CLO2	CLO3	CLO4	CLO5	CLO6	CLO7
CO1	✓	✓	✓	✓			
CO2					✓	✓	✓

Department Elective Courses in Degree of Civil Engineering

Structural Dynamics	
Course Code: 23CEP01	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1 To understand the meaning of earthquake and seismology
2 To understand the various degree of freedom system
3 To study the design aspect related to earthquake
4 To understand about the seismic performance and repair of structures
5 To study about various codes related to earthquake

COURSE LEARNING OUTCOMES (CLOs):

At the end of the course students are able to:

1. Explain the meaning of earthquake and seismology
2. Understand the various degree of freedom system
3. Understand the design aspect related to earthquake
4. Understand about the seismic performance and repair of structures
5. Understand about various codes related to earthquake

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS:

UNIT -1: SEISMOLOGY

Introduction, plate tectonics, earthquake distribution and Mechanism, seismicity, seismic waves, earthquake magnitude and intensity seismic zoning and seismometry.

UNIT -2: SINGLE DEGREE OF FREEDOM SYSTEMS

Various types of dynamic loads, vibration of single degree of freedom system, Free and forced vibrations, Types of damping, critical damping, Transmissibility, vibration measuring instruments, response spectrum

UNIT -3: MULTI-DEGREES OF FREEDOM (MDOF) SYSTEMS

Equation of Motion, normal modes and natural frequencies, semi-definite systems, dynamic vibration absorbers, vibration dampers, principle of orthogonally, Stodolas method, Holzer's method, matrix method, modal analysis and its limitations, Mode super position method.

UNIT -4: SEISMIC ANALYSIS AND DESIGN

General principles, assumptions, seismic coefficient method, response spectrum method, strength and deflection, design criterion for structures, significance of ductility, design and detailing for ductility codal provisions, design examples.

UNIT - 5 SEISMIC PERFORMANCE, REPAIR AND STRENGTHENING

Methods for assessing seismic performance, Influence of design ductility and masonry infills Criterion for repair and strengthening, repair and strengthening techniques and their applications Additions of new structural elements.

UNIT - 6 VIBRATIONAL CONTROL

General features of structural control, base isolation, Active and passive control system, Earthquake Resistance design as per I.S.:1893, I.S.4326 and I.S.13920

BOOKS

S.No.	TEXT BOOKS
1	Statically Indeterminate Structures, C.K. Wang, Mc Graw Hill Book Co., New York.
2	Advanced Structural Analysis, A.K. Jain, Nem Chand & Bros., Roorkee.
3	Indeterminate Structures, R.L. Jindal, S. Chand & Co., New Delhi.
	REFERENCE BOOKS AND OTHER MATERIALS
4	Theory of Structures, Vol. I, S.P. Gupta & G.S.Pandit, Tata Mc Graw Hill, New Delhi

Introduction to Finite Element Method	
Course Code: 23CEP02	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1 To develop shape functions and stiffness matrices for spring and bar elements

2 To develop global stiffness matrices and global load vectors

3 To apply natural and arial coordinate systems to constant strain triangle and linear strain triangle elements

4 To analyze planar structural systems using finite element modelling

COURSE LEARNING OUTCOMES (CLOs):

At the end of the course, student will be able to:

1 Develop shape functions and stiffness matrices for spring and bar elements

2 Develop global stiffness matrices and global load vectors

3 Apply natural and arial coordinate systems to constant strain triangle and linear strain triangle elements

4 Analyze planar structural systems using finite element modelling

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS:

UNIT -1: INTRODUCTION

Field conditions, boundary conditions, functional approximation, finite differences method, Development of finite element method

UNIT -2: ELEMENT PROPERTIES

Displacement models, relation between the nodal degrees of freedom and generalized coordinates, Convergence requirements, natural co-ordinate systems, shape functions, element strains and stresses Development of element stiffness, matrix and equivalent nodal loads, static condensation.

UNIT -3: ELEMENTS AND ANALYSIS

Truss element, analysis of plane truss problem, Hermitian beam Element, Solution of beam problem, Triangular elements, rectangular elements, isoparametric elements, patch Test, axisymmetric solid element, Displacement functions, plate ending elements, reduced integration, Stress smoothing technique

BOOKS

S.No.	TEXT BOOKS
1	Krishnamurthy, C.S., 'Finite Element Analysis-Theory and Programming', TMH Pub. N. Delhi.
2	Cook, R.D., Malkus, D.S. and Plesha, M.E., 'Concept and Applications of Finite Element Analysis', John Wiley & Sons, New York.
3	Manicka Selvam,V.K., 'Finite Element Primer', Dhanpat Rai Publications
	REFERENCE BOOKS AND OTHER MATERIALS
4	Desai, C.S. and Abel, J.F., 'Introduction to the Finite Element Method', Affiliated East-West Press Pvt. Ltd. N. Delhi

AIR AND NOISE POLLUTION AND CONTROL	
Course Code: 23CEP03	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1 To understanding environment, impact of various activities on environment, sustainable development, ecology and biodiversity conservation

2 To understand air pollution, its effects and control methods

3 To understand noise pollution, its effects and control measures

4 To understand the sources, types and composition of municipal solid waste and the methods of solid waste disposal.

COURSE LEARNING OUTCOMES (CLOs):

At the end of the course, student will be able to:

1 Explain environment, impact of various activities on environment, sustainable development, ecology and biodiversity conservation

2 Explain air pollution, its effects and control methods

3 Explain noise pollution, its effects and control measures

4 understand the sources, types and composition of municipal solid waste and the methods of solid waste disposal

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS:

UNIT -1: AIR POLLUTION

Composition and structure of atmosphere, classification and sources of air pollutants, Effects of air pollution on plants, animals, human health, economic effects of air pollution, Greenhouse effect and global warming, ozone layer depletion and acid rains, Meteorological behavior, parameters influencing air pollution, plume.

UNIT -2: AIR QUALITY AND INDEX

Air quality standards, air quality index, automobile pollution - effects and control measures Atmospheric self – cleansing processes, approaches and techniques of air pollution control, Air pollution control devices: Gravitational settling chamber, cyclones, wet scrubbers, fabric filters, ESP and catalytic converters.

UNIT -3: NOISE POLLUTION

General introduction to noise pollution, human acoustics unit of measurement, loudness, measurements of noise and weighting networks, Sources and effects of noise pollution, noise abatement/control, noise standards.

BOOKS

S.No.	TEXT BOOKS
1	Environmental Engineering by H. S. Peavy, D. R. Rowe and G. Tchobanoglous
2	Ecology by E. P. Odum
3	Air Pollution by M. N. Rao
4	Environmental Noise Pollution by P. F. Cunif
	REFERENCE BOOKS AND OTHER MATERIALS
5	Solid Waste Management Collection, Processing and Disposal by A. D. Bhide and B. B. Sunderan

HYDROLOGY	
Course Code: 23CEP04	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1. To learn scope and application of hydrology to engineering problems
2. To learn types and measurement of precipitation
3. To learn about measurement of evaporation and transpiration.
4. To learn about measurement of runoff
5. To understand about hydrograph

COURSE LEARNING OUTCOMES (CLOs):

1. Students will learn scope and application of hydrology to engineering problems
2. Students will learn types and measurement of precipitation
3. Students will learn about measurement of evaporation and transpiration.
4. Students will learn about measurement of runoff
5. Students will understand about hydrograph.

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS:

UNIT -1: INTRODUCTION

Hydrologic cycle, scope and application of hydrology to engineering problems, Drainage basins and its characteristics, stream geometry, hypsometric curves.

UNIT -2: PRECIPITATION

Forms and types of precipitation, Measurement of precipitation, recording and non-recording rain gages, Rain gage station, rain gage, network, estimation of missing data, Presentation of rain fall data, mean precipitation, Depth-area-duration relationship, frequency of point rainfall, Intensity - duration- frequency curves, probable max. precipitation.

UNIT -3: EVAPORATION & TRANSPIRATION

Process, evaporimeters and empirical relationships, analytical method, reservoir evaporation and methods of its control, transpiration, evapotranspiration and its measurement, Penman's equation and potential evapotranspiration.

UNIT -4: INFILTRATION & RUNOFF

Infiltration process, initial loss, infiltration capacity and measurement of infiltration, infiltration indices. Factor affecting run-off, estimation of runoff, rainfall-run off relationships, measurement of stage-staff gauge, wire gauge, automatic stage recorder and stage hydrograph, measurement of velocity-current meters, floats, area velocity method, moving boat and slope area method, electromagnetic, ultra-sonic and dilution methods of stream flow measurement, stage discharge relationship.

UNIT -5 (HYDROGRAPH)

Discharge hydrograph, components and factors affecting shape of hydrograph, effective rainfall, unit hydrograph and its derivation, unit hydrograph of different durations, use and limitations of UH, triangular UH, Snyder's synthetic UH, floods, rational methods, empirical formulae, UH method, flood frequency methods, Gumbel's method, graphical method, design flood.

BOOKS

S.No.	TEXT BOOKS
1	Engineering Hydrology by Subramanya
2	Hydrology by H.M. Raghunath
3	Water Resources Engineering by Linseley and Franzini
4	Groundwater Hydrology by David. K. Todd
	REFERENCE BOOKS AND OTHER MATERIALS
5	Water Resources Systems Planning & Economics by R.S. Varshney.
6	Operational Research-An Introduction by HamdyA.Taha

ADVANCED CONCRETE TECHNOLOGY	
Course Code: 23CEP05	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1 To learn test of all the concrete materials as per IS code.

2 To design the concrete mix using ACI and IS code methods.

3 To determine the properties of fresh and hardened of concrete.

4 To design special concretes and their specific applications.

5 To ensure quality control while testing/ sampling and acceptance criteria.

COURSE LEARNING OUTCOMES (CLOs):

At the end of the course, student will be able to:

1 Test of all the concrete materials as per IS code.

2 Design the concrete mix using ACI and IS code methods.

3 Determine of the properties of fresh and hardened of concrete.

4 Design special concretes and their specific applications.

5 Ensure quality control while testing/ sampling and acceptance criteria.

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS:

UNIT -1: Concrete: Introduction

Concrete materials, Cement: Physical tests on cement, Tests on aggregates, Quality of Water for mixing and curing, Use of sea water for mixing concrete. Rheology of concrete, Introduction Rheological behaviour, Factors affecting rheological properties Mixture adjustments.

UNIT -2: Mix Design

Factors influencing mix proportion, Mix design by ACI method and I.S. code method, Design of normal concrete, high strength concrete and self- compacting concrete. Admixtures - accelerating

admixtures, Retarding admixtures, water reducing admixtures, Air entraining admixtures, coloring agent, Plasticizers. Batching, Mixing, Transportation, placing of concrete, Curing of Concrete.

UNIT -3 (Strength of Concrete)

Shrinkage and temperature effects, creep of concrete, permeability of concrete, Durability of concrete, Corrosion, Causes and effects, remedial Measures, Thermal properties of concrete, Microcracking of concrete, microstructure of concrete. Classification of causes of concrete deterioration, Permeability of concrete, Chloride penetration. Acid attack, Sulfate attack, Alkali-aggregate reaction, Concrete in sea water AC impedance test, Corrosion of embedded steel in concrete, Case Histories

UNIT -4 (Special Concrete)

High Performance Concrete (HPC) Introduction – Principles of HPC, Ingredients used for HPC, Production of HPC, Curing of HPC, Mechanism of HPC, Properties of HPC during the fresh and hardened state. Durability of HPC – Acid Attack, Permeability, Scaling resistance, Chloride penetration, Resistance to sea water, sulfate attack, Alkali- aggregate reaction, Fire resistance, Mix design methods of HPC. Special High-Performance Concrete- Air-entrained HPC Reactive powder Concrete, Bio concrete, Geo polymer, Fiber reinforced concrete, Quality control - Sampling and testing-Acceptance criteria.

BOOKS

S.No.	TEXT BOOKS
1	Santakumar A.R., Concrete Technology, Oxford University Press, New Delhi, 2007.
2	Shetty, M.S., Concrete Technology, Theory & Practice, S. Chand and Co, 2004.
3	Gambhir, M.L., Concrete Technology, Tata McGraw Hill, 2004.
4	Neville, Properties of Concrete, Longman Publishers, 2004.
	REFERENCE BOOKS AND OTHER MATERIALS
5	P. C. Aïtcin, High Performance Concrete, E &FN SPON, 1998
6	E. G. Nawy, Fundamentals of High-Performance Concrete, John Wiley & Sons., 2nd edition, 2000
7	High Performance Concrete Structural Designers Gu ide published by FHWA, USA, 2005.

OPEN CHANNEL HYDRAULICS	
Course Code: 23CEP06	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1. To understand the flow and its types.
2. To understand the various channels and effect of depth
3. To understand the flow in various kind of channels
4. To study about various elements of hydraulic structures

COURSE LEARNING OUTCOMES (CLOs):

At the end of the course, student will be able to:

1. Explain the flow and its types.
2. Understand the various channels and effect of depth
3. Understand the flow in various kind of channels
4. Understand about various elements of hydraulic structures

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS:

UNIT -1 (BASIC FLUID FLOW CONCEPTS)

Definition, importance of study of open channel flow, Types of channels, Classification of Flows, Velocity distribution, One-Dimensional method of flow analysis, Pressure Distribution, Equation of Continuity, Energy Equation, Momentum equation.

UNIT -2 (ENERGY-DEPTH RELATIONSHIPS)

Specific Energy, specific fore, Critical Flow, critical depth, Calculation of Critical Depth for some shapes of channels.

UNIT -3 (UNIFORM FLOW IN RIGID BOUNDARY CHANNELS)

Introduction, shear stress on boundary, shear stress in open Channels, velocity distribution and effect of secondary circulation on velocity distribution, flow over roughness elements, Chezy

Equation, Darcy-Weisbach Friction Factor, Manning's roughness Formula, Resistance Formulate for Practical Use, Normal Depth and its computation for some shapes of channels.

UNIT -4 (UNIFORM FLOW IN MOBILE BOUNDARY CHANNELS)

Incipient motion, Shield's diagram, regimes of flow, bed forms, sediment load and its measurement, Regime channels, design of stable channels.

UNIT - 5 (HYDRAULIC JUMP)

Occurrence and importance, Momentum Equation for hydraulic Jump, Computation of sequent depth, Classification of Jumps, Characteristics of Jump in a Rectangular Channel, location of jump, Hydraulic jump application, Use of the Jump as an Energy Dissipater.

UNIT - 6 (RAPIDLY-VARIED FLOW)

Weirs, Sharp-crested Weir, Broad-crested Weir, submergence of weirs, Critical-Depth Flumes, Sluice-gate Flow, free and submerged flow and its analysis of sluice gate, free overfall.

BOOKS

S.No.	TEXT BOOKS
1	Ranga Raju, K.G. "Flow Through Open Channel". Tata Mc Graw-Hill
2	Choudhary, Hanif "Open Channel Hydraulics" Prentice Hall of India
3	Subramanya K. "Flow in Open Channels". Tata Mc Graw-Hill
4	Srivastava, R. "Flow Through Open Channels". Oxford University Press.
	REFERENCE BOOKS AND OTHER MATERIALS
5	Chow Ven Te, "Open Channel Hydraulics". McGaw Hill International Edition.

RAILWAY AND AIRPORT ENGINEERING	
Course Code: 23CEP07	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1. To understand the permanent way and its components.
2. To know about points, crossings and train control systems.
3. To understand the geometric design of track, about stations, yards and maintenance of tracks.
4. To learn airport layout planning and runway pavement design.

COURSE LEARNING OUTCOMES (CLOs):

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

1. Gain Engineering knowledge of the subject and apply it for the solution of problems related to railway and airport engineering.
2. Design points and crossings, design runway pavements, make investigations, use modern tools and develop solutions to problems related to railway / airport engineering.
3. Understand the engineering solutions in societal context for sustainable development that takes care of environment and optimal use of resources.
4. Understand the norms of engineering practice and the need for life-long learning as per their exposure to relevant latest IS/RDSO/FAA/ICAO specifications.

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS:

UNIT-I: INTRODUCTION OF PERMANENT WAY

History and general features of Indian railways, Railway Track Gauge, Rails, Sleepers, Track fittings and fastenings, Creep of rails, Ballast, Subgrade and formation, Rail joints and welding of rails, Modern welded railway track, Track and Track stresses.

UNIT-II: STATIONS AND YARDS, POINTS AND CROSSINGS, AND SIGNALLING

Stations and yards, Points and crossings, design of turnouts and crossings, Signalling and interlocking, Train Control systems, Track maintenance and drainage.

UNIT-III: GEOMETRIC DESIGN OF TRACK, HIGH SPEED TRAIN SYSTEMS

Geometric design of track, curves and super elevation, Train resistance and tractive power, Urban Railway system, High speed Tracks, high speed train system technologies, Introduction to RDSO/IS Specifications.

UNIT-IV: AIRPORT PLANNING, RUNWAY LAYOUT AND PAVEMENT DESIGN

Airport planning, layout, geometric design, Airport pavements, introduction to runway pavement design software like FAARFIELD.

BOOKS

S.No	**TEXT BOOKS**
1	Chandra, S. and Agarwal, M. M., "Railway Engineering", Oxford.
2	Arora, S. P. and Saxena, S. C., "A Text Book of Railway Engineering", Dhanpat Rai Publications.
3	Mundrey, J. S., "Railway Track Engineering", Tata Mcgraw Hill.
4	Khanna, S. K., Arora, M. G. and Jain, S. S., "Airport Planning & Design", Nem Chand and Bros.
	REFERENCE BOOKS AND OTHER MATERIALS
5	Horonjeff, Robert and McKelvey, Francis X., "Planning & Design of airports', 4th Ed., McGraw Hill.
6	Saxena, S.C., "Airport Engineering – Planning and Design", CBS Publishers.

DESIGN OF WASTEWATER TREATMENT PROCESSES	
Course Code: 23CEP08	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1. To learn basics of sewage collection and design of sewers
2. To learn the basics of sewage composition and its characteristics
3. To have adequate knowledge about various sewage treatment processes and its design
4. To provide adequate information on various disposal standards for treated effluents

COURSE LEARNING OUTCOMES (CLOs):

1. To get basic knowledge of sewage collection and design of sewers
2. To get basic knowledge of sewage composition and its characteristics
3. Assess the contamination in the soil and to select suitable remediation methods based on contamination.
4. Prepare the suitable disposal system for particular waste.

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS:

UNIT -1: COLLECTION OF SEWAGE

Importance of sanitation, types of sewerage systems – separate Combined and partially separate, quantity of sanitary sewage and variations, Shapes of sewer - circular and egg shaped, design of sewers, Self-cleansing velocity and slopes, Construction and testing of sewer lines, sewer materials, Joints and sewer appurtenances.

UNIT -2: SEWAGE CHARACTERISATION

Quality parameters- BOD, COD, Solids, oil and grease, Indian Standards for disposal of effluents into inland surface sources and on land, Guidelines for reuse of treated wastewater

UNIT -3: SEWAGE TREATMENT

Objectives, sequence and efficiencies of conventional treatment units, Preliminary treatment, screening and grit removal units, theory and design aspects of primary treatment, Secondary treatment- activated sludge process & its modifications, tricking filter, UASB process, Oxidation Pond and Stabilization Pond, aerated lagoon, septic tank, Sludge disposal – thickening-digestion-dewatering, Introduction of tertiary treatment

UNIT -4: DISPOSAL OF SEWAGE

Recycling and reuse of treated wastewater, Disposal of sewage by dilution – self-purification of streams - Streeter Phelps equation - oxygen sag curve, Sewage disposal by irrigation (sewage treatment).

BOOKS

S.No.	TEXT BOOKS
1	Sewage and Sewage Treatment: S.K. Garg.
2	Waste Water Engineering: B.C. Punmia
3	Sewage and Sewage Treatment: S.R. Krishansagar
4	Water Supply and Sanitary Engineering: Birdie, G. S. and Birdie
	REFERENCE BOOKS AND OTHER MATERIALS
5	Manual on Sewerage and Sewage Treatment: Ministry of Urban Dev., New Delhi.
6	Environmental Engineering: Peavy H. S., Rowe D. R. and Tchobanoglous G
7	Introduction to Environmental Engineering: Davis M. L. and Cornwell D. A.
8	Wastewater Engineering, Collection, Treatment and Disposal: Metcalf and Eddy

Building Construction Materials	
Course Code: 23CEP09	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

To how the wood, cement, admixtures is used for buildings and construction process.

1. To develop the building walls and foundations and how they are useful for buildings.
2. In these mainly we know about building arches, roofs, doors, windows and ventilators and how they are given for buildings.
3. To develop the form work and finishing work which is used for buildings and to solve the defects of building properties which are able to know with material
4. Painting is also taken for a beautiful looking structure for the good manner.
5. These courses explain about the material which we want to use and how we want to use and how to give a good building for ma using purpose.

COURSE LEARNING OUTCOMES (CLOs):

After completing this course, the students will be able to:

1. Demonstrate the ability to know about different materials such as stones, bricks, Tiles, wood, aluminum, glass & paints and their classification, manufacture and structural requirements
2. Ability to know about the materials used in making of concrete such as cement and admixtures.
3. Graduates will demonstrate the various types of ventilations, air conditioning, types of air conditioning, fire protection and classification of fire hazards and fire-resistant materials used in construction.
4. Graduates will demonstrate the types of masonry, finishers and form work, requirements, standards.

MAPPING MATRIX OF COs AND CLOs

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS:

Unit 1: Basic Building Materials I

Aggregate: Classification, Physical and mechanical properties, soundness, alkali-aggregate reaction, thermal properties of aggregate **Bricks and Masonry Blocks:** Types, properties and field and laboratory tests to evaluate quality Lime: classification, properties **Cement:** types, Portland cement: chemical composition of raw material, bogue compounds, hydration of cement, role of water in hydration, testing of cements, **Fly ash:** properties and use in manufacturing of bricks and cement.

Unit 2: Basic Building Materials II

Building stone: classifications, properties and structural requirements; **Wood and Wood products**: Introduction to wood macrostructure, sap wood and heart wood, defects and decay of timber, seasoning and preservation of timber, fire resisting treatment, introduction to wood products- veneers, plywoods, fibre board, particle board, block board, batten boards. **Metals:** Steel: Important properties and uses of Iron (Cast iron, wrought iron and steel), Important tests on steel rebar, aluminum and copper. **Glass:** types and uses, gypsum: source, properties, uses; **plastic:** properties and uses, **paint:** types, distemper, varnish, **Adhesive:** Types, **Bitumen:** types, properties and tests.

Unit 3: Mortar & Concrete

Mortar: Types and tests on mortars. **Concrete:** Production, mix proportions and grades of concrete, fresh, mechanical and durability properties of concrete, factors affecting properties of concrete, tests on concrete, admixtures, **Special concrete:** light weight concrete, high density concrete, vacuum concrete, shotcrete, steel fiber reinforced concrete, polymer concrete, Ferro cement, high performance concrete, self-compacting concrete.

Unit 4: Basic Building Constructions

Foundation: purpose, types of foundation- shallow, deep, pile, raft, grillage foundation. **Masonry:** Brick Masonry: types of bonds, relative merits and demerits of English, Single Flemish and Double Flemish bond. Stone Masonry: General principles, classification of stone masonry and their relative merits and demerits, **Cavity wall:** components and construction, **Arches:** Terminology and classifications Doors and Windows: Types, materials used.

Unit 5: Finishing, Services and Special constructions

Wall Finishes: Plastering, pointing, distempering and painting: Purpose, methods, defects and their solutions. **Vertical communication:** Stairs: Terminology, requirements of good staircase, classification; ramps, lifts and escalators. **Damp proofing:** causes, effects, prevention and treatments**, Fire resistant construction:** Fire resistant properties of common building materials, requirements for various building components.

BOOKS

TEXT BOOKS

S.No.	
1	A Text-Book of Building Construction, S.P.Bindra and S.P.Arora, Dhanpat Rai Publications
2	Building Materials and Construction, Jena and Sahu, Mc. Graw Hill.
3	Materials for Civil and Construction Engineers, Mamlouk and Zaniewski, Pearson
4	Building Materials and Building Construction, by P C Varghese
5	Building Construction, by B. C. Punima, Laxmi Publication

DISASTER MANAGEMENT	
Course Code: 23CEP10	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1 To study importance of disaster management.

2 To study the occurrences, reasons and mechanism of various types of natural disasters.

3 To study the occurrences, reasons and mechanism of various types of man-made disasters.

4 To study the various preventive measures as Civil Engineer with latest codal provisions

COURSE LEARNING OUTCOMES (CLOs):

At the end of the course, student will be able to:

1 Knowledge of the significance of disaster management

2 Analyze the occurrences, reasons and mechanism of various types of natural disaster

3 Analyze the occurrences, reasons and mechanism of various types of man-made disaster

4 Understand the preventive measures as Civil Engineer with latest codal provisions

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS:

UNIT -1: NATURAL DISASTERS

Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches. Volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.

UNIT -2: MAN MADE DISASTERS

Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents.

UNIT-3: DISASTER MANAGEMENT

Disaster Management Act 2005, Institutional framework under Disaster Management act, 2005 Role of National Disaster Management Authority (NDMA), Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community – based organizations and media. Central, state, district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations.

BOOKS

S.No.	TEXT BOOKS
1	Thomas D. Schneid., Disaster Management and Preparedness, CRC Publication, USA, 2001
2	Patrick Leon Abbott, Natural Disasters, Amazon Publications, 2002
3	Ben Wisner., At Risk: Natural Hazards, People vulnerability and Disaster, Amazon Publications, 2001
4	Oosterom, Petervan, Zlatanova, Siyka, Fendel, Elfriede M., "Geo-information for Disaster Management", Springer Publications, 2005
5	Savindra Singh and Jeetendra Singh, Disaster Management, Pravalika Publications, Allahabad
6	Nidhi GaubaDhawan and AmbrinaSardar Khan, Disaster Management and Preparedness, CBS Publishers & Distribution

EARTHQUAKE ANALYSIS AND DESIGN	
Course Code: 23CEP11	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1 To study Introduction about earthquake and seismology

2 To study about earthquake resistant design of building

3 To study effect of lateral loading on building

4 To Study Provision by BIS for earthquake resistance of a building

COURSE LEARNING OUTCOMES (CLOs):

At the end of the course, student will be able to:

1 Explain earthquake and seismology

2 Design earthquake resistant building

3 Understand effect of lateral loading on building

4 Understand provision by BIS for earthquake resistance of a building

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS:

UNIT -1: BASICS OF SEISMOLOGY

Earth and its interior, Plate Tectonics, Convection Currents, The Earth quake, Inter Plate Earthquake (Convergent Boundaries, Divergent Boundaries and Transform Boundaries), Intra Plate Earthquake (Faults and Types of Faults), Seismic Waves, Basic Terminology, Measuring Units and Instruments

UNIT -2: EARTHQUAKE RESISTANT DESIGN PHILOSOPHY

Introduction, criteria for earthquake resistant design, criteria for earthquake resistant design,

principles of reliable seismic behaviour, structural forms for earthquake resistance, earthquake forces versus other forces.

UNIT -3: LATERAL LOAD ANALYSIS

Idealization of structures and selection of analysis, Idealization of structures and selection of analysis, equivalent lateral force concepts, equivalent lateral force concepts, response spectrum analysis, seismic forces as per IS:1893– 1984, IS:1893–2002, IS:1893–2016,

UNIT – 4: BEHAVIOUR AND DESIGN OF CONCRETE STRUCTURES

Characteristics of concrete and reinforcing steel, influence of bond and anchorage and confinement of concrete, Seismic design and detailing of reinforced concrete and masonry buildings (IS 13920; IS 13827: IS 13828; IS 4326) and flexural strength and ductility of RC members.

BOOKS

S.No.	TEXT BOOKS
1	Paz M, "Structural Dynamics – Theory and Computation" CBS Publishers and Distributors, New Delhi, 2003
2	Chopra A K, "Structural Dynamics" John Wiley & Sons, New Delhi, 2002
3	Dowrick D J, "Earthquake Resistant Design for Engineers and Architects" John Wiley & Sons, New York, 2000
4	Paulay and Priestley, "Seismic Design of Reinforced Concrete and Masonry Buildings" John Wiley and sons, New York, 1992
	REFERENCE BOOKS AND OTHER MATERIALS
5	Rao S S., "Mechanical Vibrations" Pearson Education Publishers, 2004

BRIDGE ENGINEERING	
Course Code: 23CEP12	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1 To learn the design of the slab culvert, Box culvert

2 To learn the design of the T beam bridge and substructures

3 To learn the design of the Bridge bearings

4 To learn the design of the steel bridge for railways

COURSE LEARNING OUTCOMES (CLOs):

At the end of the course, student will be able to:

1 Design the slab culvert, Box culvert

2 Design the T beam bridge and substructures

3 Design the Bridge bearings

4 Design the steel bridge for railways

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS:

UNIT -1: STANDARD SPECIFICATIONS FOR ROADS AND RAILWAYS BRIDGES

Definition, components of bridge, Classification of bridges, selection of site, Economical span and essential design data. General, Indian Road Congress Bridge Code, width of carriage way, Clearance, Various loads to be considered for the design of roads and railway bridges, Detailed explanation of IRC standard live loads.

UNIT -2: DESIGN CONSIDERATION FOR R. C. C. BRIDGES

Various types of R.C.C. bridges (brief description of each type), Design of R.C.C. culvert, Design of T-beam bridges, Design of PSC Bridges.

UNIT -3: DESIGN CONSIDERATION FOR STEEL BRIDGES

Various types of steel bridges (brief description of each), Design of truss, Design of plate girder bridges, Design of composite bridges.

UNIT -4: HYDRAULIC & STRUCTURAL DESIGN

Overview of Industrial Relations, Development of IR System in India, Labour-management Relations Trade Unionism, Collective Bargaining, Employee Grievances.

BOOKS

S.No.	TEXT BOOKS
1	Essentials of Bridge Engineering, D. J. Victor, Oxford & IBH Pub. N. Delhi.
2	Design of Bridges, N. Krishna Raju, Oxford & IBH, N. Delhi.
3	Bridge Deck Analysis, R. P. Pama & A. R. Cusens, John Wiley & Sons
	REFERENCE BOOKS AND OTHER MATERIALS
5	Design of Bridge Structures, T. R. Jagadish & M. A. Jairam, Prentice Hall of India, N. Delhi.

DESIGN OF ADVANCE CONCRETE STRUCTURES	
Course Code: 23CEP13	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1. To understand the design of Retaining wall and Beam
2. To Understand the Design of flat slab and Staircase
3. To Understand the design of Water tanks, Silos and Bunkers
4. To Understand the design of Prestressed Concrete
5. To Understand the Concept of Yield line Theory

COURSE LEARNING OUTCOMES (CLOs):

1. Students Know the design of Retaining wall and Beam
2. Students will have adequate knowledge on flat slab and Staircase designs
3. Students Know the Water tanks, Silos and Bunkers designs
4. Students Know the design of Prestressed Concrete designs
5. Students Know the Concept of Yield line Theory

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	**CLO1**	**CLO2**	**CLO3**	**CLO4**	**CLO4**
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS:

UNIT 1: RETAINING WALLS AND DESIGN OF BEAMS CURVED IN PLAN

Classification, Forces on retaining walls, Design criteria, stability requirements, proportioning of cantilever retaining walls, counter fort retaining Walls, Criteria for design of count forts, design examples, Maximum moments and shear for beams curved in plan, Analysis for torsion, Torsional reinforcement, Design examples. Classification, Forces on retaining walls, Design criteria, stability requirements, proportioning of cantilever retaining walls, counter fort retaining Walls, Criteria for design of counterforts, design examples., Maximum moments and shear for beams curved in plan, Analysis for torsion, Tensional reinforcement.

UNIT 2: FLAT SLABS AND DESIGN OF STAIRCASES

Advantages of flat slabs, general design considerations, approximate direct design method, Design of flat slabs, Openings in flat slab. Design of various types of staircases, Design of various types of staircases, Design examples.

UNIT 3: WATER TANKS, SILOS AND BUNKERS

Design requirements of water retaining structures, rectangular and cylindrical underground, overhead tanks, Intze tanks, design considerations, Design examples, various theories, Bunkers with sloping bottoms, Bunkers with high side wall.

UNIT -4: PRESTRESSED CONCRETE

Introduction, basic concepts of prestress concrete, Various prestressing systems, losses in prestress, Initial and final stress conditions, load balancing concept, Analysis and design of sections for flexure, Analysis and design of sections for Shear stress.

UNIT -5: YIELD LINE THEORY

Basic assumptions, Methods of analysis, Yield line patterns and failure mechanisms, Analysis of one way, Analysis of Two-way, Analysis of Non-rectangular slabs, Effect of top corner steel in square slabs.

BOOKS

S.No.	**TEXT BOOKS**
1	Plain and Reinforced Concrete, Vo l.2, Jai Krishna & O.P.Jain, Nem Chand & Bros., Roorkee.
2	Pre-Stressed Concrete, N. Krishna Raju, TMH Pub., N, Delhi.
3	Reinforced Concrete-Limit Stage Design, A.K. Jain, Nem Chand & Bros., Roorkee.
	REFERENCE BOOKS AND OTHER MATERIALS
4	Design of Prestressed Concrete Structures, T.Y. Lin, John Wiley & Sons., Delhi.

IRRIGATION ENGINEERING	
Course Code: 23CEP14	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1. To know the basics, necessity, and types of irrigation.
2. Study and understand about canal irrigation and land reclamation.
3. Understand about canal and rivers
4. Study about canal head works and regulation works

COURSE LEARNING OUTCOMES (CLOs):

1. To get knowledge types of irrigation
2. Get an exposure about canal irrigation and land reclamation
3. To get knowledge about canal and rivers
4. To get knowledge canal head works and regulation works

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS:

UNIT -1: INTRODUCTION

Irrigation-necessity, soil-water relationship, infiltration, basic terminology such as field capacity, wilting point, deltas, duty of water, flooding methods, border strip method, check basin and furrow method, assessment of irrigation water, sprinkler irrigation and its design, drip irrigation & its design.

UNIT -2: Canal irrigation & Water logging and land reclamation

Canal irrigation: Components of canal distribution system, alignment & losses of channels, Kennedy's and Lacey's theories and design procedure, Garrets and Lacey's diagrams.

Water logging and land reclamation: Water logging-effects causes & preventive measures, lining of irrigation channels with types & design of lined channel, land drainage, open & closed drains design considerations, advantages of tile drains, discharge and spacing of closed drains, methods of land reclamation, quality of irrigation water.

UNIT -3: CANAL OUTLETS & RIVER TRAINING

Canal outlets: Classification, requirements of a good outlet, design of pipe, APM and open flume outlet, flexibility proportionality, setting and sensitivity of outlet.

River Training: River training and its objectives, classification of river training works, methods of river training, marginal embankments, guide banks, spurs, cutoffs, bank pitching and launching apron.

UNIT -4: DIVERSION CANAL HEAD WORKS & REGULATION WORKS

Diversion canal head works: Various components and their functions, layout plan, Bligh's creep theory, Khosla's method of independent variables, use of Khosla's curves, various corrections.

Regulation works: Canal falls-necessity and location, roughening devices, design of Sarda type fall. Off-take alignment, cross-regulator and distributory head regulators, devices to control silt entry into the off-taking channel and silt ejector, canal escapes.

BOOKS

S.No.	TEXT BOOKS
1	Sharma, S.K., Principles and Practice of Irrigation Engg., S. Chand& Co, 1984.
2	Arora K R "Irrigation Water Power & Water Resources Engineering" Standard Publishers & Distributors, Delhi, 2002.
3	Garg S K "Irrigation Engineering & Hydraulic Structures" Khanna Publishers, Delhi, 1995.
	REFERENCE BOOKS AND OTHER MATERIALS
4	Varshney, Gupta & Gupta "Irrigation Engineering & Hydraulic Structure" Nem Chand & Bros., Roorkee, 1982.
5	Punmia, B.C., Irrigation and Water Power Engineering, Standard Publishers, 2001
6	Modi P N " Irrigation ,Water Resources and Water Power Engg" Standard Book House N Delhi 2000
7	A M Michael " Irrigation Theory and Practice" Vikas Publishing House Pvt Ltd N Delhi 2011

Solid Waste Management	
Course Code: 23CEP15	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs): This course will enable students to

1. Study the present methods of solid waste management system and to analyze their draw backs comparing with statutory rules.
2. Understand different elements of solid waste management from generation of solid waste to disposal.
3. Analyze different processing technologies and to study conversion of municipal solid waste to compost or biogas.
4. Evaluate landfill site and to study the sanitary landfill reactions

COURSE LEARNING OUTCOMES (CLOs): After studying this course, students will be able to:

1. Analyze existing solid waste management system and to identify their drawbacks.
2. Evaluate different elements of solid waste management system.
3. Suggest suitable scientific methods for solid waste management elements.
4. Design suitable processing system and evaluate disposal sites.

MAPPING MATRIX OF COs AND CLOs

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4	CLO5
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS:

Unit I

Sources: Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Generation rate, Numerical Problems.

Collection: Collection of solid waste- services and systems, equipment's, Transportation: Need of transfer operation, transfer station, transport means and methods, route optimization. Solid waste management 2000 rules with, 2016 amendments

Unit II

Processing techniques: Purpose of processing, Volume reduction by incineration, Process description, Mechanical volume reduction (compaction), Mechanical size reduction (shredding), component separation (manual and mechanical methods).

Unit III

Composting Aerobic and anaerobic method - process description, process microbiology, design consideration, Mechanical composting, Vermi composting, Numerical Problems. **Sanitary land filling**: Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill- Gas and Leachate movement, Control of gas and leachate movement, Design of sanitary landfill. Numerical Problems.

Unit IV

Sources, collection, treatment and disposal: - Biomedical waste-waste, construction and demolition waste.

Unit V

Incineration -3Ts factor affecting incineration, types of incinerations, Pyrolsis , Energy recovery technique from solid waste management. Hazardous waste.

BOOKS

TEXT BOOKS

S.No.	
1	George Tchobanoglous, Hilary Theisen , Samuel A Vigil, "Integrated Solid Waste Management : Engineering principles and management issues", M/c Graw hill Education . Indian edition.
2	Howard S Peavy, Donald R Rowe and George Tchobanoglous, "Environmental Engineering", Tata Mcgraw Hill Publishing Co ltd.,

Reference Books

1	Municipal Solid Wastes (Management and Handling) Rules, 2000.Ministry of Environment and Forests Notification, New Delhi, the 25th September, 2000. Amendment – 1357(E) – 08-04-2016
2	Municipal Solid waste management manual, Part II published under Swachh Bharat Mission, Central Public Health and Environmental Engineering Organization (CPHEEO), 2016, Ministry of Urban Development, Government of India.
3	Handbook of Solid waste management, second edition, George Tchobanoglous, Frank Kreith, published by M/c Graw hill Education, 2002, ISBN-13 978-0071356237 ISBN -10 0071356231

GROUND IMPROVEMENT TECHNIQUES

Course Code: 23CEP16	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1. To develop an awareness of problematic soils and selection of ground improvement techniques based on soil conditions.
2. To understand drainage, dewatering, grouting technique and use of geosynthetics in ground improvement method.

COURSE LEARNING OUTCOMES (CLOs):

1. Students will be familiar with selection of ground improvement techniques based on soil conditions.
2. Students will able to understand the concepts of various ground improvement techniques.

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2
CO1	✓	
CO2		✓

COURSE CONTENTS:

UNIT -1: INTRODUCTION

Role of ground improvement in foundation engineering - Ground improvement methods - Geotechnical problems in lateritic, alluvial and black cotton soils - selection of Ground improvement techniques based on soil conditions-use of piezometers-inclinometers in field

UNIT -2: DRAINAGE AND DEWATERING

Dewatering – Purpose – Various Methods of Dewatering - Well point system - Vacuum dewatering system - Electro-osmatic method - Seepage analysis for two dimensional flow

UNIT -3: INSITU TREATMENT OF SOILS

Insitu densification of Granular and consolidation of cohesive soils - Dynamic compaction - Vibrofloatation - Sand pile compaction - Stone Column - Preloading with sand drains and fabric drains.

UNIT – 4: GROUTING OF SOILS

Types of Grouts - Desirable Characteristics of Grouts - Grouting Methods - Permeation Grouting - Displacement Compaction Grouting - Displacement Soil Fracture Grouting - Jet Grouting.

UNIT – 5: GEOSYNTHETICS

Geosynthetics – Types of Geosynthetics – Functions of Geosynthetics - Properties of Geosynthetics – Functional Requirements – Designing with Geosynthetics.

BOOKS

S.No.	TEXT BOOKS
1	Koerner.R.M. Construction and Geotechnical Methods in Foundation Engineering, McGraw Hill Publishing Company, New york, 1984.
2	Purusothamaraj.P. Ground Improvement Techniques, Laxmi Publication (P) Ltd., New Delhi, 2000.

GEOTECHNICAL ENGINEERING	
Course Code: 23CEP17	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1. To explain the concept of earth dam design.
2. To evaluate stability of slopes under different drainage conditions using different methods.
3. To explain design principles of retaining structures and coffer dams.
4. To explain the concept of soil stabilization.

COURSE LEARNING OUTCOMES (CLOs):

1. Familiar with concept of earth dam design including stability analysis under seepage.
2. To get knowledge about stability of slopes under different drainage conditions using different methods.
3. To get knowledge about design principles of retaining structures and coffer dams.
4. To get knowledge about the concept of soil stabilization.

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS:

UNIT -1: EARTH DAMS

Introduction, types of sections, earth dam foundations, Causes of failure and criteria for safe design, control of seepage through the embankment, Control of seepage through the foundation, Drainage of foundations, criterion for filter design.

UNIT-2: STABILITY OF SLOPES

Stability analysis of slopes-total stress analysis, effective stress analysis, Stability of infinite slopes, types of failures of finite slopes, analysis of finite slopes-mass procedure, Method of slices, effect of pore pressure, Fellinius method to locate, center of most critical slip circle, Friction circle method, Tayler's stability number.

UNIT -3: BRACED CUTS AND COFFERDAMS

Depth of unsupported vertical cut, Sheeting and bracing for deep excavation, Movements associated with sheeting and bracing Modes of failure of braced cuts.

Introduction, types of cofferdams, Design data for Cellular cofferdams Stability analysis of cellular cofferdams on soil and rock, inter- locking stresses.

UNIT -4: CANTILEVER SHEET PILES & ANCHORED BULKHEADS

Purpose of sheet piles, Cantilever sheet piles, depth of embedment in granular soils- rigorous method, Simplified procedure, Cantilever sheet pile penetrating clay.

Methods of design of Anchored Bulkheads, Free earth support method in cohesionless, Free earth support method in cohesive soils, Fixed earth support method in cohesion less soils.

UNIT -5: SOIL STABILIZATION

Soil improvement, mechanical treatment, Use of admixtures, lime stabilization, cement stabilization, Bituminous stabilization, Chemical stabilization, stone column, grouting, methods of Grouting.

Books

S. No.	TEXT BOOKS
1	S.Prakash, Gopal Ranjan&S.Saran, Analysis and Design of Foundation and Retaining Structures,Sarita Prakashan Meerut, 1977.
2	Gopal Ranjan, ASR Rao, Basic and Applied Soil Mechanics, New Age International (P) Ltd. Publishers- Delhi, Edition No. - 3rd, 2016
3	P. Purshotam Raj, Geotechnical Engg, Tata McGraw Hill, Delhi, Edition No.- I, 1995
4	Debashis Moitra, Geotechnical Engineering, Universities Press, Edition No. - I, 2016.
5	Swami Saran, Analysis and Design of Sub Structures, IBH Oxford
6	Teng, Foundation Design, Prentice Hall, Edition No. - 10th, 1984.

ROCK MECHANICS	
Course Code: 23CEP18	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1. To understand the problems associated with underground excavations.
2. To understand the rock mass classification.
3. To understand the failure criteria of rock.
4. To explain the concept of soil stabilization.

COURSE LEARNING OUTCOMES (CLOs):

1. To learn about in-situ stresses from field test data.
2. To learn about rock mass classification
3. To get knowledge about the failure criteria of rock.
4. To get knowledge about various in-situ stresses from field test data.

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS:

UNIT -1

Rock formation: Rock forming minerals, identification, geological classification of rock, geological structures, faults, folds, joints.

Stereographic Project of Geological Data: Principle of equal area net, representation of a line, plane, intersection of two planes, other applications.

UNIT -2

Laboratory Testing of Rocks: Determination of physical properties, uniaxial compressive strength test, tensile strength test, oblique shear test, triaxial test, slake durability test, stress-strain responses of rocks.

Engineering Classification of Rocks & Rock Mass: Deere and Miller classification, concept of rock mass, rock quality designation, rock mass rating, rock mass quality, geological strength index and applications in civil engineering projects.

UNIT -3

Strength Criteria for Rocks & Rock Mass: Mohr-Coulomb criterion, Hoek and Brown criterion, Barton's theory.

Tunneling: Ground conditions in tunneling, application of stereographic projections, elastic analysis under uniaxial, biaxial and hydrostatic conditions, Concrete lining: elastic analysis, elasto-plastic analysis: Tresca criterion, rock mass-tunnel support interaction analysis, design of support system.

UNIT -4

Rock Slope Stability Analysis: Modes of failure, limit equilibrium approaches, application of stereographic projections, remedial measures. Foundations of Weak Rocks: Bell's approach, bearing capacity based on classification approaches, UCS, plate load test, special considerations, dam foundations.

BOOKS:

S. No.	TEXT BOOKS
1	Goodman, RE (1989). Introduction to Rock Mechanics, Canada, John Wiley & Sons.
2	Hoek, E and Bray, JW (1977). Rock Slope Engineering. The Institution of Mining and Metallurgy, London.
3	Hoek, E and Brown, ET (1988). Underground Excavations. Spon Press.
4	Jaeger, JG, Cook, NGW and Zimmerman, RW (2007). Fundamentals of Rock Mechanics. 4th Ed., Singapore, Blackwell Publishing.
5	Ramamurthy, T (2007). Engineering in Rocks for Slopes, Foundation and Tunnels. N. Delhi, PHI Pvt. Ltd.
6	Singh, B and Goel RK (2011). Engineering Rock Mass Classification. Oxford, UK, Elsevier Inc.
7	Sivakugan, N, Shukla, SK and Das, BM (2013). Rock Mechanics: an introduction. Boca Raton, FL, CRC Press
8	Wyllie, DC and Mah CW (2004). Rock Slope Engineering, Civil and Mining. NY, Spon Press.

GEOSYNTHETICS AND ITS APPLICATION	
Course Code: 23CEP19	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1. To understand the emerging trends of Geosynthetic in Geotechnical Engineering.
2. To evaluate the different properties of including different tests.
3. To analyze the functions of geosynthetic and its suitability.
4. To design different structures using geosynthetics according to various applications.

COURSE LEARNING OUTCOMES (CLOs):

1. Identify the type of geosynthetics and their relevance in geotechnical field.
2. Understand the mechanism of formation of different geosynthetics.
3. Analyse and compute different properties of geosynthetics.
4. Apply the knowledge for designing the structures using Geosynthetic materials.

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS:

UNIT -1: BASIC DESCRIPTION OF GEOSYNTHETICS

Historical Development, Types of geosynthetics: geotextiles, geogrids, geonets, geomembranes, eocomposites, Recent use in India.

UNIT -2: MANUFACTURING: MATERIALS AND PROCESS

Raw materials: polyamide, polyester , polyethylene , polypropylene, polyvinyl chloride, Different type of geosynthetics based on manufacturing woven , monofilament , multifilament , slit filament , nonwoven, Different bonding process : Mechanically bonded, Chemically bonded ,Thermally bonded.

UNIT -3: PROPERTIES OF GEOSYNTHETICS

Physical Properties: Mass per unit area, Thickness, Specific gravity, Hydraulic properties: Apparent open size, Permittivity, Mechanical Properties: Uniaxial Tensile Strength, Burst and Puncture Strength, Soil Geosynthetic friction tests, Durability: Abrasion resistance, Ultraviolet resistance

UNIT -4: FUNCTIONS & APPLICATIONS OF GEOSYNTHETICS

Functions: Reinforcement, Separation, Filtration, Drainage, Barrier Functions, Confinement. Applications: Use of geosynthetics in roads, Use of reinforced soil in Retaining walls, Improvement of bearing capacity, Geosynthetics in environmental control and landfills, Ground Improvement by geodrains, Use of Geosynthetics in lining of canals.

BOOKS

S.No.	TEXT BOOKS
1	Engineering with Geosynthetics by G.VenkatappaRao and G.V.S SuryanarayanaRaju – Tata McGraw Hill, New Delhi, 1990.
2	Construction and Geotechnical Methods in Foundation Engineering by Robert M. Koerner – McGraw Hill, New York, 1985.
3	Designing with Geosynthetics by Robert M. Koerner, Prentice Hall, New Jersey, UAS, 1989.
	REFERENCE BOOKS AND OTHER MATERIALS
4	Fundamentals of Geosynthetic Engineering by Sanjay Kumar Shukla, Jian-Hua Yin, CRC Press
5	Handbook on Geosynthetics and their applications, Sanjay Kumar Shukla, Thomas Telford, 2002

ADVANCE STRUCTURAL ANALYSIS	
Course Code: 23CEP20	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 1 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1. Analyzing indeterminate beams and plane frames with and without sway.
2. To understand the flexibility method of analysis
3. To understand the stiffness method of analysis.
4. To understand the software of structural analysis.

COURSE LEARNING OUTCOMES (CLOs):

1. To familiar with Analysis indeterminate beams and plane frames with and without sway
2. To know about the flexibility method of analysis
3. To know about the stiffness method of analysis
4. To know about the software of structural analysis

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS:

UNIT -1: ROTATION CONTRIBUTION METHOD AND APPROXIMATE METHODS

Basic concepts, rotation factor Application to continuous beams, portal frames and multistoried Frames Approximate Methods of Analysis of Multistoried Frames Portal method, Cantilever Method for Multistory frames.

UNIT -2: FLEXIBILITY METHOD OF ANALYSIS

Introduction, method of consistent deformation application to pin jointed frames, effect of temperature and pre-strain, displacements forces in members of indeterminate structures, flexibility matrix of plane member.

UNIT -3: STIFFNESS METHOD OF ANALYSIS

Introduction, relation between slope deflection method and stiffness method, Difference between flexibility and stiffness method, stiffness method for members with relative displacement of supports analysis of indeterminate structures Analysis of pin-Jointed frames.

UNIT -4: INTRODUCTION TO STRUCTURAL ANALYSIS SOFTWARE

Structural analysis using spread sheets Structural analysis using Etabs or STAAD.Pro, Comparison of both the methods

BOOKS

S.No.	TEXT BOOKS
1	Gere W and Weaver J M, "Matrix Analysis of Structures" CBS Publishers, New Delhi, 1986.
2	Pandit G S and Gupta S P, "Structural Analysis A Matrix Approach" Tata McGraw Hill, New Delhi,1994.
3	Ganju T N, "Matrix Structural Analysis using Spreadsheets" TMH Publishing Co. Ltd. New Delhi,2002.
	REFERENCE BOOKS AND OTHER MATERIALS
4	Vazirani V N and Ratwani M, ―Advanced Theory of Structures and Matrix Methods‖ Khanna Publishers, New Delhi, 1995.
5	Kanchi M B, ―Matrix Methods of Structural Analysis‖ Wiley Eastern Limited, New Delhi, 2002.

TEMPORARY STRUCTURES	
Course Code: 23CEP21	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1. To be familiar with Temporary structures installations for construction projects
2. To have thorough understanding of Temporary structures in residential and commercial buildings
3. To be familiar with Temporary structures in Dams, bridges and Tunnelling.

COURSE LEARNING OUTCOMES (CLOs):

1. Students will be familiar with temporary structures installations for construction projects.
2. Students will have thorough understanding of Temporary structures in residential and commercial buildings.
3. Students will Be familiar with Temporary structures in Dams, bridges and Tunnelling

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3
CO1	X		
CO2		X	
CO3			X

COURSE CONTENTS:

UNIT-1: INTRODUCTION

Introduction to temporary structures, Temporary structures in residential and commercial buildings, Temporary structures in Dams, bridges and Tunnelling

UNIT-2: TEMPORARY STRUCTURES IN RESIDENTIAL AND COMMERCIAL BUILDINGS

Erection and earthwork equipment, Construction dewatering, Concrete formwork, Scaffolding, Slip-formwork, Timber formwork, steel formwork, aluminium formwork.

UNIT-3: TEMPORARY STRUCTURES IN DAMS, BRIDGES AND TUNNELLING

Sheeting and bracing, Movements associated with sheeting and bracing, Trenching & Shoring, Tunneling, various methods of De-watering.

BOOKS

S. No.	TEXT BOOKS
1	Handbook of Temporary Structures in Construction; Robert T. Ratay; McGraw-Hill
2	Indian Standard on Fire Precautionary Measures in Construction of Temporary Structures and Pandals — Code of Practice. (IS8758:2013)

MAINTENANCE AND REPAIR OF STRUCTURES	
Course Code: 23CEP22	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1. To select the relevant method of maintaining different building structures.
2. To test the structures to predict its stability
3. To select the relevant materials for repair of structures.
4. To apply the relevant methods of repair for the masonry structures.

COURSE LEARNING OUTCOMES (CLOs):

1. Students will be familiar with the relevant method of maintaining different building structures
2. Students will able to test the structures to predict its stability.
3. Students will able to select the relevant materials for repair of structures.
4. Students will able to apply the relevant methods of repair for the masonry structures and Students will able to restore the damages of building structural elements using suitable method of repair.

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS:

UNIT -1: BASICS OF MAINTENANCE AND REPAIRS

Maintenance and its classifications, repair, retrofitting, re-strengthening, rehabilitation and restoration. Necessity, objectives and importance of maintenance and repairs. Factors influencing the maintenance and repairs. Advantages and limitations of maintenance and repairs. Approach of effective management for maintenance and repairs. Periodical maintenance, maintenance manual containing building plan, reinforcement details, material sources, maintenance frequency, Pre and post monsoon maintenance.

UNIT -2: CAUSES AND DETECTION OF DAMAGES

Causes of damages due to distress, earthquake, wind, flood, dampness, corrosion, fire, dilapidation,

termites. Systematic approach of damages detection, various aspects of visual observations for detection of damages. Tests on damaged structures: rebound hammer, ultrasonic pulse velocity, rebar locator, cover gauge, crack detection microscope, chloride test, sulphate attack, pH measurement, half-cell potential meter.

UNIT -3: MAINTENANCE AND REPAIR METHODS FOR MASONRY

Causes of wall cracks due to bulging of wall, shrinkage, bonding, shear and tension, differential settlement of foundation, thermal movement and vegetation. Probable crack location such as junction of main & cross wall, junctions of RCC column & wall, junction of slab & Wall cracks in masonry joints. Stages of repair: material removal and surface preparation, fixing suitable formwork, bonding/passivating coat and repair applications. Repair techniques: grouting, patch spalling replacement or delaminating and epoxy bonded mortar. Repairing methods for minor & medium cracks include epoxy injection, grooving & sealing, shotcrete, stitching, grouting and guniting. Repairing methods for major cracks (width more than 5 mm) include fixing mesh across cracks, dowel bars, RCC band and installing ferro-cement plates at corners and propping. Effects of dampness in wall, damping repair techniques such as replacement or inserting DPC in brick wall, bituminous painting, painting using water proof solution and cement with adhesive gum.

UNIT -4: MAINTENANCE AND REPAIR METHODS FOR RCC

Probable location of cracks in RCC elements, various causes of RCC failure. Causes of dampness in roof slab and its repair techniques such as mud phuska with brick tile topping, lime concrete terracing and ferro-cement topping. Repair methods for cracks in RCC structures such as epoxy injection, grooving & sealing, stitching, rebaring, grouting, spalling replacement, jacketing, shotcrete and gunitting. Repair of corroded RCC element: exposing and undercutting rebar, cleaning reinforcing steel, compensating reinforcement and protective coating

BOOKS

S.No.	TEXT BOOKS
1	Building Repair and maintenance management Gahlot, P. S. Sharma, Sanjay CBS Publishers & Distributors Pvt. Ltd. New Delhi, ISBN: 81-239-1243-9
2	Maintenance Engineering for civil Engineers Nayak B. S. Khanna Publication, New Delhi ISBN: 978-81-7409-051-7
3	Maintenance and Repairs of Buildings Guha,P. K. New Central book Agencies, New Delhi, ISBN 10: 8173810737 ISBN: 9788173810732
	REFERENCE BOOKS AND OTHER MATERIALS
4	Maintenance and Repairs of Buildings Hutchin Son, BD Newnes-Butterworth, London (UK) ISBN : 0408001917
5	Rehabilitation of Concrete Structures by Dr. B. Vidivelli, Standard Publishers Distributors,ISBN / Product Code: 9788180141102.

HEALTH MONITORING OF STRUCTURES	
Course Code: 23CEP23	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1. To understand about Evaluation of Structure.
2. To investigate the material damage.
3. To study about data interpretation.
4. To study about assessment and various case studies

COURSE LEARNING OUTCOMES (CLOs):

Students will able to:

1. Explain about Evaluation of Structure.
2. Investigate the material damage.
3. Understand about data interpretation.
4. Understand about assessment and various case studies.

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4
CO1	✓			
CO2		✓		
CO3			✓	
CO4				✓

COURSE CONTENTS:

UNIT -1: INTRODUCTION

Introduction- Qualitative and non-continuous methods of evaluation of structures SHM definition.

UNIT -2: STRUCTURAL DAMAGE

Detecting the existence of the damage on the structure, locating the damage – Identifying the types of damage - Quantifying the severity of the damage.

UNIT -3: DATA COLLECTION

Sensors - Feature extraction through signal processing and statistical classification, Structure Data acquisition systems-Data transfer and storage mechanism. Data management- Data interpretation and diagnosis: System Identification, Structural model update -Structural condition assessment.

UNIT -4: ASSESSMENT OF DATA

Prediction of remaining service life Different sensors, Accelerometers, strain gauges, displacement transducers, Level sensing stations, anemometers, temperature sensors and dynamic weight-in-motion sensors.

BOOKS

S. No.	TEXT BOOKS
1	Raghavan, A. and Cesnik, C. E., Review of guided-wave structural health monitoring," Shock and Vibration Digest, vol. 39, no. 2, pp. 91-114, 2007
2	Shen-En Chen, R. Janardhanam, C. Natarajan, Ryan Schmidt, Ino-U.S. Forensic Practices.

DESIGN AND DETAILING OF STRUCTURES	
Course Code: 23CEP24	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1. To understand about Detailing requirement, principles of limit state design concepts.
2. To study about concepts of earthquake-resistant design.
3. To study about detailing of flexural member.
4. To study about detailing of compression member.
5. To study about connections detailing.

COURSE LEARNING OUTCOMES (CLOs):

Students will able to:

1. Explain about Detailing requirement, principles of limit state design concepts.
2. Concepts of earthquake-resistant design.
3. Understand about detailing of flexural member.
4. Understand about detailing of compression member.
5. Understand about connections detailing.

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	CLO1	CLO2	CLO3	CLO4	CLO4
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS:

UNIT 1: INTRODUCTION

Detailing introduction – requirement – principles –limit state design concepts - sources of tension – anchorage of deformed bars in tension – lapped splices for bars in tension

UNIT 2: CONCEPTS OF EARTHQUAKE-RESISTANT DESIGN

Planning considerations and Architectural concepts – Evaluation of Earthquake forces – Lateral

load analysis – Guidelines for Earthquake resistant design – Earthquake resistant design of masonry and RCC buildings - Design considerations – Guidelines– Design and detailing.

UNIT 3: DETAILING OF FLEXURAL MEMBER

Design of beam – detailing of beam – anchorages of stirrups – support and loading point – slab support by upturned beam

UNIT 4: DETAILING OF COMPRESSION MEMBER

Design of column – detailing of column – lapped compressive splices – detailing of corbel

UNIT 5: CONNECTIONS DETAILING

Beam to beam - beam to column – knee connections – column to column – column to footing – joints in structures.

BOOKS

S.No.	TEXT BOOKS
1	Shah and Kurvey; Limit State theory & Design of Reinforced Concrete.
2	Dr. B.C.Punamia, A.K. Jain; RCC Designs; Laxmi Publication
3	IS: 456-2000 Indian Standard code of practice for plain and reinforced concrete, Bureau of Indian Standards, New Delhi
4	Agarwal.P and Shrikhande.M. Earthquake Resistant Design of Structures, Prentice Hall of India Pvt. Ltd. 2011.
	REFERENCE BOOKS AND OTHER MATERIALS
4	IS 4326: 2013 Earthquake Resistant Design and Construction of Buildings – Code of Practice
5	IS 1893: 2016 Criteria for Earthquake Resistant Design of Structures – Part 1 General Provisions and Buildings.
6	IS 13920:2016 Ductile Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces – Code of Practice

DESIGN OF MASONRY STRUCTURES	
Course Code: 23CEP25	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	
Prerequisite: None	

COURSE OBJECTIVES (COs):

1. To learn concept of Reinforced Masonry and Load Combination.
2. To understand the Concrete Masonry Units with applications and Prefabricated Masonry.
3. To understand the Materials of masonry construction and Thermal Effects.
4. To understand the design concept of reinforced Masonry beam and Deflection.
5. To understand the design concept of reinforced Masonry Shear Wall.

COURSE LEARNING OUTCOMES (CLOs):

Student will able to

1. Acquire knowledge about the Reinforced Masonry and Load Combination.
2. Acquire knowledge about the Concrete Masonry Units with applications and Prefabricated Masonry.
3. Acquire knowledge about the Materials of masonry construction and Thermal Effects.
4. Acquire knowledge about the design concept of reinforced Masonry beam and Deflection.
5. Acquire knowledge about the design concept of reinforced Masonry Shear Wall.

MAPPING MATRIX OF COs AND CLOs:

MAPPING MATRIX	**CLO1**	**CLO2**	**CLO3**	**CLO4**	**CLO4**
CO1	✓				
CO2		✓			
CO3			✓		
CO4				✓	
CO5					✓

COURSE CONTENTS:

Unit -1: INTRODUCTION

Plain and Reinforced Masonry, a Brief History of Masonry Construction, Unreinforced And Reinforced Masonry, Historical Development of Building Codes And Standards For Masonry Construction, Design Methods and Load Combinations

Unit -2: MASONRY UNITS: APPLICATIONS, TYPES, SIZES, AND CLASSIFICATION

Application of Masonry Units in Construction, General Description of Masonry Units, Clay Building Brick,

Functional Aspects, Concrete Masonry Units, Bonds and Patterns in Masonry Work, Structural Requirements for Masonry in Stack Bond, Mortar Joints, Types of Wall Construction, Glass Unit Masonry, Prefabricated Masonry.

Unit -3: MATERIALS OF MASONRY CONSTRUCTION

Mortar, Grout, Differences between Mortar, Grout, and Concrete, Compressive Strength of Masonry, Steel Reinforcement, Modulus of Elasticity of Masonry Materials, Thermal Effects on Masonry, Influence of Moisture on Masonry: Shrinkage, Creep of Masonry.

Unit -4: DESIGN OF REINFORCED MASONRY BEAMS

Strength design philosophy and its assumptions, analysis of rectangular sections in flexure, Modulus of Rupture and Nominal Cracking Moment of a Masonry Beam, Design of Masonry Singly & Doubly Reinforced Masonry Beams, Procedure for Flexural Design of Beams, Over Reinforced Beams, Design For Shear in Reinforced Masonry Beams, Masonry Wall Beams (Deep Wall Beams), Bond Beams, Diaphragm Action, Flexural Strength of A Wall Due To In-Plane Loads, Deflections of Reinforced Masonry Beams

Unit -5: DESIGN OF SHEAR WALLS

Fundamental Concepts of Shear Walls, Types of Shear Walls, Rigidity and Relative Rigidity Of A Shear Wall, Determination of Seismic Lateral Forces In Shear Walls, Horizontal Diaphragms, Influence of Building Configuration on Lateral Force Distribution in Shear Walls, Analysis of Shear Walls and Diaphragms under Direct Shear and Torsional Moments, Design Considerations for Shear Walls, Analysis of Shear Walls under Flexure and Axial Loads, Design of Multi-storey Shear Walls, Failure Modes of Shear Wall.

BOOKS

S.No.	TEXT BOOKS
1	Design Of Reinforced Masonry Structures By Narendra Taly, Ph.D., P.E., F.Asce
2	Design Of Masonry Structures Third Edition Of Load Bearing Brickwork Design A.W.Hendry,
3	Dayaratnam, P., “Brick and Reinforced Brick Structures”, Oxford & IBH Publishing House, 1997
	REFERENCE BOOKS AND OTHER MATERIALS
4	Dayaratnam, P., “Brick and Reinforced Brick Structures”, Oxford & IBH Publishing House, 1997
5	IS1905:1987, Code of Practice for Structural use of Unreinforced Masonry Bureau of Indian Standards, New Delhi, 2002

SOFT SKILLS TRAINING MODULES/COURSES CREDIT STRUCTURE IN FACULTY OF ENGINEERING & TECHNOLOGY (UG COURSE)					
S. No.	**Course Code**	**Course Name**	**Semester**	**Credits**	**Hours / Week**
1	23SS351	Effective Communication Skills	III	1	2
2	23SS452	Teamwork & Interpersonal Skills	IV	1	2
3	23SS553	Presentation Skills	V	1	2
4	23SS654	Professional Skills	VI	1	2
5	23AR755	Aptitude & Reasoning	VII	1	2

SOFT SKILLS TRAINING MODULES/COURSES STRUCTURE SEMESTER WISE IN FACULTY OF ENGINEERING & TECHNOLOGY (UG COURSES)

SEMESTER – III

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**2 / 3**	**Course Category**	**SEC**
Course Code	**23SS351**	**Course Title**	**Effective Communication Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Objectives (TO): -

- TO1. To define and understand communication and its process.
- TO2. To make student practice on communication skills via LSRW approach via instructing, engaging, assessing and re engaging.
- TO3. To enhance the confidence and motivation of a student by honing his communication skills.

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

- TLO1. To communicate effectively and interact with people with confidence.
- TLO2. To demonstrate and differentiate between various forms of communication.
- TLO3. To apply effective communication skills confidently which a student need to get ahead in job and life.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)			
TRAINING LEARNING OUTCOMES (TLO) → TRAINING OBJECTIVES (TO) ↓	TLO1	TLO2	TLO3
TO1			
TO2			
TO3			

Unit	Course Contents	Student Engagement Activity
Unit-I	**Verbal Communication Skills** • Communication Process & its importance • 7 C's of Communication • Formal & Informal Conversation • Requirements of effective verbal communication	Conversation Cards Activity

Unit-II	**Nonverbal Communication Skills** • Importance of nonverbal skills in effective communication • Types of nonverbal (body language) skills • Barriers to nonverbal communication	Power of Body Language Activity
Unit-III	**Listening Skills** • Role of listening skills in effective communication • Barriers to listening • Overcoming listening barriers • Empathetic listening & avoiding selective listening	Chinese Whisper Activity
Unit-IV	**Reading & Writing Skills** • Types of reading strategies to enhance improve reading skills • Types of written communication	The What IF Activity
Unit- V	**Visual Communication** • Types of visual communication • Importance of visual communication • Picture narration/description technique	Interpret The Picture Activity

Learning Resources	
Text Book	***Communication Skills*** by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	***Personality Development & Communication Skills-1*** by C B Gupta: Scholar Tech Press,2019.

Pedagogy

- The training will be based on the concept of learning by practice.
- The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student's engagement in training activities.
- The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.

Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Effective Communication Skills Course

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Verbal Communication Skills	Speech Activity	15	Written Test	10
II	Non Verbal Communication Skills	Role Play	15		
III	Listening Skills	Oral Assessment / Written Assessment	10		
IV	Reading & Writing Skills		20	Viva	20
V	Visual Communication		10		

SEMESTER –IV

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**2 / 4**	**Course Category**	**SEC**
Course Code	**23SS452**	**Course Title**	**Teamwork & Interpersonal Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Objectives (TO): -

- TO1. To make the students learn & demonstrate effective teamwork, leadership & interpersonal skills.
- TO2. To equip the students with capability of handling stress and utilization of work time effectively.
- TO3. To make the students understand the importance and application of Emotional Quotient, Critical Thinking & Problem Solving Skills.

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

- TLO1. To be confident working in a team and leading it as well.
- TLO2. To categorize the work and achieve expected performance within the time frame & will be able to adapt himself to work under various kinds of stress and re-energies himself to bounce back from such situations.
- TLO3. To get benefitted from Emotional Quotient in building stronger professional relationships and achieving career and personal goals.
- TLO4. To face complex problems and effectively deal with it in the job due to Critical Thinking & Problem Solving Skills.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)				
Training Learning Outcomes (TLO)➔ Training Objectives(TO)🡻	TLO1	TLO2	TLO3	TLO4
TO1				
TO2				
TO3				

Unit	Course Contents	Student Engagement Activity
Unit - I	**Team Management** • Team communication & team conflict resolution • Role of a team leader • Team goal setting & understanding team development • Team dynamics & multicultural team activity • Johari Window Model	Collaborative Working Game Activity
Unit-II	**Time Management** • Time management matrix • Pareto Principle (80/20 rule) • Development process of plan of action	What You Did Yesterday Activity
Unit-III	**Leadership** • Difference between leadership & management • Types of leadership style • Core leadership skills	Lead The Blindfolded Activity
Unit-IV	**Stress Management** • Sign of stress & its impact • Types of stress • Techniques of handling stress	Keeping Cool Activity
Unit - V	**Emotional Intelligence** • Emotional intelligence & emotional competence • Components & behavioral skills of emotional intelligence	Guess The Emotion Game Activity
Unit - VI	**Critical Thinking** • Types of thinking & Characteristics • Critical thinking standards • Barriers to critical thinking	Think Pair Share Activity

Learning Resources	
Text Book	***Communication Skills*** by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	***Personality Development & Communication Skills-1*** by C B Gupta: Scholar Tech Press, 2019.(ISBN No. – 9382209131)

Pedagogy

- The training will be based on the concept of learning by practice.
- The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student's engagement in training activities.
- The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.

Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Teamwork & Interpersonal Skills

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Team Management	Role Play / Group Activity	10	Written Test	10
II	Time Management		10		
III	Leadership		10		
IV	Stress Management	Assignment	10	Viva	20
V	Emotional Intelligence	Written Test	10		
VI	Critical Thinking		20		

SEMESTER – V

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**3 / 5**	**Course Category**	**SEC**
Course Code	**23SS553**	**Course Title**	**Presentation Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Objectives (TO):-

- TO1. To develop the public speaking skills in the student.
- TO2. To make the students learn and adapt to the necessary etiquettes required working and growing in corporate culture.
- TO3. To make the students learn to speak in a debate session by putting his arguments and making others accept his viewpoint convincingly.

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

- TLO1. To be confident in presenting himself in front of audience.
- TLO2. To become professional in his approach towards work culture.
- TLO3. To enhance the level communication skills while interacting with others.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)			
Training Learning Outcomes (TLO)➔ Training Objectives(TO)🡻	TLO1	TLO2	TLO3
TO1			
TO2			
TO3			

Unit	Course Contents	Student Engagement Activity
Unit-I	**Importance of Presentation Skills** • 4 P's of presentation skills – plan, prepare, practice & present • Guidelines for effective presentation	PPT Presentation Activity
Unit-II	**Storytelling Skills** • 4 P's of storytelling skills – people, place, plot & purpose • Types of storytelling techniques • Importance of storytelling skills	Start From Where I Stopped Activity
Unit-III	**Corporate Culture Etiquettes** • Importance of professional behavior at work place • Understand & implementation of etiquettes at work place • Importance of values & ethics • Types of professional / corporate etiquettes	Etiquettes Role Play Activity
Unit-IV	**Debate / Extempore** • Difference between debate, extempore & group discussion • Learning argument /counter argument in debate	Current Affair Topic Speech Activity
Unit-V	**Art of Creating Impression** • Importance of creating first impression • 6 ways to master the art of creating impression	Speech Activity
Unit-VI	**Problem Solving** • Types of problems & its solutions Problem solving process & tools	Think Pair Share Activity

Learning Resources	
Text Book	***Communication Skills*** by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	***Personality Development & Communication Skills-1*** by C B Gupta: Scholar Tech Press, 2019.(ISBN No. – 9382209131)

Pedagogy

- The training will be based on the concept of learning by practice.
- The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student's engagement in training activities.
- The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.
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Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Presentation Skills

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Importance of Presentation Skills	Presentation Activity	20	Written Test	10
II	Storytelling Skills	Speech Activity	15		
III	Corporate Culture Etiquettes	Assignment	10		
IV	Debate/Extempore	Speech Activity / Written Activity	15	Viva	20
V	Art of Creating Impression		10		
VI	Problem Solving				

SEMESTER – VI

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**3 / 6**	**Course Category**	**SEC**
Course Code	**23SS654**	**Course Title**	**Professional Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Objectives (TO): -

- TO1. To encourage students to learn and apply the effective writing skills.
- TO2. To make the students learn various types of business correspondence letters, cover letters & resume.
- TO3. To encourage students to learn as to how to talk and convince people in GD & interview.
- TO4. To make the students learn to build rapport for building positive relationships professionally at workplace.

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

- TLO1. To understand the importance of professional writing required in workplace.
- TLO2. To explore different formats in resume, cover letters & other business related letters.
- TLO3. To develop knowledge, skills and understanding people in-group and individually.
- TLO4. To apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)				
Training Learning Outcomes (TLO) ➔ Training Objectives(TO)⬇	TLO1	TLO2	TLO3	TLO4
TO1				
TO2				
TO3				
TO4.				

Unit	Course Contents	Student Engagement Activity
Unit-I	**Email Writing** • Importance of email communication skills • Basic rules of effective email writing • Structure of email – address, subject, message text, attachments, signature	Email Practice Activity
Unit-II	**Resume Writing** • Difference between Resume, CV & Bio data • Guidelines of resume writing • Resume preparation of the student	Resume Making Activity
Unit-III	**Letter Writing** • Types of Letter Writing – Application, Leave, etc. • Cover letter	Letter Writing Activity
Unit--IV	**Group Discussion (GD)** • Characteristics of GD & subject knowledge • Do's & Don'ts in GD • Strategies of GD • Types of GD	Group Discussion Practice Activity

Unit-V	**Interview Skills** • Preparation of the interview & company details information • Do's & Don'ts in interview • Types of Interviews • Strategies of interview	Mock Interview Practice Activity
Unit-VI	**Negotiation Skills** • Importance of negotiation skills • Four phases of negotiation skills • Barriers to negotiation & overcoming it • Win-win negotiation	Win-Win Activity

Learning Resources	
Text Book	***Communication Skills*** by Sanjay Kumar & Pushp Lata: Oxford University Press, 2019.
Suggested Reference Book	***Personality Development & Communication Skills-1*** by C B Gupta: Scholar Tech Press, 2019.(ISBN No. – 9382209131)

Pedagogy

- The training will be based on the concept of learning by practice.
- The training will involve 30% of the training time on briefing and demonstration & the remaining 70% will be focusing on student's engagement in training activities.
- The training will follow a circular approach where students are engaged, evaluated, given feedback and then re engaged.

Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Professional Skills

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Email Writing	Written Assignment	10	Written Test	10
II	Resume Writing		10		
III	Letter Writing		10		
IV	Group Discussion	Group Discussion Activity	15	Viva	20
V	Interview Skills	Mock Interview Activity	15		
VI	Negotiation Skills	Role Play	10		

SEMESTER – VII

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Engineering & Technology**		
Year / Semester	**4 / 7**	**Course Category**	**SEC**
Course Code	**23AR755**	**Course Title**	**Aptitude & Reasoning**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Objectives (TO): -

- TO1. To understand the basic concepts of quantitative ability and logical reasoning.
- TO2. To make student practice on the concepts of quantitative ability and logical reasoning.
- TO3. To prepare the students for aptitude and reasoning round in placement selection process & other competitive exams.

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

- TLO1. To understand the basic concepts of quantitative ability.
- TLO2. To solve campus placements aptitude papers covering Quantitative Ability.
- TLO3. To Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

Mapping Matrix of Training Objectives (TO) & Training Learning Outcomes (TLO)			
TRAINING LEARNING OUTCOMES (TLO) ➔ TRAINING OBJECTIVES (TO) ↓	TLO1	TLO2	TLO3
TO1			
TO2			
TO3			

A-Quantitative Ability

UNIT - I

- Number System
- Percentage
- Profit, Loss and Discount
- Simple Interest and Compound Interest

UNIT – II

- Allegation and Mixture
- Average
- Ratio, Proportion and Variation, Problem on Ages and Numbers
- Time and Work
- Time, Speed and Distance

UNIT – III

- Permutation and Combination
- Probability
- Data Interpretation
- Geometry and Menstruations
- Sequence, Series & Progression and Logarithmic

B- Logical Reasoning

UNIT - IV

- Number Series and Alphabet Series
- Direction Sense Test
- Coding -Decoding
- Blood Relation

UNIT – V

- Syllogism
- Dice, Cube and Cuboids
- Seating Arrangement

UNIT – VI

- Clock and Calendar
- Critical Reasoning
- Order and Ranking, Ven diagram, Analogy

Learning Resources	
Text Books	***Quantitative Aptitude for Competitive Examinations*** by R S Aggarwal: S Chand Publishing, 2022.
	A Modern Approach to Logical Reasoning by R S Aggarwal: S Chand Publishing, 2022.

Pedagogy-

- The training will be based on the concept of learning by doing and practice.
- The training will involve 50% of the training time on teaching the concepts and the remaining 50% will be focusing on practice.
- The training will follow a circular approach where students are taught, evaluated and given the feedback.

Internal (Continuous Assessment & Evaluation) & End Term (Assessment & Evaluation) for Aptitude & Reasoning

Unit No.	Unit Name	Internal Assessment Parameter	Internal Marks (70)	End Term Assessment Parameters	End Term Marks (30)
I	Quantitative Ability	Written Assignment	10	Written Test	30
II			10		
III			10		
IV	Logical Reasoning		15		
V			15		
VI			10		