SCHEME & SYLLABUS
OF

UNDERGRADUATE DEGREE COURSES
IN
CIVIL ENGINEERING

2022-23
(B.Tech. I Yr admitted 2021-22 and B.Tech. LEET Admitted 2022-23)

DEPARTMENT OF CIVIL ENGINEERING

J C BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA
FARIDABAD, HARYANA

Program Educational Objectives (PEOs)

PEO-01	A fundamental knowledge of the basic and engineering sciences and develop mathematical andanalytical skills required for civil engineering.
PEO-02	Civil engineering graduates to be equipped with practical skills and experimental practices related to core and applied areas of civil engineering to expand their knowledge horizon beyond books. This will prepare the students to take-up career in industries or to pursue higher studies in civil and interdisciplinary programs.
PEO-03	Civil engineering graduates will have improved team building, team working and leadership skills with high regardfor ethical values and social responsibilities.
PEO-04	Civil engineering graduates will explore and create innovations in various aspects of engineering.

PROGRAMME OUTCOMES (POs) B.TECH. CIVIL ENGINERING

Engineering Graduates will be able to:

PO-01	***Engineering Knowledge:*** Apply knowledge of mathematics, science, engineering fundamentals, and civil engineering to the solution of engineering problems.
PO-02	***Problem Analysis:*** Identify, formulate, review literature and analyze civil engineering problems to design, conduct experiments, analyze data and interpret data.
PO-03	***Design /Development of Solutions:*** Design solution for civil engineering problems and design system components of processes that meet the desired needs with appropriate consideration for public health and safety, and cultural, societal and environmental considerations.
PO-04	***Conduct Investigations of Complex Problems:*** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions in civil engineering.
PO-05	***Modern Tool Usage:*** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to civil engineering activities with an understanding of the limitations.
PO-06	***The Engineer and Society:*** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to civil engineering practice.
PO-07	***Environment and Sustainability:*** Understand the impact of the civil engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.
PO-08	***Ethics:*** Apply ethical principles and commit to professional ethics and responsibilities and norms of the civil engineering practice.
PO-09	***Individual and Teamwork:*** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings in civil engineering.
PO-10	***Communication:*** Communicate effectively on complex engineering activities with the engineering committee and with society at large, such as being able to comprehend and write effective reports and design documentation, and make effective presentations in civil engineering.
PO-11	***Project Management and Finance:*** Demonstrate knowledge & understanding of the civil engineering principles 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 in civil engineering.
PO-12	***Life-Long Learning:*** Recognize the need for, and the preparation and ability to engage in independent research and lifelong learning in the broadest context of technological changes in civil engineering.

PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO-01	To apply practical skills, and knowledge of engineering fundamentals and civil engineering, to industries and institutions.
PSO-02	To explore, create and develop innovations in various aspects of engineering. The student will be ready to take-up career or to pursue higher studies with high regard to ethical values and social responsibilities.

GRADING SCHEME

Marks %	Grade	Grade	Category
90-100	O	10	Outstanding
80≤marks<90	A+	9	Excellent
70≤marks< 80	A	8	Very good
60≤marks< 70	B+	7	Good
50≤marks< 60	B	6	Above Average
45≤marks< 50	C	5	
40≤marks< 45	P	4	Pass
<40	F	0	Fail
	Ab	0	Absent

Percentage calculation= CGPA * 9.5

Course code and definition:

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences Including Management Courses
PCC	Professional Core Courses
PEC	Professional Elective Courses
OEC	Open Elective Courses
LC	Laboratory Course
MC	Mandatory Courses
PROJ	Project

Curriculum for First Year
Undergraduate Degree Courses in Engineering & Technology

General, Course structure & Theme

&

Semester-wise credit distribution

A. Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
Hr. Practical (P) per week Hours Practical (Lab)/week	0.5 credits 1 credit

Total First Year Credit= 38+ 3*

***Refer implementation of Credit Transfer/Mobility Policy of online courses ,17th meeting of Academic Council (11.6.2019) for details, regarding MOOC credits. Minimum credit to be earned is **03** through MOOC for I Year B.Tech. students admitted in 2019 and onwards.

B. Course code and definition:

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses
PROJ	Project

C. Category of Courses:

BASIC SCIENCE COURSES

Sl. No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
2		Physics	3	1	3	5.5
1		Chemistry-I	3	1	3	5.5
3		Mathematics –I	3	1	0	4
4		Mathematics –II	3	1	0	4

ENGINEERING SCIENCE COURSES

Sl. No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1		Basic Electrical Engineering	3	1	2	5
2		Engineering Graphics & Design	0	0	4	2
3		Programming for Problem Solving	3	0	4	5
4		Workshop I	0	0	4	2
5		Workshop II	0	0	4	2

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT

Sl. No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1		English	2	0	2	3

Detailed first year curriculum contents

Mandatory Induction program

[Induction program for students to be offered right at the start of the first year.]

3 weeks duration
• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations

S.No.	Course code	Course Title	Branch
1.	**BSC101 A** **BSC104A**	**Physics** (Introduction to Electromagnetic Theory) **Physics** (Introduction to Electromagnetic Theory) Lab	Mechanical Engineering, Automation Engineering, Automobile Engineering
2	**BSC101B** **BSC104B**	**Physics** (Mechanics) **Physics** (Mechanics) Lab	Civil Engineering, Fashion Technology
3	**BSC101C** **BSC104C**	**Physics** (Waves and Optics) **Physics** (Waves and Optics) Lab	Electrical Engineering, Electronics & Communication Engineering, Electronics Instrumentation and Control Engineering, Electrical and Electronics Engineering
4	**BSC101D** **BSC104D**	**Physics** (Semiconductor Physics) **Physics** (Semiconductor Physics)	Computer Engineering, Computer Science & Engineering, Information Technology
5	**BSC103A**	**Mathematics-I (**Calculus and Linear Algebra)	Mechanical Engineering, Automation Engineering, Automobile Engineering
6	**BSC103 B**	**Mathematics-I (**Calculus, Multivariable Calculus & Linear Algebra)	Civil Engineering
7	**BSC103 C**	**Mathematics-I (**Calculus and Differential Equations)	Electrical Engineering
8	**BSC103 D**	**Mathematics-I (**Calculus and Linear Algebra)	Electronics & Communication Engineering, Electronics Instrumentation and Control Engineering, Electrical and Electronics Engineering, Fashion Technology
9	**BSC103 E**	**Mathematics-I (**Calculus and Linear Algebra)	Computer Engineering, Computer Science & Engineering, Information Technology
10	**BSC106 A**	**Mathematics-II (**Calculus, ODE & Complex Variables)	Mechanical Engineering, Automation Engineering, Automobile Engineering
11	**BSC106 B**	**Mathematics-II (**Differential Equations)	Civil Engineering
12	**BSC106 C**	**Mathematics-II (**Linear Algebra, Transform Calculus and Numerical methods)	Electrical Engineering,
13	**BSC106 D**	**Mathematics-II (**Calculus, Ordinary Differential Equations and Complex Variable)	Electronics & Communication Engineering, Electronics Instrumentation and Control Engineering, Electrical and Electronics Engineering, Fashion Technology
14	**BSC106 E**	**Mathematics-II (**Probability & Statistics)	Computer Engineering, Computer Science & Engineering, Information Technology

Curriculum for Second to Final Year
Undergraduate Degree Courses in Engineering & Technology

(As per guidelines of All India Council for Technical Education Model curriculum)

General, Course structure & Theme &Semester-wise credit distribution

Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week 2 Hours Practical (Lab)per week	0.5 credits 1 credit

Credits –178 for a student to be eligible to get Under Graduate degree in Engineering.

Structure of Undergraduate Engineering program:

SEMESTER I – VIII (w. e. f. Session 2022-23)

B. TECH SCHEME CREDITS CALCULATIONS

S. No.	Category of Courses	Contact Hours	Credits
1.	Professional Core Courses (PCC)	75	68
2.	Basic Science Courses (BSC)	28	25
3.	Engineering Science Courses (ESC)	32	23
4.	Humanities and Social Sciences including ManagementCourses (HSMC)	10	6
5.	Professional Elective Courses (PEC)	18	18
6.	Open Elective Courses (OEC)	9	9
7.	Skill Enhancement Course (SEC)	10	20
8.	Mandatory Audit Courses (MAC)	2	0
9.	Massive Open Online Courses (MOOCS)*	-	12*
10.	Value Added Courses (VAC)**	-	-
	Total	**184**	**169+12* =181**

* 03 credit each year through MOOC.

Refer implementation of Credit Transfer/Mobility Policy of online courses,17th meeting of Academic Council (11.6.2019) for details, regarding MOOC credits. Minimum credit to be earned is 12 (**03 each year)** through MOOC for all B.Tech.students in this scheme.

SEMESTER-WISE SUMMARY OF THE PROGRAMME

S. No.	Semester	Contact Hours	Marks	Credits
1.	I	25	650	19.5
2.	II	26	600	18.5
3.	III	28	800	24
4.	IV	33	1000	26
5.	V	29	950	28
6.	VI	23	750	23
7.	VII	20	650	20
8.	VIII	One Semester	500	10
	Total	**184**	**5900**	**169***

Total Credit = 169+12= 181 (* 03 credit each year through MOOC).

Refer implementation of Credit Transfer/Mobility Policy of online courses,17th meeting of Academic Council (11.6.2019) for details, regarding MOOC credits. Minimum credit to be earned is 12 (**03 each year)** through MOOC for all B.Tech.students in this scheme.

Professional Core Courses (PCC)

S.No.	Code	Subject Name	Contact Hours	Total Marks	Credits	Semester
1	PCC-CED201	Fluid Mechanics	3	100	3	III
2	PCC-CED202	Surveying	3	100	3	III
3	PCC-CED203	Building Materials and Testing	3	100	3	III
4	PCC-CED204	Engineering Geology	3	100	3	IV
5	PCC-CED205	Strength of Materials	3	100	3	IV
6	PCC-CED206	Highway Engineering	3	100	3	IV
7	PCC-CED207	Soil Mechanics	3	100	3	IV
8	PCC-CED208	Environmental Engineering	3	100	3	IV
9	PCC-CED301	Railway and Airport Engineering	3	100	3	V
10	PCC-CED302	Structural Analysis	3	100	3	V
11	PCC-CED303	Foundation Engineering	3	100	3	V
12	PCC-CED304	Hydraulic Engineering	3	100	3	V
13	PCC-CED305	Geomatics Engineering	3	100	3	V
14	PCC-CED306	Wastewater Engineering	3	100	3	V
15	PCC-CED308	Design of Concrete Structures	3	100	3	VI
16	PCC-CED309	Engineering Hydrology	3	100	3	VI
17	PCC-CED401	Construction Planning and Management	3	100	3	VII
18	PCC-CED402	Design of Steel Structures	3	100	3	VII
19	PCC-CED403	Irrigation Engineering	3	100	3	VII
20	PCC-CED201P	Fluid Mechanics Lab	2	50	1	III
21	PCC-CED202P	Survey Lab	2	50	1	III
22	PCC-CED203P	Materials Testing Lab	2	50	1	III
23	PCC-CED206P	Highway Engineering Lab	2	50	1	IV
24	PCC-CED207P	Soil Mechanics Lab	2	50	1	IV
25	PCC-CED208P	Environmental Engineering Lab	2	50	1	IV
26	PCC-CED304P	Hydraulic Engineering Lab	2	50	1	V
27	PCC-CED306P	Wastewater Engineering Lab	2	50	1	V
28	PCC-CED307P	Computational Analysis and Design Laboratory	2	50	1	V
29	PEC-CED-SC	Survey Camp*		50	2	V

BASIC SCIENCE COURSES (BSC)

S. No.	Code	Name of Course	Contact Hours	Credits	Semester
1.	BSC101	Physics (Mechanics & Mechanics of Solids)	4+3	5.5	I
2.	BSC103	Mathematics –I (Calculus, Multivariable Calculus and Linear Algebra)	4	4	I
3.	BSC 102	Chemistry-I	4+3	5.5	II
4.	BSC 104	Mathematics –II (Differential Equations)	4	4	II
5.	BSC 01	Biology	3	3	IV
6.	BSC-201	Mathematics-III	3	3	IV
		Total	**28**	**25**	

ENGINEERING SCIENCE COURSES (ESC)

S. No.	Code	Name of Course	Contact Hours	Credits	Semester
1.	ESC-101A	Basic Electrical Technology	4	4	I
2.	ESC-107A	Basic Electrical Technology Laboratory	2	1	I
3.	ESC-104	Workshop- I	4	2	I
4.	ESC-103	Programming for Problem Solving	3	3	II
5.	ESC-105	Programming for Problem Solving Lab	4	2	II
6.	ESC-102	Engineering Graphics and Drawing	4	2	II
7.	ESC-106	Workshop- II	4	2	II
8.	ESC-201	Basics of Electronics Engineering	3	3	III
9.	ESC-203R	Engineering Mechanics	4	4	III
		Total	**32**	**23**	

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES (HSMC)

S. No.	Code	Name of Course	Contact Hours	Credits	Semester
1.	HSMC-101	English	2	2	I
2.	HSMC-102	English Lab	2	1	I
3.	HSMC01	Humanities-I (Effective Technical Communication)	3	3	III
4.	VAC01	Human Values and Professional Ethics	-	0 (VAC)	I year
5.	VAC02	Universal Human Values	-	0(VAC)	I year
6.	HSMC(H102)	Universal Human Values 2: Understanding Harmony	3	0	IV
		Total	**10**	**6**	

VAC = Value Added Course

PROFESSIONAL ELECTIVE COURSES (PEC)

S. No.	Name of Course	Contact Hours	Credits	Semester
1.	Professional Elective Course I	3	3	VI
2.	Professional Elective Course II	3	3	VI
3.	Professional Elective Course III	3	3	VI
4.	Professional Elective Course IV	3	3	VI
5.	Professional Elective Course V	3	3	VII
6.	Professional Elective Course VI	3	3	VII
	Total	**18**	**18**	

OPEN ELECTIVE COURSES (OEC)

S. No.	Name of Course	Contact Hours	Credits	Semester
1.	Open Elective Course I	3	3	V
2.	Open Elective Course II	3	3	VI
3.	Open Elective Course III	3	3	VII
	TOTAL	**9**	**9**	

SKILL ENHANCEMENT COURSES (SEC)

S. No.	Code	Name of Course	Contact Hours	Credits	Semester
1.	PRCED-1P	Skill Enhancement Project I	2	2	III
2.	PRCED-2P	Skill Enhancement Project II	2	2	IV
3.	PRCED-3P	Skill Enhancement Project III	2	2	V
4.	PRCED-4P	Skill Enhancement Project IV	2	2	VI
5.	PRCED-5P	Skill Enhancement Project V	2	2	VII
6.	PRCED-6P	Industrial Training	One semester	10	VIII
		Total	**10**	**20**	

MANDARORY AUDIT COURSES (MC)

S. No.	Code	Name of Course	Contact Hours	Credits	Semester
1.	MC-01	Indian Constitution	1	0	III
2.	MC-04	Message of Bhagwat Gita	1	0	IV
		Total	**2**	**0**	

*** Course each year to be completed (3*4 = 12 credits)**

Branch / Course: Civil Engineering Total credits (4-year course):169 + 12 (MOOC) = 181
Semester-wise structure of curriculum
[L= Lecture, T = Tutorials, P = Practical & C = Credits]

First year credit=38 + 3 (MOOC)
III to VIII Sem credit=131+9 (Including MOOC Credits = 03 per year)

J C BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B. TECH 1st YEAR (SEMESTER –I) CIVIL ENGINEERING (2022-23)

Course Code	Course Title	L	T	P	Credits	Sessional	External	Category Code
BSC101B	Physics (Mechanics)	3	1	-	4	25	75	BSC
BSC103 B (for Civil*)	Mathematics-I (Civil: Calculus, Multivariable Calculus & Linear Algebra)	3	1	-	4	25	75	BSC
ESC102	Engineering Graphics & Design	-	-	4	2	30	70	ESC
ESC103	Programming for Problem solving	3	-	-	3	25	75	ESC
ESC104	Workshop- I	-	-	4	2	30	70	ESC
BSC104	Physics lab	-	-	3	1.5	15	35	BSC
ESC105	Programming for Problem solving Lab	-	-	4	2	15	35	ESC
	Total Credit				**18.5**			

Note: Exams duration will be as under

a. Theory exams will be of 03 hours duration.
b. Practical exams will be of 02 hours duration
c. Workshop exam will be of 03 hours duration

Important Notes:
Significance of the Course Notations used in this scheme: -

C = These courses are common to both the groups Group-A and Group-B.
A = Other compulsory courses for Group-A.
B = Other compulsory courses for Group-B.

Students will study either
Group A (BSC103., ESC101, BSC102, ESC104, HSMC101, ESC105, BSC105, HSMC102)
OR
Group B (BSC101., BSC103A/B, ESC102, ESC103, ESC104, BSC104, ESC105)

(* Branch specific scheme and syllabus for Math's-I, Math-II and Physics on next page)

J C BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B. TECH 1st YEAR (SEMESTER –II) CIVIL ENGINEERING (2022-23)

Course Code	Course Title	L	T	P	Credits	Sessional	External	Category Code
BSC106 B (for Civil*)	Mathematics-II (Civil: Differential Equations)	3	1	-	4	25	75	BSC
ESC101	Basic Electrical Engineering	3	1	-	4	25	75	AECC
BSC 102	Chemistry	3	1	-	4	25	75	BEC
ESC106	Workshop- II	-	-	4	2	30	70	BEC
HSMC101	English	2	-	-	2	25	75	BEC
ESC107	Basic Electrical Technology Lab	-	-	2	1	15	35	BSC
BSC 105	Chemistry Lab	-	-	3	1.5	15	35	BEC
HSMC102	English Lab	-	-	2	1	15	35	BEC
	Total Credit	**19.5**						

Note: Exams duration will be as under

a. Theory exams will be of 03 hours duration.
b. Practical exams will be of 02 hours duration
c. Workshop exam will be of 03 hours duration

Total First Year Credit= 38+ 3*

*****Refer implementation of Credit Transfer/Mobility Policy of online courses ,17th meeting of Academic Council (11.6.2019) for details, regarding MOOC credits. Minimum credit to be earned is **03** through MOOC for I Year B.Tech. students admitted in 2019 and onwards.

J C BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCAFARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B. TECH 2nd YEAR (SEMESTER – III) CIVIL ENGINEERING (2022-23)

Course No.	Course Title	Teaching Schedule				Marks for Sessional	Marks for End Term Examination		Total Marks	Credits	Course Code
		L	T	P	Total		Theory	Practical			
ESC201	Basic Electronics	3	0	0	3	25	75	0	100	3	ESC
HSMC01	Effective Technical Communication	3	0	0	3	25	75	0	100	3	HSMC
ESC-203R	Engineering Mechanics	3	1	0	4	25	75	0	100	4	ESC
PCC-CED201	Fluid Mechanics	3	0	0	3	25	75	0	100	3	PCC
PCC-CED202	Surveying	3	0	0	3	25	75	0	100	3	PCC
PCC-CED203	Building Materials and Testing	3	0	0	3	25	75	0	100	3	PCC
PCC-CED201P	Fluid Mechanics Lab	0	0	2	2	15	0	35	50	1	PCC
PCC-CED202P	Survey Lab	0	0	2	2	15	0	35	50	1	PCC
PCC-CED203P	Materials Testing Lab	0	0	2	2	15	0	35	50	1	PCC
PRCED-1P	Skilled Based Project-I	0	0	2	2	15	0	35	50	2	PRCED
MC-01	Audit Course-1 Indian Constitution	1	0	0	1	25	75	0	0	0	MC
	Total	**19**	**1**	**8**	**28**				**800**	**24**	

J C BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCAFARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B. TECH 2nd YEAR (SEMESTER – IV) CIVIL ENGINEERING (2022-23)

Course No.	Course Title	Teaching Schedule				Marks for Sessional	Marks for End Term Examination		Total Marks	Credits	Course Code
		L	T	P	Total		Theory	Practical			
PCC-CED204	Engineering Geology	3	0	0	3	25	75	0	100	3	PCC
PCC-CED205	Strength of Materials	3	0	0	3	25	75	0	100	3	PCC
PCC-CED206	Highway Engineering	3	0	0	3	25	75	0	100	3	PCC
PCC-CED207	Soil Mechanics	3	0	0	3	25	75	0	100	3	PCC
PCC-CED208	Environmental Engineering	3	0	0	3	25	75	0	100	3	PCC
BSC-201	Mathematics-III	3	0	0	3	25	75	0	100	3	BSC
BSC-01	Biology	3	0	0	3	25	75	0	100	3	BSC
PCC-CED206P	Highway Engineering Lab	0	0	2	2	15	0	35	50	1	PCC
PCC-CED207P	Soil Mechanics Lab	0	0	2	2	15	0	35	50	1	PCC
PCC-CED208P	Environmental Engineering Lab	0	0	2	2	15	0	35	50	1	PCC
HSMC(H102)	Universal Human Values 2: Understanding Harmony	2	1	0	3	50	50	0	100	0	HSMC
MC-04	Audit Course-2: Bhagwat Gita	1	0	0	1	25	75	0	0	0	MC
PRCED-2P	Skilled Based Project-II	0	0	2	2	15	0	35	50	2	PRCED
	Total	**24**	**1**	**8**	**33**				**1000**	**26**	

J C BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS

B. TECH 3rd YEAR (SEMESTER –V) CIVIL ENGINEERING (2022-23)

Course No.	Course Title	Teaching Schedule				Marks for Sessional	Marks for End Term Examination		Total Marks	Credits	Course Code
		L	T	P	Total		Theory	Practical			
PCC-CED301	Railway and Airport Engineering	3	0	0	3	25	75	0	100	3	PCC
PCC-CED302	Structural Analysis	3	0	0	3	25	75	0	100	3	PCC
PCC-CED303	Foundation Engineering	3	0	0	3	25	75	0	100	3	PCC
PCC-CED304	Hydraulic Engineering	3	0	0	3	25	75	0	100	3	PCC
PCC-CED305	Geomatics Engineering	3	0	0	3	25	75	0	100	3	PCC
PCC-CED306	Wastewater Engineering	3	0	0	3	25	75	0	100	3	PCC
PCC-CED304P	Hydraulic Engineering Lab	0	0	2	2	15	0	35	50	1	PCC
PCC-CED306P	Wastewater Engineering Lab	0	0	2	2	15	0	35	50	1	PCC
PCC-CED307P	Computational Analysis and Design Laboratory	0	0	2	2	15	0	35	50	1	PCC
OEC-CED301	Open Elective - I	3	0	0	3	25	75	0	100	3	OEC
PRCED-3P	Skilled Based Project-III	0	0	2	2	15	0	35	50	2	PRCED
PEC-CED-SC	Survey Camp	-	-	-	-	50	0	0	50	2	PEC
	Total	**21**	**0**	**8**	**29**				**950**	**28**	

Surveying Camp to be organized at the end of the semester.

J C BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B. TECH 3rd YEAR (SEMESTER –VI) CIVIL ENGINEERING (2022-23)

Course No.	Course Title	Teaching Schedule				Marks for Sessional	Marks for End Term Examination		Total Marks	Credits*	Course Code
		L	T	P	Total		Theory	Practical			
PCC-CED308	Design of Concrete Structures	3	0	0	3	25	75	0	100	3	PCC
PCC-CED309	Engineering Hydrology	3	0	0	3	25	75	0	100	3	PCC
PEC-CED301	Elective I	3	0	0	3	25	75	0	100	3	PEC
PEC-CED302	Elective-II	3	0	0	3	25	75	0	100	3	PEC
PEC-CED303	Elective-III	3	0	0	3	25	75	0	100	3	PEC
PEC-CED304	Elective-IV	3	0	0	3	25	75	0	100	3	PEC
PRCED-4P	Skilled Based Project-IV	0	0	2	2	15	0	35	50	2	PRCED
OEC-CED302	Open Elective - II	3	0	0	3	25	75	0	100	3	OEC
	Total	**21**	**0**	**2**	**23**				**750**	**23**	

J C BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B. TECH 4th YEAR (SEMESTER –VII) CIVIL ENGINEERING (2022-23)

Course No.	Course Title	Teaching Schedule				Marks for Sessional	Marks for End Term Examination		Total Marks	Credits	Course Code
		L	T	P	Total		Theory	Practical			
PCC-CED401	Construction Planning and Management	3	0	0	3	25	75	0	100	3	PCC
PCC-CED402	Design of Steel Structures	3	0	0	3	25	75	0	100	3	PCC
PCC-CED403	Irrigation Engineering	3	0	0	3	25	75	0	100	3	PCC
PEC-CED405	Elective-V	3	0	0	3	25	75	0	100	3	PEC
PEC-CED406	Elective-VI	3	0	0	3	25	75	0	100	3	PEC
OEC-CED403	Open Elective - III	3	0	0	3	25	75	0	100	3	OEC
PRCED-5P	Skilled Based Project-V	0	0	2	2	15	0	35	50	2	PRCED
	Total	**18**	**0**	**2**	**20**				**650**	**20**	

J C BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B. TECH 4th YEAR (SEMESTER – VIII) CIVIL ENGINEERING (2020-21)

Sl. No.	Course Title	Code	Hours per week			Sessional	End Semester	Total	Credits
			L	T	P				
1	Industrial Training with projects	PRCED-6P	0	0	30	150	350	500	10 (including 02 credit or 20% weightage for project)

Procedure for Annual Exam and Continuous Assessment of Industrial Training:

(A) Annual Exams Marks

1. Training Evaluation	100 Marks
2. Training Seminar	100 Marks
3. Training Viva	150 Marks

(B) Continuous Assessment Marks

1. Assessment by University / Institute Faculty	50 Marks
2. Assessment by Industrial Guide	50 Marks
3. Conduct Marks	50 Marks

Total: 500 Marks

PROFESSIONAL ELECTIVE COURSES CIVIL ENGINEERING

S. No	Code No.	**Subject**	**Semester**	**Credits /Lectures**
1.	PEC-CED301	Elective-I	VI	3
2.	PEC-CED302	Elective-II	VI	3
3.	PEC-CED303	Elective-III	VI	3
4.	PEC-CED304	Elective-IV	VI	3
5.	PEC- CED405	Elective V	VII	3
6.	PEC- CED406	Elective VI	VII	3

PROFESSIONAL ELECTIVE COURSE TRACKS- CIVIL ENGINEERING [PEC-CED]

The following six Mandatory Professional Specialized Tracks offer electives in the respectiveTracks:

Track	**Professional Elective Courses (PEC)**
I	Transportation Engineering
II	Environmental Engineering
III	Geotechnical Engineering
IV	Structural Engineering
V	Water Resource Engineering
VI	Disaster Management

The students will have options of selecting the electives from the different tracks depending on the specialization one wishes to acquire.

Professional Elective Courses (PEC)

Elective-I, PEC-CED301

Note: PEC-CED301-1 subject 1 Highway Construction and Management coding: indicates that Program elective scheme subject code is **PEC-CED301** and S. No. 1 is chosen for this semester.

1. Highway Construction and Management
2. Traffic Analysis and Transportation Planning
3. Dock and Harbours
4. Metro and Tunnel Engineering

Elective-II, PEC-CED302

Note: PEC CED 302-1 subject 1 Environmental Engineering coding: indicates that Program elective scheme subject code is PEC CED-302 and S. No. 1 is chosen for this semester.

1. Environmental Impact Assessment
2. Solid and Hazardous Waste Management
3. Air & Noise Pollution Control
4. Environmental Systems and Legislation

Elective-III, PEC-CED303
Note: PEC CED 303-1 subject 1 Geotechnical Engineering coding: indicates that Program elective scheme subject code is PEC CED-303 and S. No. 1 is chosen for this semester.

1. Geo-Environmental Engineering
2. Advance Foundation Engineering
3. Soil Dynamics and Machine Foundation
4. Ground Improvement Techniques

Elective-IV, PEC-CED304
Note: PEC CED 304-1 subject 1 Structural Engineering coding: indicates that Program elective scheme subject code is PEC CED-304 and S. No. 1 is chosen for this semester.

1. Sustainable Construction Practices
2. Design of Prestressed Structures
3. Earthquake Resistant Structures
4. Composite Structures

Elective-V, PEC-CED405
Note: PEC CED 405-1 subject 1 Ground Water Flow and Pollution Modelling coding: indicates that Program elective scheme subject code is PEC CED-405 and S. No. 1 is chosen for this semester.

1. Ground Water Flow and Pollution Modelling
2. GIS and Remote Sensing
3. Draught and Flood
4. Ground Water Engineering

Elective-VI, PEC-CED406
Note: PEC CED 406-1 subject 1 Disaster Management and Mitigation coding: indicates that Program elective scheme subject code is PEC CED-406 and S. No. 1 is chosen for this semester.

1. Disaster Management and Mitigation
2. Solid And Hazardous Waste Management
3. Retrofitting and Structural Health Monitoring
4. Fire and Safety Engineering

OPEN ELECTIVE COURSE CIVIL ENGINEERING
(3 Credit/3Lecture each)

There may be at least three different electives from the open elective course choices (OEC).
Open Elective I, OEC-CED301
Note: OEC-CED301-2 indicates that open elective scheme subject code is OEC-CED301 and S. No. 2 is chosen for Solid Waste Management Subject.

1. Non-Conventional Energy Resources and Utilisation
2. Solid Waste Management
3. Energy studies
4. Environmental Science

Open Elective II, OEC-CED302
Note: OEC-CED302-3 indicates that open elective scheme subject code is OEC-CED302 and S. No. 3 is chosen for Human Resource Management Subject.

1. Research and IPR
2. Soft Skills for Engineers

3. Human Resource Management
4. Engineering Economics

Open Elective III, OEC-CED403

Note: OEC-CED403-4 indicates that open elective scheme subject code is OEC-CED403 and S. No. 4 is chosen for Safety Engineering Subject.

1. Civil Engineering – Societal & Global Impact
2. Estimation and Costing
3. Metro System and Engineering
4. Safety Engineering

SEMESTER - I

BSC 101B: PHYSICS (MECHANICS)

L	T	P	Total
3	1	0	4

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Content:

UNIT I: Scalars and Vectors
Transformation of scalars and vectors under Rotation transformation
Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law; Solving Newton's equations of motion in polar coordinates; Problems including constraints and friction; Extension to cylindrical and spherical coordinates

UNIT II: Potential energy function
F = - Grad V, equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, curl of a force field; Central forces; Conservation of Angular Momentum; Energy equation and energy diagrams; Elliptical, parabolic and hyperbolic orbits; Kepler problem; Application: Satellite maneuvers;

UNIT III: Non-inertial frames of reference
Rotating coordinate system: Five-term acceleration formula- Centripetal and Coriolis accelerations; Applications: Weather systems, Foucault pendulum;

UNIT IV: Simple harmonic Motion
Harmonic oscillator; Damped harmonic motion – over-damped, critically damped and lightly-damped oscillators; Forced oscillations and resonance

UNIT V: Rigid body
Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion; Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion; Examples

UNIT VI: Three-Dimensional Rigid body motion
Introduction to three-dimensional rigid body motion — only need to highlight the distinction from two-dimensional motion in terms of (a) Angular velocity vector, and its rate of change and (b) Moment of inertia tensor; Three-dimensional motion of a rigid body wherein all points move in a coplanar manner: e.g. Rod executing conical motion with center of mass fixed — only need to show that this motion looks two-dimensional but is three-dimensional, and two- dimensional formulation fails.

Reference books:

1. Engineering Mechanics, 2nd ed. — MK Harbola
2. Introduction to Mechanics — MK Verma
3. An Introduction to Mechanics — D Kleppner& R Kolenkow
4. Principles of Mechanics — JL Synge & BA Griffiths
5. Mechanics — JP Den Hartog
6. Engineering Mechanics - Dynamics, 7thed. - JL Meriam
7. Mechanical Vibrations — JP Den Hartog
8. Theory of Vibrations with Applications — WT Thomson

BSC 103B: MATHEMATICS I

L	T	P	Total
3	1	0	4

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Content:

UNIT I: Calculus: (6 hours) Calculus (Single Variable)
Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

UNIT II: Calculus: (6 hours)
Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

UNIT III: Sequences and series: (10 hours)
Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions; Fourier series: Half range sine and cosine series, Parseval's theorem.
Multivariable Calculus

UNIT IV: Multivariable Calculus (Differentiation) (10 hours)
Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

UNIT V: Multivariable Calculus (Integration) (6 hours)
Multiple Integration: Double integrals, change of order of integration. Double integral in polar coordinates, Applications of double integration to find area enclosed by plane curves and volume of solids of revolution. Triple integral: Change of variables, volume of solids.

UNIT VI: Matrices (8 hours)
Matrices, vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

ESC 102 ENGINEERING GRAPHICS AND DESIGN

L	T	P	Total
0	0	0	4

Sessional: 30 marks
Theory: 70 marks
Total: 100 marks
Duration of exam: 4 hours

Course Outcomes

- All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to:
- Learn about the visual aspects of engineering design.
- Analyse engineering graphics standards.
- Prepare orthographic and isometric projection.
- Draw section of solids and conic sections.
- Exposure to computer-aided geometric design

Course Content:

- Traditional Engineering Graphics:
- Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.
- Computer Graphics:
- Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)

UNIT I: Introduction to Engineering Drawing covering,
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

UNIT II: Orthographic Projections covering,
Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

UNIT III: Projections of Regular Solids covering,
Those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

UNIT IV: Sections and Sectional Views of Right Angular Solids covering,
Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT V: Isometric Projections covering,
Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

UNIT VI: Overview of Computer Graphics covering,
listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

UNIT VII: Customization & CAD Drawing
consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles.

Text/Reference Books:

1. (Corresponding set of) CAD Software Theory and User Manuals
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
4. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
5. Aggarwal M L & Sandhya Dixit (2017), Engineering Graphics and Machine Drawing, Dhanpat Rai & Company P Ltd.
6. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers

ESC 103 PROGRAMMING FOR PROBLEM SOLVING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Outcomes

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

Course Content:

Unit 1 Introduction to Programming (4 lectures)
Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **(1 lecture).**
Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**
From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)**

Unit 2: Arithmetic expressions and precedence (2 lectures)
Conditional Branching and Loops **(6 lectures)**
Writing and evaluation of conditionals and consequent branching **(3 lectures)**
Iteration and loops **(3 lectures)**

Unit 3Arrays (6 lectures)
Arrays (1-D, 2-D), Character arrays and Strings

Unit 4 Basic Algorithms (6 lectures)
Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 5 Function (5 lectures)
Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 6 Recursion (4 -5 lectures)
Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 7 Structure (4 lectures)
Structures, Defining structures and Array of Structures

Unit 8 Pointers (2 lectures)
Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 9
File handling (only if time is available, otherwise should be done as part of the lab)

Text Books

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. Bala Guruswamy, Programming in ANSI C, Tata McGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

ESC 104 WORKSHOP- I

L	T	P	Total
0	0	4	4

Sessional: 30 marks
Theory: 70 marks
Total: 100 marks
Duration of exam: 4 hours

MECHANICAL WORKSHOP

Course Outcomes (COs): After studying this course the students would:

- Have exposure to mechanical workshop layout and safety aspects.
- Understand the functions of various machines and cutting tools used in machine shop.
- Practice real time job preparation using various operations related to machine shop such as filing, drilling, milling & turning.
- Practice job preparation in welding shop.
- Learn to use different measuring tools like vernier caliper, vernier height gauge and micrometer.
- Practice job preparation in sheet metal shop.

List of Exercises:
Fitting, sheet metal and welding workshop:

1. To study layout, safety measures and different engineering materials (mild steel, medium carbon steel, high carbon steel, high speed steel and cast iron etc) used in workshop.
2. To study and use of different types of tools, equipments, devices & machines used in fitting, sheet metal and welding section.
3. To determine the least count of vernier calliper, vernier height gauge, micrometer and take different reading over given metallic pieces using these instruments.
4. To study and demonstrate the parts, specifications & operations performed on lathe machine.
5. To study and demonstrate the parts, specifications & operations performed on milling machine.
6. To study and demonstrate the parts, specifications & operations performed on shaper machine.
7. To prepare a job involving different type of filing practice exercise in specified dimensions.
8. To prepare a job involving multi operational exercise (drilling, counter sinking, tapping, reaming, hack sawing etc.)
9. To prepare a multi operational sheet metal job (self-secured single groove joint/ hasp & stay etc.).
10. To practice striking an arc, straight short bead, straight continuous bead and restart of electrode in flat position by arc welding on given M.S. plate as per size.
11. To practice tack weld of two close plate in flat position by arc welding on given M.S. plate as per size.
12. To practice close butt joint in flat position by arc welding on given M.S. plate as per size.

NOTE: - At least nine exercises should be performed from the above list; remaining three may either be performed from above list or designed by the concerned institution as per the scope of the syllabus and facilities available in institute.

BSC-104: PHYSICS LAB

L	T	P	Total
0	0	3	3

Sessional: 15 marks
Theory: 35 marks
Total: 50 marks
Duration of exam: 3 hours

Select at least 06 experiments from the following:

1. To determine the height of a building using a Sextant.
2. To study the Motion of Spring and calculate (a) Spring constant, (b) **g** and (c) Modulus of rigidity.
3. To determine the Moment of Inertia of a Flywheel.
4. To determine the Young's Modulus of a Wire by Optical Lever Method.
5. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
6. To determine the elastic Constants of a wire by Searle's method.
7. To determine the value of g using Bar Pendulum.
8. To determine the value of g using Kater's Pendulum
9. Note: Experiments may be added or deleted as per the availability of equipments.

Reference Books:

1. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practical's, Michael Nelson and Jon M. Ogborn, 4^{th} Edition, reprinted 1985, Heinemann Educational Publishers
3. Engineering Practical Physics, S. Panigrahi & B.Mallick,1515, Cengage Learning India Pvt. Ltd.
4. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11^{th} Edn, 1511, Kitab Mahal

ESC 105: PROGRAMMING FOR PROBLEM SOLVING LAB

L	T	P	Total
0	0	4	4

Sessional: 15 marks
Theory: 35 marks
Total: 50 marks
Duration of exam: 4 hours

Laboratory Outcomes

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to write iterative as well as recursive programs
- To be able to represent data in arrays, strings and structures and manipulate them through a program
- To be able to declare pointers of different types and use them in defining self- referential structures.
- To be able to create, read and write to and from simple text files.

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures

Tutorial 12: File handling:
Lab 12: File operations

SEMESTER - II

BSC 106B: MATHEMATICS- II (DIFFERENTIAL EQUATIONS)

L	T	P	Total
3	1	0	4

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Content:

UNIT I: First order ordinary differential equations (6 hours)
Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

UNIT II: Ordinary differential equations of higher orders (Prerequisite 2c, 4a) (8 hours)
Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

UNIT III: Partial Differential Equations
First order (Prerequisite 5a-b) (6 hours)
First order partial differential equations, solutions of first order linear and non-linear PDEs.

UNIT IV: Partial Differential Equations
Higher order (Prerequisite 5b-c) (10 hours) Solution to homogenous and non-homogenous linear partial differential equations second and higher order by complimentary function and particular integral method. Flows, vibrations and diffusions, second-order linear equations and their classification, Initial and boundary conditions (with an informal description of well-posed problems), D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables. Boundary-value problems: Solution of boundary-value problems for various linear PDEs in various geometries.

Textbooks/References (for Module 1 and 2):

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary
3. Value Problems, 9th Edition, Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
6. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
7. G.F. Simmons and S.G. Krantz, Differential Equations, Tata McGraw Hill, 2007.

Textbooks/References (for module 3 and 4):

1. S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993.
2. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.
3. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.
4. Manish Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.

ESC 101A: BASIC ELECTRICAL TECHNOLOGY

L	T	P	Total
3	1	0	4

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Outcomes (COs): At the end of the course, the student shall be able to:

- Analyze and solve D. C. networks by different analysis methods and theorems.
- Formulate and solve complex AC single phase and three circuits.
- Identify the type of electrical machines and their applications.
- Introduce the components of low voltage electrical installations.

Course Contents:

UNIT I

DC Circuits: Basic definitions, Electrical circuit elements (R, L and C), voltage and current sources, Ohm's law and its limitations, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation by mesh analysis and node analysis, Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems. (10)

UNIT II

AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. (10)

UNIT III

Poly Phase Systems: Advantages of 3-phase systems, generation of 3-phase voltages, three phase connections (star and delta), voltage and current relations in star and delta connections, three phase powers, analysis of 3-phase balanced circuits, measurement of 3-phase power- 2 wattmeter method. (7)

UNIT IV

Transformers: Magnetic Circuits, construction and working of single-phase transformer, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency, Auto transformer (7)

UNIT V

Electrical Machines: Induction motor: Construction, principle and working of a three-phase induction motor, Single-phase induction motor: Construction, principle and working, Applications DC machine: Construction, principle and working of dc motor and generator. Applications Synchronous machine: Construction, principle and working of synchronous motor and generators. Applications. (9)

UNIT VI

Electrical Installations: Components of LT Switchgear: Fuses, MCB, ELCB, MCCB, Types of Wires, Earthing, Power factor improvement. (7)

Recommended/ Reference Books:

1. D. P. Kothari and, I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill.
3. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press.
4. E. Hughes, “Electrical and Electronics Technology”, Pearson.
5. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India.

Web Links:

1. NPTL Web Course, Basic Electrical Technology, Prof. G. D. Roy, Prof. N. K. De, Prof. T.K.
1. Bhattacharya, IIT Kharagpur
2. (https://nptel.ac.in/courses/108/105/108105053/)
3. NPTL Web Course, Electrical Machines-I, Prof. P. Sasidhara Rao, Prof. G. Sridhara Rao, Dr.
4. Krishna Vasudevan, IIT Madras
5. (https://nptel.ac.in/courses/108/106/108106071/)
2. NPTL Web Course, Electrical Machines-II, Prof. P. Sasidhara Rao, Prof. G. Sridhara Rao, Dr.
6. Krishna Vasudevan, IIT Madras
7. https://nptel.ac.in/courses/108/106/108106072/

BSC 102: CHEMISTRY

L	T	P	Total
3	1	0	4

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Outcomes

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalize bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalize periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

Course Content:

UNIT I Atomic and molecular structure (12 lectures)

Schrodinger equation. Particle in a box solution and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

UNIT II Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques. Diffraction and scattering.

UNIT III Intermolecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces.

UNIT IV Use of free energy in chemical equilibria (6 lectures)

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion.

Use of free energy considerations in metallurgy through Ellingham diagrams.

UNIT V Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

UNIT VI Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

UNIT VII Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Text Books

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and A. Plane
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
5. Physical Chemistry, by P. W. Atkins
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition

BSC 106: WORKSHOP II

L	T	P	Total
0	0	4	4

Sessional: 30 marks
Theory: 70 marks
Total: 100 marks
Duration of exam: 4 hours

PART-A
COMPUTER ENGINEERING WORKSHOP

Course Outcomes: After the completion of the course the student will be able to:

- Acquire skills in basic engineering practice.
- Have working knowledge of various equipment's used in workshop.
- Have hands on experience about various machines and their components.
- Obtain practical skills of basic operation and working of tools used in the workshop.

Course Content:

1. To study and demonstrate Block diagram of Digital Computer System and brief explanation of each unit.
2. To demonstrate History/ Generation/ classifications and different types of Personnel Computers.
3. To study and demonstrate internal parts of a Computer System (Card level) and other peripheral devices and explanation of POST & BIOS.
4. To study and demonstrate primary memory and secondary memory.
5. To demonstrate CPU Block diagram and other Peripheral chips, Mother Board/ Main Board and its parts, Connectors, Add On Card Slots etc.
6. To study working of various types of monitors: CRT type, LCD type & LED type.
7. To study Keyboard and Mouse: Wired, Wireless, Scroll & Optical with detail working.
8. To study Printers: Dot Matrix Printers, Daisy wheel Printers, Ink-Jet Printers and Laser Jet Printers with detailed working explanation.
9. Assembly / Installation and Maintenance of Personnel Computer Systems: Practical exercise on assembly of Personnel Computer System, Installation of Operating System: Windows & Linux etc, Installation of other Application Softwares and Utility Softwares, Fault finding in Personnel Computers: Software or Hardware wise, Virus: Introduction, its Types & Removal techniques, Data Backup and Restore, Data Recovery Concepts, Typical causes of Data loss.
10. To demonstrate networking concepts: Introduction of Connecting devices: Hub, Switch & Router etc, Networking Cable preparation: Normal & Cross Cables, Data Transferring Techniques from one Computer System to another Computer System, Configuration of Switch/ Routers etc.

PART-B
ELECTRICAL WORKSHOP

1. Introduction of Electrical Safety precautions, Electrical Symbols, Electrical Materials, abbreviations commonly used in Electrical Engg. and familiarization with tools used in Electrical Works.
2. To make a Straight Joint & Tee joint on 7/22 PVC wire and Britannia Joint on GI wire.
3. To study fluorescent Tube Light, Sodium Lamp and High-Pressure Mercury Vapour Lamp.
4. To study different types of earthing and protection devices e.g., MCBs, ELCBs and fuses.
5. To study different types of domestic and industrial wiring and wire up a circuit used for Stair case and Godown wiring.
6. To make the connection of fan regulator with lamp to study the effect of increasing and decreasing resistance in steps on the lamp.
7. To fabricate half wave and full wave rectifiers with filters on PCB.
8. Maintenance and Repair of Electrical equipment i,e Electric Iron , Electric Toaster ,Water heater, Air coolers and Electric Fans etc.
9. To study soldering process with simple soldering exercises.
10. To make the connection of a three core cable to three pin power plug and connect the other cable end by secured eyes connection using 23/0.0076” or 40/0.0076” cable.

PART- C
ELECTRONICS WORKSHOP

1. To study and demonstrate basic electronic components, Diode, Transistor, Resistance, Inductor and capacitor.
2. To study and demonstrate resistance color coding, measurement using color code and multimeter and error calculation considering tolerance of resistance.
3. To study and demonstrate Multimeter and CRO- front panel controls, description of block diagram of CRT and block diagram of CRO.
4. To study and demonstrate Vp(peak voltage),Vpp(peak to peak voltage), Time, frequency and phase using CRO.
5. Introduction to function generator. Functions of front panel controls and measurement of different functions on CRO.
6. To study and demonstrate variable DC regulated power supply, function of controls and DC measurement using multimeter and CRO.
7. Soldering practice on wire mesh or a resistance decade board includes fabrication, soldering, lacing, harnessing forming and observation.
8. Testing of components using multimeter and CRO like diode, transistor, resistance capacitor, Zener diode and LED.
9. To study and demonstrate rectification, half wave, Full wave and bridge rectifier. Fabrication, assembly and waveform observation.
10. To design and fabricate a printed circuit board of a Zener regulated/ series regulated power supply and various measurements, testing of power supply.

Note: At least 8 exercises are to be performed from each part by the students.

HSMC 101: ENGLISH

L	T	P	Total
2	0	2	2

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Content:

UNIT I: Vocabulary Building
The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives., Synonyms, antonyms, and standard abbreviations.

UNIT II Basic Writing Skills
Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely.

UNIT III Identifying Common Errors in Writing
Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés.

UNIT IV Nature and Style of sensible Writing
Describing, Defining, Classifying, Providing examples or evidence

UNIT V Writing introduction and conclusion

UNIT VI Writing Practices
Comprehension, Précis Writing, Essay Writing

ESC 107: BASIC ELECTRICAL TECHNOLOGY LAB

L	T	P	Total
0	0	2	2

Sessional: 15 marks
Theory: 35 marks
Total: 50 marks
Duration of exam: 2 hours

Course Outcomes (COs): At the end of the course, the student shall be able to:

- Get an exposure to common electrical components and their ratings.
- Make electrical connections by wires of appropriate ratings.
- Understand the usage of common electrical measuring instruments.
- Understand the basic characteristics of transformers and electrical machines.
- Get an exposure to the working of power electronic converters.

List of Experiments/ Demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Verification of network theorem in DC circuits, Thevenin's Theorem, Norton's, Theorem, Superposition Theorem etc.
3. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
4. Poly phase systems, three phase connections (star and delta), measurement of three phase power.
5. Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
6. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
7. Torque Speed Characteristic of separately excited dc motor.
8. Components of LT switchgear.

BSC 105: CHEMISTRY LAB

L	T	P	Total
0	0	3	3

Sessional: 15 marks
Theory: 35 marks
Total: 50 marks
Duration of exam: 3 hours

Laboratory Outcomes

- The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:
- Estimate rate constants of reactions from concentration of reactants/products as a function of time
- Measure molecular/system properties such as surface tension, viscosity conductance of solutions, redox potentials, chloride content of water, etc
- Synthesize a small drug molecule and analyse a salt sample.

Chemistry Laboratory

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Colligative properties using freezing point depression
6. Determination of the rate constant of a reaction
7. Determination of cell constant and conductance of solutions
8. Potentiometry - determination of redox potentials and emfs
9. Synthesis of a polymer/drug
10. Saponification/acid value of an oil
11. Chemical analysis of a salt
12. Lattice structures and packing of spheres
13. Models of potential energy surfaces
14. Chemical oscillations- Iodine clock reaction
15. Determination of the partition coefficient of a substance between two immiscible liquids
16. Adsorption of acetic acid by charcoal
17. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg .

HSMC 102: ENGLISH LAB

L	T	P	Total
0	0	2	2

Sessional: 15 marks
Theory: 35 marks
Total: 50 marks
Duration of exam: 2 hours

Course Outcomes

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

English Lab

1. Listening Comprehension
2. Pronunciation, Intonation, Stress and Rhythm
3. Common Everyday Situations: Conversations and Dialogues
4. Communication at Workplace
5. Interviews
6. Formal Presentations

Suggested Readings:

1. *Practical English Usage*. Michael Swan. OUP. 1995.
2. *Remedial English Grammar*. F.T. Wood. acmillan.2007
3. *On Writing Well.* William Zinsser. Harper Resource Book. 2001
4. *Study Writing.* Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. *Communication Skills*. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. *Exercises in Spoken English.* Parts. I-III. CIEFL, Hyderabad. Oxford University Press

SEMESTER - III

ESC- 201 BASIC ELECTRONICS ENGINEERING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective: To provide an overview of electronic device components to Mechanical engineering students.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Understand the principles of semiconductor devices and their applications.
2. Design an application using an Operational amplifier.
3. Understand the working of timing circuits and oscillators.
4. Understand logic gates and flip flop as a building block of digital systems.
5. Learn the basics of electronic communication systems.
6. Design the Rigid pavement.

Course Content:

UNIT-I

Semiconductor Devices and Applications: Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single-stage CE amplifier, frequency response and bandwidth.

UNIT-II

Operational amplifier and its applications: Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, Inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.

UNIT-III

Timing Circuits and Oscillators: RC-timing circuits, IC 555 and its applications as stable and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator.

UNIT-IV

Digital Electronics Fundamentals: Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K-map, Logic ICs, half and full adder/subtractor, multiplexers, de-multiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications.

UNIT-V

Electronic Communication Systems: The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.

Reference Books:

1. Floyd ," Electronic Devices" Pearson Education 9th edition, 2012.
2. R.P. Jain , "Modern Digital Electronics", Tata Mc Graw Hill, 3rd Edition, 2007.
3. Frenzel, "Communication Electronics: Principles and Applications", Tata Mc Graw Hill, 3rd Edition, 2001

HSMC01 EFFECTIVE TECHNICAL COMMUNICATION

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective: To provide an overview of English communication of engineering students.

Course Outcomes (CO):

- Students will be able to demonstrate an understanding of the fundamental concepts and principles of Information Design and Development.
- Students will be able to apply the knowledge and skills learned in the course to real-world problems related to Technical Writing, Grammar and Editing.
- Students will be able to analyze and evaluate information critically, especially in the context of Self-Development and Assessment.
- Students will be able to communicate effectively in writing, speaking, and graphic presentation, especially in the context of Communication and Technical Writing.
- Students will be able to work collaboratively with others to achieve common goals, especially in the context of Technical Writing, Grammar and Editing.
- Students will be able to demonstrate an appreciation for ethical considerations in technical communication, especially in the context of Ethics.

Course Content:

UNIT: I

Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

UNIT: II

Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization.

UNIT: III

Self-Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, taking notes; Complex problem solving; Creativity.

UNIT: IV

Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report

UNIT: V

Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, engineering ethics, managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, taking notes, Complex problem solving, Creativity.

Text/Reference Books:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York,2004
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN0312406843)
3. Shiv Khera, You Can Win, Macmillan Books, NewYork,2003.
4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.

ESC-203R ENGINEERING MECHANICS

L	T	P	Total
3	0	1	4

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

To understand the various important mechanical properties of material for designing of structural components such as beams, columns, pressure vessels, springs etc.

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Understand the fundamental principles of forces, FBD and equilibrium
2. Study the concept of friction, work, energy and degree of freedom
3. Determine the centroid, first moment and second moment of various areas.
4. Analyse the various motions and rotation of rigid bodies.
5. Study the equation of motions and momentum
6. Understand system of motion, impact, conservation of energy and momentum

Course Content:

UNIT I:
Introduction to Mechanics, Fundamental Principles, Coplanar forces, Equilibrium of particles, Free body diagram, Equilibrium of particle in space, Single equivalent force, Equilibrium of rigid bodies in two dimensions, Analysis of plane trusses, Method of joints, Method of sections, Zero-force member

UNIT II:
Characteristics of dry friction, Problems involving dry friction, Ladder, Wedges, Square threaded screws, Definition of virtual work, Principle of virtual work, System of connected rigid bodies, Degrees of freedom, Conservative forces, Potential energy, Potential energy criteria for equilibrium.

UNIT III:
Centroid, First moment of area, Theorems of Pappus and Guldinus, Second moment of area, Moment and Product of inertia of plane areas, Transfer Theorems, Polar moment of inertia, Principal axes, Mass moment of inertia

UNIT IV:
Position, Velocity and Acceleration, Rectilinear motion, Curvilinear motion of a particle, Tangential and Normal components, Radial and Transverse components, Rotation of rigid bodies about a fixed axis.

UNIT V:
General plane motion, Absolute and relative motion method, Instantaneous centre of rotation in plane motion, Linear momentum, Equation of motion, Angular momentum of a particle and rigid body in plane motion, D'Alembert's principlePrinciple of work and energy for a particle and a rigid body in plane motion,

UNIT VI:

Conservation of energy, Principle of impulse and momentum for a particle and a rigid bodies in plane motion, Conservation of momentum, System of rigid bodies, Impact, direct and central impact, coefficient of restitution

Reference Books:

1. Mechanics of Materials by Hibbeler, Pearson.
2. Mechanics of Materials by.Beer, Jhonston, DEwolf and Mazurek, TMH
3. A. K. Tayal (2009), Engineering Mechanics – Statics and Dynamics, Umesh Publications, ISBN- 978-8 188-11401-6.
4. Introduction to Solid Mechanics by Shames, PHI
5. P. Ferdinand, E. Beer and J. Russell (2010), Vector Mechanics for Engineers, 9th Edition, McGraw-Hill International Edition. ISBN: 978-0-079-12637-5
6. P. Ferdinand, E. Beer and J. Russell (2010), Vector Mechanics for Engineers, 9th Edition, McGraw-Hill International Edition. ISBN: 978-0-079-12637-5

PCC-CED201 FLUID MECHANICS

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

1. To apply hydrostatic law, principle of mass and momentum in fluid flows, concepts in Euler's and Bernoulli equations.
2. To provide fundamental knowledge of fluids, its properties and behaviour under various conditions of internal and external flows.
3. To determine the losses in a flow system, flow through pipes, boundary layer concepts.

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Analyse various hydraulic systems by applying the fundamental laws of fluid statics.
2. Solve the fluid flow governing equations by taking suitable constraints and assumptions
3. Evaluate major and minor losses in pipes
4. Analyse the practical significance of open channel flows
5. Perform dimensional analysis on any real-life problems
6. Interpret the boundary layer aspects of laminar and turbulent flows

Course Content:

UNIT I: 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 II: Kinematics of Fluid Flow
Steady & 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, graphical and experimental methods of drawing flownets.

UNIT III: 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 IV: 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, aeration of nappe.

UNIT V: Laminar Flow

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

Flow through pipes

Types of flows-Reynold's experiment, shear stress on turbulent flow, boundary layer in pipes-Establishment of flow, velocity distribution for turbulent flow in smooth and rough pipes, resistance to flow of fluid in smooth and rough pipes, Stanton and Moody's diagram. 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.

UNIT VI: Drag and Lift

Types of drag, drag on a sphere, flat plate, cylinder and airfoil, development of lift on immersed bodies like circular cylinder and airfoil.

Dimensional Analysis and Hydraulic Similitude

Dimensional analysis, Buckinghum pi theorem, important dimensionless numbers and their significance, geometric, kinematic and dynamic similarity, model studies, physical modeling, similar and distorted models.

Reference Books:

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. McDonald
5. Fluid Mechanics Through Problems by R. I. Garde
6. Engineering Fluid Mechanics by R. I. Garde & A.G. Mirajgaoker

PCC-CED202 SURVEYING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

In this subject, the students will acquire basic knowledge on building materials such as stones, bricks, cement, aggregates, mortar and concrete. Study various aspects of paints, varnishes and timber. Develop knowledge of material science and behaviour of various building materials used in construction. Identify the construction materials required for the assigned work.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Posses a sound knowledge of fundamental principles Geodetics.
2. Measurement of vertical and horizontal plane, linear and angular dimensions to arrive at solutions to basic surveying problems.
3. Capture geodetic data to process and perform analysis for survey problems.
4. Analyse the obtained spatial data and compute areas and volumes. Represent 3D data on plane figures as contours.
5. Determine the horizontal and vertical angles
6. Study the plane table surveying

Course Contents:

UNIT I:

Importance of surveying to engineers, plane and geodetic surveying, principles of surveying, classification of surveys, Accuracy and Errors, Linear Measurements, Measurement of directions: Reference meridians, bearing and azimuths, Compass.

UNIT II:

Methods of determining elevations, Direct levelling- basic terms and definitions, principle, booking and reduction of field notes, curvature and refraction correction, Automatic level, Digital Level, Vertical Control.

UNIT III:

Contouring: methods and uses, Tacheometric surveying, Stadia Tachometry, Different Types of Tachometric Measurements, Analytic lens, Tangential method, Temporary and permanent adjustments Theodolite surveying, Vernier theodolite, Electronic Theodolites and Total Station.

UNIT IV:

Measurement of horizontal and vertical angles, Methods of repetition and reiteration, errors in theodolite surveying, elimination of errors, Area and volume computation, area from latitude and departure, Simpson's rule and Trapezoidal rule.

UNIT V:

Principles of traversing by compass and theodolite, computations of traverse coordinates, Principles and classification of triangulation systems, strength of figures, satellite stations, triangulation fieldwork. Plane table surveying, equipment, methods, resection by three-point problem

UNIT VI:

Elements of simple circular curves, theory and methods of setting out simple circular curves, transition curves- types and their characteristics, ideal transition curve, equations of various transition curves, Introduction to vertical curves

Reference Books:

1. B.C. Punmia, "Surveying Vol.1", Laxmi Publications pvt Ltd., New Delhi – 2009.
2. Kanetkar T P and S V Kulkarni, Surveying and Leveling Part I, Pune Vidyarthi Griha Prakashan, 1988.
3. S.K. Duggal, "Surveying Vol.1", Tata McGraw Hill Publishing Co. Ltd. New Delhi. – 2009.
4. K.R. Arora, "Surveying Vol. 1" Standard Book House, New Delhi. – 2010
5. R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi
6. A. Bannister, S. Raymond, R. Baker, "Surveying", Pearson, 7th ed., New Delhi

PCC-CED203 BUILDING MATERIALS AND CONSTRUCTION

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

In this subject, the students will acquire basic knowledge on building materials such as stones, bricks, cement, aggregates, mortar and concrete. Study various aspects of paints, varnishes and timber. Develop knowledge of material science and behaviour of various building materials used in construction. Identify the construction materials required for the assigned work.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Predict the properties of building stones and its classifications
2. Understand the concept of various methods of manufacture of bricks.
3. Obtain differentiate the fine aggregates and coarse aggregates under various views
4. Explain various types of cements and their applications in construction. Various field and laboratory tests on cement.
5. Analyze the importance of mineral and chemical admixtures, requirements of the concrete in construction
6. Understand the types of properties of wood, aluminium and manufacture of glass.

Course Contents:

UNIT I:

Stones: Classifications of stones, uses of stones as building materials, characteristics of good building stones. Bricks: Composition of brick clay. Process of manufacturing bricks. Characteristics of good building bricks, classification of bricks. Introduction to lightweight bricks. Timber: Timber as a building material and its uses. Various types of timber. Seasoning and its importance. Preservation of wood. Plywood & Laminates and their uses

UNIT II:

Cement: Chemical composition of cement, manufacturing process. Specifications for Ordinary Portland Cement, Types of cements. Fine Aggregate: Characteristics of good sand and its classifications, bulking of sand. Quarry sand. Coarse Aggregate: Characteristics of good coarse aggregates for manufacture of concrete.

UNIT III:

Cement: Various types of cement and their properties, Mortar: Types and uses. Concrete: Designation, workability of concrete – factors affecting, Slump test, Ready Mix Concrete (RMC).

UNIT IV:

Reinforcing steel: Types of reinforcement, specifications - M.S., HYSD, TMT. Paints: Constituents, characteristics of good paints, varnishes.

UNIT V:

Building Components and Foundations: Lintels, arches, different types of floors-concrete, mosaic, terrazzo floors, pitched, flat and curved roofs, lean-to roof, coupled roofs, trussed roofs, king and

queen post trusses; RCC roofs, madras terrace/shell roofs. Foundations: Shallow foundations, spread, combined, strap and mat footings

UNIT VI:

Wood, Aluminium and Glass: Structure, properties, seasoning of timber; Classification of various types of woods used in buildings, defects in timber; Alternative materials for wood, galvanized iron, fibre-reinforced plastics, steel, aluminium; Types of masonry, English and Flemish bonds, rubble and ashlars masonry, cavity and partition walls

Text Books:

1. S. K. Duggal, "Building Materials", New Age International Publishers.
2. Sushil Kumar "Building Materials and construction", Standard Publishers, 20th edition, reprint, 2015.
3. Dr.B. C. Punmia, Ashok kumar Jain, Arun Kumar Jain, "Building Construction", Laxmi Publications (P) ltd., New Delhi.
4. Rangawala S. C. "Engineering Materials", Charter Publishing House, Anand, India
5. PC Verghese, "Building Construction", PHI.
6. R. Chuddy, "Construction Technology",Vol 1&2, Longman UK.
7. Subhash Chander, "Basic Civil Engineering", Jain Brothers

Web Reference: www.nptel.ac.in/courses/105101088/2 home.htm

PCC-CED201P FLUID MECHANICS LAB

L	T	P	Total
0	0	2	2

Sessional: 15 marks
Theory: 35 marks
Total: 50 marks
Duration of exam: 3 hours

Course Objective:

This course aims to provide students with a comprehensive understanding of fluid mechanics and its applications in the field of naval architecture. Students will learn about the fundamental principles of fluid mechanics and their application to ship hydrostatics and stability. The course will also cover the design and analysis of various fluid systems used in ships.

Course Outcomes:

- Determine the metacentric height of a ship model.
- Verify Bernoulli's theorem.
- Determine the coefficient of discharge for an orificemeter/venturimeter.
- Determine the coefficient of discharge for an orifice under variable head.

List of Experiments:

1. To determine metacentric height of the ship model.
2. To verify the Bernoulli's theorem.
3. To determine coefficient of discharge for an Orificemeter/venturimeter.
4. To determine coefficient of discharge for an Orifice under variable head.
5. To calibrate a given notch.
6. To determine the coefficient of drag by Stoke's law for spherical bodies.
7. To study the phenomenon of cavitation in pipe flow.
8. To determine the critical Reynold's number for flow through commercial pipes.
9. To study the momentum characteristics of a given jet.
10. To determine head loss due to various pipe fittings.

Note: Students are required to complete at least eight experiments from the above list.

Reference Books:

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. McDonald
5. Fluid Mechanics Through Problems by R. I. Garde
6. Engineering Fluid Mechanics by R. I. Garde & A.G. Mirajgaoker

PCC-CED202P SURVEYING LAB

L	T	P	Total
0	0	2	2

Sessional: 15 marks
Theory: 35 marks
Total: 50 marks
Duration of exam: 3 hours

Course Objective:

This course aims to provide students with a comprehensive understanding of surveying and its applications in the field of civil engineering. Students will learn about the fundamental principles of surveying and their application to topographical maps, traverse surveys, levelling, and theodolite surveys. The course will also cover the design and analysis of various surveying instruments used in civil engineering.

Course Outcomes:

- Prepare a conventional symbol chart based on the study of different types of topographical maps.
- Measure bearings of a closed traverse by prismatic compass and adjust the traverse by graphical method.
- Find out reduced levels of given points using Auto/dumpy level.
- Perform fly levelling with Auto/tilting level.

List of Experiments:

1. To prepare conventional symbol chart based on the study of different types of topographical maps.
2. To measure bearings of a closed traverse by prismatic compass and to adjust the traverse by graphical method.
3. To find out reduced levels of given points using Auto/dumpy level.
4. To perform fly leveling with Auto/tilting level.
5. To study parts of a Vernier theodolite and measurement of horizontal and vertical angle.
6. To measure horizontal angle between two objects by repetition/reiteration method.
7. To determine the height of a vertical structure (e.g. chimney/ water tank etc.) using trigonometrical levelling by taking observations in single vertical plane.
8. To study various parts of Electronic Theodolite, Total Station and practice for measurement of distance, horizontal and vertical angles.
9. To set out a simple circular curve by Rankine's method
10. Plane Table Surveying.

Note: Students are required to complete at least eight experiments from the above list.

Reference Books:

1. B.C. Punmia, “Surveying Vol.1”, Laxmi Publications pvt Ltd., New Delhi – 2009.
2. Kanetkar T P and S V Kulkarni, Surveying and Leveling Part I, Pune Vidyarthi Griha Prakashan, 1988.
3. S.K. Duggal, “Surveying Vol.1”, Tata McGraw Hill Publishing Co. Ltd. New Delhi. – 2009.
4. K.R. Arora, “Surveying Vol. 1” Standard Book House, New Delhi. – 2010
5. R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi
6. A. Bannister, S. Raymond, R. Baker, “Surveying”, Pearson, 7th ed., New Delhi

PCC-CED203P MATERIALS TESTING LAB

L	T	P	Total
0	0	2	2

Sessional: 15 marks
Theory: 35 marks
Total: 50 marks
Duration of exam: 3 hours

Course Objective:

This course aims to provide students with a comprehensive understanding of construction materials and their properties. Students will learn about the fundamental principles of cement, aggregates, concrete, steel, and bricks. The course will also cover the design and analysis of various construction materials used in civil engineering.

Course Outcomes:

- Understand the properties of cement and its applications in construction.
- Analyze the properties of coarse aggregates and their impact on construction.
- Evaluate the properties of fine aggregates and their impact on construction.
- Analyze the properties of cement concrete and its applications in construction.

List of Experiments:

1. ***Cement:*** Normal Consistency, Initial & final setting time, Fineness of cement by air permeability and Le-chatalier's apparatus, Soundness of cement, Compressive strength, Tensile strength of Cement
2. ***Coarse Aggregate:*** Crushing value, Impact value, Water absorption, Sieve Analysis, Specific gravity & bulk density, Grading of aggregates.
3. ***Fine Aggregate:*** Sieve analysis of sand, Silt content of sand, Bulking of sand
4. ***Cement Concrete:*** Workability tests, compressive strength, Tensile strength
5. ***Reinforcing Steel:*** Tensile and yield strength, Percentage elongation
6. Non-destructive testing on concrete
7. ***Bricks:*** Water absorption, Dimension Tolerances, Compressive strength, Efflorescence

Note: Students are required to complete at least eight experiments from the above list.

MC-01 CONSTITUTION OF INDIA

L	T	P	Total
1	0	0	1

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

CONSTITUTION OF INDIA– BASIC FEATURES AND FUNDAMENTAL PRINCIPLES

The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the ―basic structure‖ of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of ―Constitutionalism‖ – a modern and progressive concept historically developed by the thinkers of ―liberalism‖ – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of ―constitutionalism‖ in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America. The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India‘s legacy of ―diversity‖. It has been said that Indian constitution reflects ideals of its freedom movement, however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be ―static‖ and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it ―as one of the strongest court in the world‖.

COURSE CONTENT

1. Meaning of the constitution law and constitutionalism.
2. Historical perspective of the Constitution of India.
3. Salient features and characteristics of the Constitution of India.
4. Scheme of the fundamental rights.
5. The scheme of the Fundamental Duties and its legal status.
6. The Directive Principles of State Policy – Its importance and implementation.
7. Federal structure and distribution of legislative and financial powers between the Union and the States.
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions : National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India

13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

REFERENCES:

1. The Constitutional Law Of India 9th Edition, by Pandey. J. N.
2. The Constitution of India by P.M.Bakshi
3. Constitution Law of India by Narender Kumar
4. Bare Act by P. M. Bakshi

SEMESTER – IV

PCC-CED204 ENGINEERING GEOLOGY

L	T	P	Total
3	0	0	0

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective: To teach the process of rock formation, engineering properties of rocks, structural features of rocks, occurrence of landslides and earthquake, and site selection for dam, reservoir, tunnel, bridge and highway

Course Outcomes (CO): On completion of this course, the students will be able to

1. Understand the formation, structure and texture of different rock types and their suitability in Civil construction
2. Know the rock weathering process, structural geology terms like dip, strike, outcrop and engineering properties of building stones
3. Appreciate the usefulness and utilization of natural materials in civil engineering works
4. Distinguish the structural features of rock such as folds, faults, joints and unconformities
5. Learn about earthquake, different seismic zones in India
6. Analyze and interpret geological reports and information and the latest geological exploration methods for suitable site selection

Course Contents:

UNIT I:

Introduction and importance of Geological knowledge, Rocks: their origin, structure and texture, Classification of igneous, sedimentary and metamorphic rocks and their suitability as engineering materials.

UNIT II:

Weathering and erosion of rocks, Stratification, Lamination bedding, Outcrop-its relation to topography, Dip and Strike of bed, Overlap, outlier and Inlier, Building stones and their engineering properties.

UNIT III:

Physical properties of minerals, Detailed study of certain rock forming minerals, Alkali aggregate reaction. Grouting, Pozzolonic materials.

UNIT IV:

Folds, Faults, Joints and unconformities, their classification, causes and relation to engineering behavior of rock masses, Landslides, its causes and preventive measures.

UNIT V:

Earthquake, its causes, classification, seismic zones of India and its geological consideration.

UNIT VI:

Geophysical exploration methods for sub-surface structure, Underground water and its origin, Aquifer & Aquiclude, Artesian wells, Underground provinces and its role as geological hazard, Site selection for dam, reservoir, tunnel, bridge and highway.

***References Books*:**

1. Reddy, D. V., Engineering Geology, Vikas Publication, 2nd edition, (2016)
2. Waltham, T., Foundations of Engineering Geology, Spon Press, 2nd edition, (2005)
3. Gokhale, K. V. G. K., Text book of Engineering Geology, B S Publication, (2008)
4. Singh, P., Enginering and General Geology, Katson Publishing House, 8th edition, (2008)
5. Bell, F. G., Fundamental of Engineering Geology, B S Publication, (2009)

PCC-CED205 STRENGTH OF MATERIALS

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective: The course will help the students understand the concepts of indeterminacy of structural elements, analysis of the structures, drawing shear force and bending moment diagrams.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Demonstrate the different theories of failure for brittle and ductile materials.
2. Apply the different methods of bending analysis.
3. Study the stresses in pressure vessels
4. Analyse the effect of bending and torsion on hollow and solid circular shafts.
5. Understand the bending and shear stress distribution in the beam
6. Demonstrate the different theories of failure for brittle and ductile materials.

Course Contents:

UNIT I:

Normal stress and strain, shear stress and strain, generalized Hooke's law, Elastic constants, strain energy, Compound stresses, stresses on inclines sections, thermal stresses, Energy due to axial force, Resilience, stresses due to impact and suddenly applied load.

UNIT II:

Principal stress and strain, maximum shear stress, Mohr's stress circle, three-dimensional state of stress & strain, equilibrium equations, theories of failure, Stresses in Beams: Pure Bending, Theory of Bending, normal and shear stresses distribution in beams of various cross sections due to transverse and axial loads, composite beams.

UNIT III:

Deflection of Beams: Equation of elastic curve, cantilever and simply supported beams, Macaulay's method, area moment method, fixed and continuous beams Torsion: Torsion, combined bending & torsion of solid & hollow shafts, torsion of thin walled tubes, Strain Energy of deformable systems, Maxwell's reciprocal & Betti's theorem, Castigliano's first theorem, unit load & Conjugate beam methods.

UNIT IV:

Helical and Leaf Springs: Deflection of springs by energy method, helical springs under axial load and under axial twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously both for open and closed coiled springs, laminated springs.

UNIT V:

Columns and Struts: Buckling and stability, slenderness ratio, combined bending and direct stress, middle third and middle quarter rules, struts with different end conditions, Euler's theory for pin ended columns, effect of end conditions on column buckling, Ranking Gordon formulae, examples of

columns in mechanical equipment's and machines. Analysis of Arches, Linear arch, Eddy's theorem, three hinged parabolic arches, two hinged arches, spandrel braced arch, moving load & influence lines.

UNIT VI:

Thin cylinders & spheres: Introduction, difference between thin walled and thick-walled pressure vessels, Thin-walled spheres and cylinders, hoop and axial stresses and strain, volumetric strain.

Thick cylinders: Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures, compound cylinders, stresses in rotating shaft and cylinders, stresses due to interference fits. Equilibrium of light cable, General cable theorem, uniformly loaded cable, anchor cables, temperature stresses in suspension cables, three hinged stiffening girder, two hinged stiffening girder, temperature stresses in two hinged girders.

***References Books*:**

1. Strength of Materials by Nag and Chandra, Wiley India.
2. Strength of Materials by Nash (Sp Indian Edition), TMH
3. Strength of Materials by Jindal, Pearson Education
4. Strength of Material by Bhavikatti, Vikas Publishing.
5. Fundamentals of Solid Mechanics by Gambhir, PHI
6. Strength of Materials by Basavajaiah and Mahadevappa, University Press.

PCC-CED206 HIGHWAY ENGINEERING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective: To teach the overview of highway engineering, fundamentals related to materials used in pavements and maintenance of the highways.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Carry out surveys involved in planning and highway alignment
2. Analysis of geometric aspects of highways and expressways
3. Understand the traffic studies and implement traffic regulation and control measures and intersection design.
4. Knowledge about pavement materials.
5. Learn the design of the flexible pavement.
6. Design the Rigid pavement.

UNIT I:
Highway development and planning-Classification of roads, road development in India, Current road projects in India; highway alignment and project preparation.

UNIT II:
Geometric design of highways-: Introduction; highway cross-section elements; sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems

UNIT III:
Traffic engineering & control- Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems.

UNIT IV:
Introduction- GSB, WBM and WMM based roads. Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests and requirements for different types of pavements.

UNIT V:
Design of flexible pavements- Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; and its maintenance parameters.

UNIT VI:
Design of rigid pavements- components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems, and its maintenance parameters.

Reference Books:

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand &Bros,2017
2. Kadiyalai, L.R., ' Traffic Engineering and Transport Planning, Khanna Publishers.
3. Partha Chakraborty, ' Principles of Transportation Engineering, PHI Learning,
4. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski,' Principles of Highway Engineering and Traffic Analysis', 4th Edition, John Wiley
5. Srinivasa Kumar, R, Textbook of Highway Engineering, UniversitiesPress,2011.
6. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley Student Edition,2009.

PCC-CED207 SOIL MECHANICS

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective: To teach the overview of soil properties and fundamental of soil mechanics in relation to soil hydraulics, compaction, consolidation, stress distribution and shear strength.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Understand basic terminology of soil mechanics, soil classification and laboratory tests to determine properties of different types of soils
2. Examine the interaction between soil and water systems to understand capillary flow, permeability and seepage
3. Apply the weight-volume relationships for compaction and consolidation of soils
4. Analyse the stresses in the soil system due to applied loads
5. Learn the shear strength and earth pressure theories for slope stability analysis
6. Assessment of bearing capacity of shallow and deep foundations

Course Contents:

UNIT I:
Origin and classification of soils, preview of geotechnical field problems in Civil Engineering, soil composition, basic definitions, weight volume relationships, clay minerals, soil structure, index properties, sensitivity and thixotropy, particle size analysis, determination of moisture content, specific gravity and unit weight. Unified and Indian standard soil classification system.

UNIT II:
Stress conditions in soil-total, effective and neutral stresses and relationships, fluctuations of effective stress, permeability - Darcy's Law, hydraulic conductivity, determination of coefficient of permeability: laboratory method and field method, equivalent hydraulic conductivity in stratified soil, seepage, flow nets, seepage calculation from a flow net, flow nets in anisotropic soils, seepage through earth dam, capillarity, critical hydraulic gradient and quick sand condition, uplift pressure, piping.

UNIT III:
Soil compaction, water content - dry unit weight relationships, factors controlling compaction, field compaction equipment, field compaction control, Proctor needle method.
Consolidation, primary and secondary consolidation, Terzaghi’s one dimensional theory of consolidation, consolidation test, normal and over-consolidated soils, over-consolidation ratio, determination of coefficient of consolidation.

UNIT IV:
Stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area, influence factors, isobars, Boussinesq‘s equation, Newmark‘s influence chart, contact pressure under rigid and flexible area, computation of displacements from elastic theory.

UNIT V:

Shear strength, Mohr-Coulomb failure criterion, shear strength parameters and determination; direct and tri-axial shear test, unconfined compression test, pore pressure, Skempton's pore pressure coefficients.

Earth pressure, classical theories, Coulomb and Rankine's approaches for frictional and c-φ soils, inclined backfill, graphical methods of earth pressure determination, stability of slopes, Culman method and Method of slices, stability number and chart.

UNIT VI:

Sub surface structure, bearing capacity of shallow foundations, SPT, plate load test, effect of water table, deep foundations, types of piles, static and dynamic formulae, pile group, settlement of pile group, negative skin friction.

***Text and References Books*:**

1. Das, B. M., Advanced Soil Mechanics. Taylor and Francis Group, London, Second edition, (2013)
2. Arora, K. R., Soil Mechanics and Foundation Engineering, 5th edition, Standard publishers (2000)
3. Gopal, R. and ASR Rao, Basic and applied soil mechanics, 2nd edition, New age International publishers (2004)
4. Lambe, T.W. and Whitman, R. V., Soil Mechanics, John Wiley New York (2004)
5. Powrie, W., Soil Mechanics concepts and applications, Spon Press, Taylor and Francis Group, London, Second edition, (2009)

PCC-CED208 ENVIRONMENTAL ENGINEERING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective

To provide students with a comprehensive understanding of the principles and practices of water supply engineering, including water sources, water quality, water treatment, and water distribution systems.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Evaluate water sources, water quality and transportation of water.
2. Understand the various water quality parameters
3. Learn the basic design principles of water treatment
4. Analyse the fundamentals of water softening
5. Design the water supply systems
6. Understand the selection criteria of pumps and water fixtures in buildings

Course Contents:

UNIT I:

Water Sources: Definition and Scope of Environmental Engineering, Surface and ground water sources; Selection and development of sources;

Water Supply Systems: Municipal water demands and demand variations, Population forecasting and water demand estimations; Intakes and transmission systems, pipes for transporting water and their design

UNIT II:

Water Quality: Physical, chemical and biological water quality parameters; Water quality index; Water quality standards;

UNIT III:

Water treatment - I: Water treatment schemes; Basic principles of water treatment; Design of plain sedimentation, coagulation and flocculation, filtration – slow, rapid and pressure filter; Disinfection units.

UNIT IV:

Water treatment - II: Fundamentals of water softening, fluoridation and deflouridation, and water desalinization and demineralization. Advanced treatments like adsorption, ion exchange, membrane processes.

UNIT V:

Design of Water Supply Systems: Water supply network design and design of balancing and service reservoirs; operation and maintenance of water supply systems. Data and background information for the design of water supply system;

UNIT VI:

Pumps and pumping stations: Types of pumps and their characteristics and efficiencies; Pump operating curves and selection of pumps; pumping stations.

Small scale and household level water purification system and water fixtures, Various valves used in W/S systems, Introduction to various types of home plumbing systems for water supply.

References Books

1. Manual on Water Supply and Treatment by Ministry of Urban Development, New Delhi.
2. Water Supply and Sewerage, McGhee, McGraw Hill.
3. Environmental Engineering, Vol. I, S.K. Garg, Khanna Publishers, New-Delhi.
4. Environmental Engineering Peavy, Rowe and Tchobanglous, McGraw Hill.
5. Water and Waste Water Engineering (Vol. 1&2), Fair, Geyer &Okun, John Wiley, New York.
6. Water Supply Engineering P.N. Modi, Standard Book House New-Delhi.
7. Standard Methods for the Examination of Water and Waste Water, American Public Health Association.

BSC-201 MATHEMATICS III

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

This syllabus aims to teach partial differential equations and their applications to physical phenomena such as heat diffusion, wave propagation, and vibration. It also covers the properties and solutions of discrete and continuous random variables and their distributions, as well as statistical analysis using measures such as moments, skewness, kurtosis, correlation, and regression.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Solve field problems in engineering involving PDEs.
2. Formulate and solve problems involving random variables
3. Apply statistical methods for analysing experimental data.
4. Understand the concept of probability.

Course Contents:

UNIT I:

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables.

UNIT II:

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality. Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities. Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

UNIT III:

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of

significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

References Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
3. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall.
4. S. Ross, A First Course in Probability, Pearson Education India.

BSC-01 BIOLOGY

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective

Provide a general overview of biology and its key concepts, including the scientific method, classification, genetics, biomolecules, enzymes, information transfer, macromolecular analysis, metabolism, and microbiology.

Course Outcomes: Upon successful completion of this course, students will be able to:

- Describe the hierarchy of life forms and the different criteria used for classification
- Explain the fundamental principles of genetics, including Mendel's laws, gene mapping, and gene interaction
- Identify the major biomolecules found in living organisms and describe their structure and function
- Explain how enzymes catalyse reactions and discuss the importance of enzyme kinetics
- Describe the molecular basis of information transfer and explain the universality and degeneracy of the genetic code
- Analyse biological processes at the reductionist level by understanding protein structure and function

MODULE 1: INTRODUCTION

Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry.

Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

MODULE 2: CLASSIFICATION

Purpose: To convey that classification per seis not what biology is all about. The underlying criterion,

such as morphological, biochemical or ecological be highlighted.

Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilisation -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitataacquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. Musculus.

MODULE 3: GENETICS

Purpose: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences" Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

MODULE 4: BIOMOLECULES

Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine, Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.

MODULE 5: ENZYMES

Purpose: To convey that without catalysis life would not have existed on earth.

Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

MODULE 6: INFORMATION TRANSFER

Purpose: The molecular basis of coding and decoding genetic information is universal

Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure-from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

MODULE 7: MACROMOLECULAR ANALYSIS

Purpose: How to analyse biological processes at the reductionist level

Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

MODULE 8: METABOLISM

Purpose: The fundamental principles of energy transactions are the same in physical and biological world.

Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy Charge.

MODULE 9: MICROBIOLOGY

Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.

Reference Books

1. Biology: A global approach: Campbell,N. A.;Reece,J. B.;Urry, Lisa;Cain,M,L.;Wasserman, S. A.;Minorsky,P.V.; Jackson, R.B. Pearson EducationLtd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H.,John Wileyand Sons
3. Principles of Bio chemistry (VEdition), By Nelson,D. L.; andCox,M. M. W. H. Freeman and Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H.Freemanand company, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.MJ.P. Harleyand C. A. Klein 1995.2 nd editionWm,C. Brown Publishers.

PCC-CED206P HIGHWAY ENGINEERING LAB

L	T	P	Total
0	0	2	2

Sessional: 15 marks
Theory: 35 marks
Total: 50 marks
Duration of exam: 3 hours

Course Objective:

This course aims to provide students with a comprehensive understanding of construction materials and their properties. Students will learn about the fundamental principles of testing various construction materials such as aggregates and bitumen. The course will also cover the design and analysis of various tests used in civil engineering.

Course Outcomes:

- Understand the properties of aggregates and their impact on construction.
- Analyze the properties of bitumen and their impact on construction.
- Evaluate the results of various tests conducted on aggregates.
- Analyze the results of various tests conducted on bitumen.

List of Experiments:

1. Flakiness and elongation test
2. CBR Value test
3. Bulk density and Void test
4. Specific gravity test
5. Aggregate's Water absorption Test
6. Aggregate Impact Test
7. Los-Angeles Abrasion Test on Aggregates
8. Dorry's Abrasion Test on Aggregates
9. Deval Attrition Test on Aggregates
10. Crushing Strength Test on Aggregates
11. Penetration Test on Bitumen.
12. Ductility Test on Bitumen
13. Softening Point Test on Bitumen.
14. Flash and Fire Point Test on Bitumen.

Reference Books:

1. "Highway Engineering" by S.K. Khanna and C.E.G. Justo
2. "Highway Materials Testing Manual" by K. Khosla
3. "Highway Engineering: Pavements, Materials and Control of Quality" by Amit Prashant and Purushothama Raj
4. "Materials Testing for the Highway Engineer" by J.P. Singh
5. "Bituminous Materials" by Mang Tia and Animesh Das
6. "Handbook of Tests on Bitumen and Bituminous Mixes" by IS 1203
7. "Aggregate Testing Manual: Procedures, Test Reports and Forms" by R. W. Edelman

PCC-CED207P SOIL MECHANICS ENGINEERING LAB

L	T	P	Total
0	0	2	2

Sessional: 15 marks
Theory: 35 marks
Total: 50 marks
Duration of exam: 3 hours

Course Objective:
This course aims to provide students with a comprehensive understanding of soil testing methods and their applications in the field of civil engineering. Students will learn about the fundamental principles of soil testing and their application to water content, specific gravity, dry density, grain size distribution, consistency limits, soil classification, compaction characteristics, permeability, consolidation characteristics, and shear strength characteristics.

Course Outcomes:

1. Understand the principles of soil testing and their impact on construction.
2. Analyze the properties of soil samples and their impact on construction.
3. Evaluate the results of various tests conducted on soil samples.
4. Analyze the results of various tests conducted on soil samples.

List of Experiments:

1. Determination of water content of a given moist soil sample by (i) oven drying method, (ii) pycnometer method.
2. Determination of specific gravity of a given soil sample by (i) density bottle, (ii) pycnometer method.
3. Determination of in situ dry density of soil mass by (i) core-cutter method, (ii) sand replacement method.
4. Determination of relative density of a given soil sample.
5. Determination of complete grain size distribution of a given soil sample by sieve analysis and sedimentation (hydrometer) analysis.
6. Determination of consistency limits (liquid, plastic and shrinkage limits) of the soil sample.
7. Classify the soil as per the IS 1498- 1970 based on the results obtained from experiments at serial nos. 5 & 6 (grain size distribution and consistency limits).
8. Determination of compaction characteristics (OMC & MDD) of a given soil sample.
9. Determination of permeability of a remolded soil sample by constant head &/or falling head method.
10. Determination of consolidation characteristics of a remolded soil sample by an oedometer test.
11. Determination of shear strength characteristics of a given soil sample by U/U test from Tri-axial Compression Machine.
12. Retrieving soil samples and conducting SPT tests by advancing boreholes through hand-held auger.

*Note: Any 8 experiments are to be performed from the list of experiments.

References:
1. Bowles, Joseph E., “Engineering Properties of Soil and Their Measurement” Fourth Edition, Indian Edition, McGraw Hill Education (India) Pvt. Ltd, New Delhi-110032.

PCC-CED208P ENVIRONMENTAL ENGINEERING LAB

L	T	P	Total
0	0	2	2

Sessional: 15 marks
Theory: 35 marks
Total: 50 marks
Duration of exam: 3 hours

Course Objective:

This course aims to provide students with a comprehensive understanding of water quality testing methods and their applications in the field of environmental engineering. Students will learn about the fundamental principles of water quality testing and their application to turbidity, conductivity, pH, alkalinity, acidity, hardness, chlorides, residual chlorine, MPN of coliforms, SPM, PM10, sound level, total solids, suspended solids, dissolved solids, BOD, COD, fluoride and coagulants. The course will also cover the design and analysis of various water quality testing instruments used in environmental engineering.

Course Outcomes:

- Understand the principles of water quality testing and their impact on environmental engineering.
- Analyze the properties of water samples and their impact on environmental engineering.
- Evaluate the results of various tests conducted on water samples.
- Analyze the results of various tests conducted on water samples.

List of Experiments:

1. Determination of turbidity and conductivity.
2. Determination of pH, alkalinity and acidity.
3. Determination of hardness and chlorides.
4. Determination of residual chlorine.
5. Determination of MPN (most probable number) of coliforms.
6. Measurement of SPM and PM10 with high volume sampler.
7. Measurement of sound level with sound level meter.
8. Determination of total, suspended and dissolved solids.
9. Determination of BOD.
10. Determination of COD.
11. Determination of fluoride.
12. Determination of optimum dose of coagulants by Jar Test Apparatus.

Note: Any 8 Experiments out of the list of experiments are to be performed.

References:

1. A.P.H.A. “Standard Methods for the Examination of Water and Wastewater”, American Public Health Association.
2. Sawyer, C.N., McCarty, P.L. & Parkin, G.F. “Chemistry for Environmental Engineering”, Mc-Graw Hill.
3. Mathur, R.P. “Water & Wastewater Testing”, Lab Manual, Roorkee.

MC-04 MESSAGE OF BHAGWAT GITA

L	T	P	Total
1	0	0	1

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objectives:
To enable the students to create an awareness on message of Bhagwat Gita.
To instil moral, social values and to appreciate the Karma Yoga.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Realize the relevance of Bhagavad Gita today.
2. Relate Yoga to Devotion
3. Realize the duties and Responsibilities in the Society.

Course Contents:

UNIT I:

Introduction: Relevance of Bhagavad Gita Today- Background of Mahabharata. Arjuna Vishada Yoga: Arjuna's Anguish and Confusion- Symbolism of Arjuna's Chariot. Sankhya Yoga: Importance of Self- knowledge- Deathlessness: Indestructibility of Consciousness Being Established in Wisdom- Qualities of Sthita- Prajna.

UNIT II:

Karma Yoga: Yoga of Action- Living in the Present- Dedicated Action without Anxiety over Results- Concept of Swadharma.
Dhyana Yoga: Tuning the Mind- Quantity, Quality and Direction of Thoughts- Reaching Inner Silence.

UNIT III:

Bhakti Yoga: Yoga of Devotion- Form and Formless Aspects of the Divine- Inner Qualities of a True Devotee **Gunatraya Vibhaga Yoga:** Dynamics of the Three Gunas: Tamas, Rajas, Sattava- Going Beyond the Three Gunas- Description of the Gunatheetha.

References Books

1. Swami Chinmayananda, "The Holy Geeta", Central Chinmaya Mission Trust.
2. Swami Chinmayananda, "A Manual of Self Unfoldment", Central Chinmaya Mission Trust

HSMC(H102) UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course Outcomes:

- Define harmony and explain its importance in all aspects of life
- Analyze the current scenario and explain the challenges to fulfilling basic human aspirations
- Understand the role of others in making material goods available to them and differentiate between prosperity and accumulation
- Understand the interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
- Discuss the basis for Humanistic Education, Humanistic Constitution, and Humanistic Universal Order
- Discuss the strategy for transition from the present state to Universal Human Order at the level of the individual and the society

UNIT-I

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education, Purpose and motivation for the course, Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and experiential Validation- as the process for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority 4. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

UNIT-II

Understanding Harmony in the Human Being - Harmony in Myself!, Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - happiness and physical facility, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and

activities of ‘I’ and harmony in ‘I’, Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one’s own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

UNIT-III

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship, Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students’ lives

UNIT-IV

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence, Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in allpervasive space, Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film “Home” can be used), pollution, depletion of resources and role of technology etc.

UNIT-VI

Implications of the above Holistic Understanding of Harmony on Professional Ethics, Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations, Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

Reference Books:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
3. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
4. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
5. The Story of Stuff (Book).
6. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
7. Small is Beautiful - E. F Schumacher.
8. Slow is Beautiful - Cecile Andrews
9. Economy of Permanence - J C Kumarappa
10. Bharat Mein Angreji Raj - PanditSunderlal
11. Rediscovering India - by Dharampal
12. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
13. India Wins Freedom - Maulana Abdul Kalam Azad
14. Vivekananda - Romain Rolland (English)
15. Gandhi - Romain Rolland (English)

SEMESTER – V

PCC-CED301 RAILWAY AND AIRPORT ENGINEERING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective: To teach the basic term of railway engineering, track materials, track fittings and fastenings, geometric design of tracks, railway tunnelling and an overview of airport engineering.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Understand the various terminology of railway engineering
2. Examine the properties of track materials
3. Describe various components of railways and their functions.
4. Design a railway geometry according to the design specifications.
5. Knowledge of tunnelling and different layouts.
6. Classify various components of an airport and identify the alignment and the required length of a runway.

UNIT-I
Introduction to railway engineering, railway track gauge, alignment of railway lines, engineering surveys and construction of new lines, tracks and track stresses; rails, sleepers, creep of rails.

UNIT-II
Ballast, subgrade and formation-ballast and its function, specification of good ballast, formation and its function, subgrade improvement.

UNIT-III
Track fittings and fastenings- Rail to rail fastening, rail to different types of sleepers fastening, elastic fastening Point and crossings- turnout, points, crossing, crossovers.

UNIT-IV
Geometric design of track curves and super-elevation, track junctions and simple track layouts; rail joints and welding of rails; track maintenance, track drainage; modern methods of track maintenance, rehabilitation and renewal of track; tractive resistance and power, railway stations and yards.

UNIT-V
Railway tunnelling; operation involved in bore tunnelling, signalling and interlocking; engineering principles of signals, classification of signals, maintenance of railways and high-speed trains.

UNIT-VI
Air transportation in India - Airport classifications - Airport site selection. Runway configurations – wind rose and orientation of runway - runway length - Corrections to runway length - runway geometric design – taxiway, exit taxiway, aprons, hangars – aircraft parking configuration and parking system - Landing and Visual aids.

Reference Books:

1. Railway Engineering, Satish Chandra, Oxford Publishing 2013
2. Railway Engineering, S.C Rang Wala, Charotar Publishing 2008
3. Railway Engineering by Arora and Saxena, Dhanpat Rai& Sons, New Delhi
4. Railway Engineering by M.M. Aggarwal.
5. Airport Planning and Design"- Khanna, Arora and Jain, Nem Chand and Bros., Roorkee
6. Airport Engineering - Rangwala, Charotar., Publisher
7. Virender Kumar and Satish Chandra, "Airport Planning and Design"- Galotia Publication press
8. Planning and Design of Airports" - Robert Horenjeff, 2nd edition, McGraw Hill Book Co.

PCC-CED302 STRUCTURAL ANALYSIS

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective: To study the multi-storey frames subjected to gravity loads and lateral loads, and to know the concepts of flexibility and stiffness methods for structural analysis and basics of finite element modeling of structures.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Analyse multi-storey frames subjected to gravity loads and lateral loads
2. Know the importance of the shape factor
3. Under the effect plastic hinge formation in structural member.
4. Analyse beams and frames using flexibility and stiffness methods.
5. Evaluate thermal strain for various boundary conditions.
6. Understand the concept of finite element method.

Course Contents:

UNIT – I

Classification of Structures, stress resultants, degrees of freedom, Static indeterminacy, Classification of Pin jointed determinate trusses, Analysis of determinate plane and space trusses, Approximate methods for gravity loads, Substitute frame method for dead load and live loads, Calculation of wind load, earthquake load, portal method, cantilever method, and Factor method.

UNIT – II

Basics of Plastic Analysis, Applications of Static and Kinematic theorem for Plastic Analysis of Beams and Frames. Shape factor - simple sections - rectangular - triangle - circular - flanged sections - Load factor. Plastic moment of resistance - collapse load - analysis of continuous beams and portals - limiting conditions for applications.

UNIT – III

Analysis of continuous beams and portals to draw bending moment and shear force diagram using Slope Deflection Method and Moment Distribution Method, Rolling loads, influence lines for beams and trusses, Absolute maximum bending moment,

UNIT – IV

Muller-Breslau's principles & application. Flexibility - compatibility equation - flexibility influence coefficients - force transformation matrix - flexibility matrix-analysis of beams & frames.

UNIT – V

Direct stiffness method - equivalent joint load - transformation matrix - development of structure stiffness matrix for axial element - assembly of structure stiffness matrix from element stiffness matrix - incorporation of boundary conditions

UNIT – VI

Basics of Force and Displacement Matrix methods for beams and trusses. Thermal and initial strain (temperature change and misfit) - Displacement boundary conditions, Introduction to basics of Finite Element modelling.

***References Books*:**

1. Aslam Kassimali, Matrix Analysis of Structures, 2nd Edition, CENGAGE Learning Custom Publishing, 2011.
2. C.S. Reddy, Basic Structural Analysis,3rd Edition, Tata Mcgraw Hill Education, 2014
3. Igor A. Karnovsky and Olga Lebed, Advanced methods of Structural Analysis, Springer New York. 2010.
4. C. Natarajan and P. Revathi, Matrix Methods of Structural Analysis: Theory and Problems, PHI Pvt Ltd, India, 2014.
5. Pandit, G.S, & Gupta S.P, Structural Analysis (A matrix approach), Tata McGraw Hill Publishing Ltd., 2008.
6. Reddy, C.S, "Structural Analysis", Tata McGraw Hill, 2010
7. Bhavikatti S. S. “Structural Analysis 1”, Vikas Publishing House, Noida, 2011.
8. Punmia, B.C, Ashok Kumar Jain & Arun Kumar Jain, "Theory of Structures", Laxmi Publications, India, 2014.
9. Ramamrutham, S. "Theory of structures", Dhanpat Rai publications. 2011.
10. Hibbeler, R.C, "Structural Analysis", Pearson India, 2014.

PCC-CED303 FOUNDATION ENGINEERING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective: To teach the evaluation of soil bearing capacity and geotechnical design of shallow foundations, deep foundations, well foundations, earth retaining structures and machine foundation.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Understand the practical aspects of modern methods of soil investigations
2. Analyse bearing capacity and settlement analysis of shallow foundations
3. Compute load carrying capacity and settlement of single pile or pile group
4. Analyse and design well foundations
5. Analyse and design retaining walls
6. Demonstrate the considerations for design of foundations in expansive soils

Course Contents:

UNIT-I

Introduction to soil exploration, methods of boring and drilling, soil sampling techniques, in-situ tests, SPT, CPT, DCPT, depth of exploration, geophysical methods; soil resistivity methods seismic refraction methods.

UNIT-II

Bearing capacity of shallow foundation, design criteria, factors affecting bearing capacity, factors influencing selection of depth of foundation, modes of shear failures, types of shallow foundations, contact pressure under rigid and flexible footings, Terzaghi's, Meyerhof, Hansen's bearing capacity theories, IS code method.

Settlement of shallow foundations, components of settlement and its estimation, immediate, consolidation, differential settlements.

UNIT-III

Design of shallow foundation, principles of design of footing, design of isolated footings and strip footing, codal provisions.

Deep foundations, necessity of deep foundations, pile installation, pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, single and double under-reamed piles, laterally loaded piles, codal provisions.

UNIT-IV

Introduction shapes and characteristics of wells, components of well foundation, depth and size of wells on the basis of scour depth, bearing capacity and settlement, Terzaghi's lateral stability analysis, sinking of wells, causes and remedies of tilts and shifts.

UNIT-V

Earth retaining structures, earth pressures, design of rigid, flexible and reinforced soil retaining walls, braced excavations, and ground anchors for retaining walls, construction methods, introduction and uses of sheet piles.

UNIT-VI

Foundation on expansive soils, identification of expansive soil, problems associated with expansive soils, design considerations of foundations on expansive soils.

***Text and Reference Books*:**

1. Gopal, R. and ASR Rao, Basic and applied soil mechanics, 2nd edition, New age International publishers (2004)
2. Arora, K. R., Soil Mechanics and Foundation Engineering, 5th edition, Standard publishers (2000)
3. Murthy, V. N. S., Soil Mechanics and Foundation engineering, Sai Kripa
4. Das, B.M., Principles of Foundation Engineering, Cengage Learning. 7th Edition, (2010)
5. Bowles, J. F., Foundation analysis and design, McGraw Hill (1998).

PCC-CED304 HYDRAULIC ENGINEERING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

1. To apply hydrostatic law, principle of mass and momentum in fluid flows, concepts in
2. Euler's and Bernoulli equations.
3. To provide fundamental knowledge of fluids, its properties and behaviour under various conditions of internal and external flows.
4. To determine the losses in a flow system, flow through pipes, boundary layer concepts.

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Acquire specific knowledge regarding fluid flow phenomena observed in Civil Engineering systems such as flow in open channel flow
2. Develop understanding of the basic principles of fluid flow patterns and provide skills in analyzing fluid flows in open channel hydraulics
3. Understand gradually varied flow profile in detail
4. Understand rapidly varied flow profile in detail
5. Analyse the practical significance of open channel flows
6. Knowledge is useful for the design of open channels for rectangular and non-rectangular channels for hydraulic jump phenomena.

Course Content:

UNIT-I:

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-II:

Chezy Equation, Darcy-Weisbach Friction Factor, Manning's roughness Formula, Resistance Formulate for Practical Use, Normal Depth and its computation.

UNIT-III:

Specific Energy, specific fore, Critical Flow, critical depth, Calculation of Critical Depth for some shapes of channels. Weirs, Sharp-crested Weir, Broad-crested Weir, Critical-Depth Flumes, Sluice-gate Flow, free and submerged flow and its analysis of sluice gate.

UNIT-IV:

Gradually varied flow: Theory and analysis, gradually-varied flow computations in prismatic channels, gradually varied flow in non-prismatic channels. Characteristics of flow profiles –Draw down and back water curves – Profile determination – Graphical integration, direct step and standard step method – Flow through transitions,

UNIT- V:

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 Dissipates.

UNIT-VI:

Reciprocating pumps, their types, work done by single and double acting pumps. Centrifugal pumps, components and parts and working, types, heads of a pump-statics and manometric heads, Force executed by fluid jet on stationary and moving flat vanes., Turbines, classifications of turbines based on head and specific speed, component and working of Pelton wheel and Francis turbines, cavitation and setting of turbines.

Reference Books:

1. Chow Ven Te, "Open Channel Hydraulics". McGaw Hill International Edition.
2. Ranga Raju, K.G. "Flow Through Open Channel". Tata McGraw-Hill
3. Choudhary, Hanif "Open Channel Hydraulics" Prentice Hall of India
4. Subramanya K. "Flow in Open Channels". Tata McGraw-Hill
5. Srivastava, R. "Flow Through Open Channels". Oxford University Press.

PCC-CED305 GEOMATICS ENGINEERING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objectives (CO):

1. To understand use of aerial camera, aerial photographs and procedure of aerial survey
2. To provide background knowledge and understanding of principle of remote sensing and remote sensing system
3. To gain knowledge about the data interpretation techniques.
4. To provide knowledge about the basic of GPS
5. To gain knowledge about working principle of GIS

Course Outcomes (CO): On completion of this course, the students will be able to

1. Gain a clear understanding of photogrammetry surveying.
2. Understand the working principle of remote sensing system.
3. Understanding of various image processing techniques
4. Gain understanding of GPS
5. Gain understanding of GIS
6. Analysis of geospatial data.

Course Contents:

UNIT – I

Photogrammetry: Principles& types of aerial photograph, geometry of vertical aerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy.

UNIT – II

Remote Sensing: Introduction, Definition and Overview of Remote Sensing and Remote Sensing Systems, Electromagnetic Radiation, Terms and Definitions, electromagnetic Spectrum, Sources of electromagnetic radiation, Principles of energy interaction in atmosphere and earth surface features, Remote sensing advantages & Limitations.

UNIT-III

Image Processing and Interpretation: Image interpretation techniques, visual interpretation, Digital image processing, Principles of Thermal Remote Sensing & its applications, Principles of Microwave Remote Sensing & its applications

UNIT – IV

GPS Basics: System overview, working principle of GPS, Satellite ranging, calculating position, Ranging errors and its correction, Static and Rapid GPS surveying, DGPS and Kinematic methods, Real time and post processing DGPS, visibility diagram, GAGAN.

UNIT – V

Geographical Information System: Definition of GIS, Key Components of GIS, Functions of GIS,

UNIT- VI

Geospatial Analysis: Spatial data, spatial information system Geospatial analysis, Integration of Remote sensing and GIS, and Applications in Civil Engineering

Text Books

1.Basics of Remote sensing & GIS by S. Kumar, Laxmi Publications.

2.Concepts & Techniques of GIS by C. P. Lo Albert, K.W. Yonng, Prentice Hall India) Publications.

3.Principals of Geo physical Information Systems – Peter ABurragh and Rachael A. Mc Donnell, Oxford Publishers 2004.

4.Surveying Vol. II and III by Dr. B.C. Punamia, Laxmi Publishers. New Delhi

5. Remote Sensing and GIS Lillesand and Kiefer, John Willey 2008.

6. Remote Sensing and GIS B. Bhatta by Oxford Publishers 2015

7. Introduction to Geographic Information System – Kang-Tsung Chang, McGraw-Hill 2015

PCC-CED306 WASTE WATER ENGINEERING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective

To provide students with a fundamental understanding of the principles and practices of wastewater treatment, including the sources, characteristics, and treatment of wastewater, as well as recent technologies in the field.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Define the concept of wastewater flow engineering.
2. Evaluate reuse of treated effluent in the most efficient manner.
3. Analyse the sewage treatment units.
4. Determine the various characteristics of sewage
5. Estimate the most appropriate disposal option for waste water.
6. Understand the waste water schemes.

Course Contents:

UNIT – I

Introduction: Wastewater flow and its characteristics, Wastewater collection systems. Problems of industrial wastewaters. Wastewater treatment processes. Theory and design of screens, grit chambers, sedimentation, coagulation, flocculation.

UNIT – II

Physio-chemical and biological treatment strategies and their evaluation.

UNIT-III

Activated sludge process (ASP), extended aeration systems, trickling filters (TF), aerated lagoons, stabilization ponds, oxidation ditches, sequential batch reactor, rotating biological contactor, etc.

UNIT – IV

Anaerobic treatment process, Effects of pH, temperature and other parameters on anaerobic treatment, Concept of anaerobic contact process, anaerobic filter, anaerobic fixed film reactor, fluidized bed and expanded bed reactors and upflow anaerobic sludge blanket (UASB) reactor**.**

UNIT – V

Indian standards for disposal of treated wastewaters on land and in natural streams, Treated wastewater reclamation and reuse. Recent technologies of treatment.

UNIT- VI

Study on wastewater generation points, wastewater characteristics, process flow sheets, treatment scheme for tannery, sugar, textile, steel, distillery, paper/ pulp and oil refinery industry wastewater.

Text Books

1. Metcalf & Eddy "Wastewater Engineering: Treatment & Reuse", Tata Mc Graw Hill.
2. Peavy, Rowe & Tchobanoglous "Environmental Engineering", Mc. Graw Hill, New Delhi.
3. Davis, M. "Water and Wastewater Engineering'', Mc-Graw Hill.
4. Fair, G.M. & Geyer, J.C. "Water supply and Wastewater Disposal", John Wiley & Sons.
6. Qasim, S.R., Motley, E.M., and Zhu, G. "Water Works Engineering", Prentice Hall Publication.
7. CPHEEO "Manual on Sewerage & Sewage Treatment", Ministry of urban development, Government of India, New Delhi.
8. Parker, H. "Wastewater System Engineering", Prentice Hall.
9. Garg, S.K. "Environmental Engineering Vol. II (Sewage Disposal and Air Pollution Engineering)", Khanna Publishers.
10. Rao, M.N. & Dutta, A.K. "Wastewater Treatment", Oxford & IBH Publishing.

PCC-CED304P HYDRAULIC ENGINEERING LAB

L	T	P	Total
0	0	2	2

Sessional: 15 marks
Theory: 35 marks
Total: 50 marks
Duration of exam: 3 hours

Course Objective:

This course aims to provide students with a comprehensive understanding of hydraulic flumes and wind tunnels and their applications in the field of civil engineering. Students will learn about the fundamental principles of hydraulic flumes and wind tunnels and their application to flow visualization, velocity distribution, standing wave flume, gradually varied flow, hydraulic jump, coefficient of discharge, V-notch flow, boundary layer, and flow around an airfoil/circular cylinder. The course will also cover the design and analysis of various hydraulic flumes and wind tunnels used in civil engineering.

Course Outcome:

- Understand the principles of hydraulic flumes and wind tunnels and their impact on civil engineering.
- Analyze the properties of hydraulic flumes and wind tunnels and their impact on civil engineering.
- Evaluate the results of various tests conducted on hydraulic flumes and wind tunnels.
- Analyze the results of various tests conducted on hydraulic flumes and wind tunnels.

List of Experiments

1. Flow Visualization of uniform Flow in hydraulic flumes.
2. Velocity Distribution in open channel flow
3. Venturiflume
4. Standing wave flume
5. Gradually varied flow in hydraulic flumes
6. To study the characteristics of a hydraulic jump in hydraulic flumes
7. To determine the coefficient of discharge for flow over a sluice gate
8. To determine the coefficient of discharge for flow over a broad crested weir.
9. Flow through V - Notch
10. Studies in wind tunnel and Boundary Layer
11. Flow around an airfoil/circular cylinder

Note: Ten experiments are to be performed in the Semester taking at least seven experiments from the above list. Remaining three experiments should be performed as designed & set by the concerned Institution as per the scope of the syllabus.

Reference Books:

1. Chow Ven Te, “Open Channel Hydraulics”. McGaw Hill International Edition.
2. Ranga Raju, K.G. “Flow Through Open Channel”. Tata McGraw-Hill
3. Choudhary, Hanif “Open Channel Hydraulics” Prentice Hall of India
4. Subramanya K. “Flow in Open Channels”. Tata McGraw-Hill
5. Srivastava, R. “Flow Through Open Channels”. Oxford University Press.

PCC-CED306P WASTEWATER ENGINEERING LAB

L	T	P	Total
0	0	2	2

Sessional: 15 marks
Theory: 35 marks
Total: 50 marks
Duration of exam: 3 hours

Course Objective:
Application of principles of waste water engineering for assessment of waste water quality parameters.

Course Outcomes:

- Understand the principles of wastewater testing and their impact on environmental engineering.
- Analyze the properties of wastewater samples and their impact on environmental engineering.
- Evaluate the results of various tests conducted on wastewater samples.
- Analyze the results of various tests conducted on wastewater samples.

List of Experiments

1. To determine the acidity of a wastewater sample
2. To determine the alkalinity of a wastewater sample
3. To determine total, suspended, dissolved and settable solids in a wastewater sample
4. To determine volatile and fixed solids in a wastewater sample
5. To determine oil and grease in a wastewater sample
6. To determine the chloride concentration in a wastewater sample.
7. To determine the sulphate concentration in a wastewater sample.
8. To determine the B.O.D. of a given wastewater sample.
9. To determine the C.O.D. of a given wastewater sample.
10. To determine the T.O.C. of a given wastewater sample.
11. To determine the fecal count of a given wastewater sample.
12. Microscopic studies of a wastewater

References:

1. A.P.H.A. “Standard Methods for the Examination of Water and Wastewater”, American Public Health Association.
2. Sawyer, C.N., McCarty, P.L. & Parkin, G.F. “Chemistry for Environmental Engineering”, Mc-Graw Hill.
3. Mathur, R.P. “Water & Wastewater Testing”, Lab Manual, Roorkee.

PCC-CED307P COMPUTATIONAL ANALYSIS AND DESIGN LAB

L	T	P	Total
0	0	2	2

Sessional: 15 marks
Theory: 35 marks
Total: 50 marks
Duration of exam: 3 hours

Course Objective:

This course aims to provide students with a comprehensive understanding of structural, transportation, geotechnical, environmental and water resources engineering. Students will learn about the fundamental principles of these fields and their application to design, analysis and detailing of various structures and systems. The course will also cover the use of software packages in these fields.

Course Outcomes:

- Understand the principles of structural, transportation, geotechnical, environmental and water resources engineering.
- Analyze the properties of various structures and systems.
- Evaluate the results of various tests conducted on structures and systems.
- Analyze the results of various tests conducted on structures and systems using software packages.

Course Content:

List of the Practical Experiment:

Solution of the following problems using concerned software's

1. Design of the structural elements in concrete and steel.
2. Development of simple programs for solving Transportation Engineering problems: Highway geometrics, pavement design.
3. Development of simple programs for solving Geotechnical Engineering problems: Earth pressure, Foundation settlement and stress analysis, Consolidation.
4. Problems in Environmental and Water resources engineering: Treatment systems, Pipe networks analysis, Synthetic Unit hydrograph derivation, Flood routing, Water balance model.
5. Analysis, Design and detailing using software packages in Structural Engineering/Transportation Engineering/Environmental/Water Resources/Geotechnical Engineering/GIS and Remote sensing applications

Note: Students can opt one problem from the above-mentioned practical's in the semester.

Reference Books

1. Rajasekaran S. Computational Structural Mechanics, Prentice Hall of India, New Delhi, 2001.
2. Manickaselvam V. K. Elements of Matrix and Stability Analysis of Structures, Khanna Publishers, New Delhi, 1998.
3. Software Manuals.

SEMESTER – VI

PCC-CED308 DESIGN OF CONCRETE STRUCTURES

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective: This course contains design for RCC structures starting with historical development to the latest limit state theory, understanding the codal provisions and refreshing the bending and shear theory. The objective of the subject is to provide a coherent development to the students for the courses in sector of reinforced concrete designing. To present the foundations of many basic engineering concepts related designing of structures. To give an experience in the implementation of designing concepts those are applied in field of structural engineering. To involve the application of scientific and technological principles of design of buildings according to limit state method of design

Course Outcomes (CO): On completion of this course, the students will be able to

1. The students will gain an experience in the implementation of designing on engineering concepts which are applied in field structural engineering
2. The students will get a diverse knowledge of design practices applied to real life problems
3. Understand the various design methodologies for the design of RC elements.
4. Know the analysis and design of flanged beams by limit state method and sign of beams for shear, bond and torsion.
5. Design the various types of slabs and staircase by limit state method.
6. Design columns for axial, uniaxial and biaxial eccentric loadings.

Course Contents:

UNIT-1

Introduction to Designing Process and Material: Structural Layout – Analysis – Designing – Detailing, Stress – Strain Curves for Concrete and Steel, Types of Steel, Grade of Concrete, Function of Concrete and Steel in RC structures, Modes of Failure (Balanced Section, Under Reinforced Section and Over Reinforced Section), Introduction to IS 456:2000 and SP 16

UNIT-II

Introduction to Design Methods: Working Stress Method – Introduction, Assumptions, Ultimate Strength Method – Introduction, Assumptions Limit State Method – Introduction, Assumptions

Unit- III

Shear and Torsion Limit State of Collapse: Shear. Nominal shear stress. Design shear strength of concrete. Design of shear reinforcement. Use of SP16 for shear design. Critical sections for shear in important structural elements such as slabs, beams, retaining walls, footings etc. Design project for the design and detailing the beams of a framed system. Limit State of Collapse: Torsion. General.

Critical section. Shear and torsion. Equivalent. Reinforcement for torsion. Equivalent longitudinal moment. Design project for the design and detailing of a water tank with curved beams.

Unit- IV

Design of Beam: Function of Beam, Types of Beam (Singly Reinforced Beam, Doubly Reinforced Beam, Flanged Beam) Calculation of Moment Carrying Capacity of Rectangular and Flanged Beam Section Design (Flexure, Shear & Torsion) of Rectangular and Flanged beam, Singly Reinforced Section and Doubly Reinforced Section (With appropriate checks)

UNIT-V

Design of Column: Function of Column, Types of Column (Short Column & Long Column) Design of Axially Loaded Columns Design (Flexure & Shear) of Axially Loaded Column, Uni – Axially Loaded Column, Limit State of Serviceability Deflection. Short term deflection. Long term deflection. Cracking. Control of cracking. Estimation of width of cracks.

UNIT-VI

Design of Slab: Function of slab, Introduction to different types of Slabs (One – Way Slab, Two – Way Slab, Flat Slab and Continuous Slab) Design of One – Way Simply Supported Slab, One – Way Continuous, Slab (With appropriate checks) Design of Two – Way Simply Supported Slab and Continuous Slab (With appropriate checks)

***References Books*:**

1. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, Pvt. Ltd., New Delhi, 2002.
2. Gambhir. M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi,2006.
4. Subramanian,N. "Design of Reinforced Concrete Structures", Oxford University Press, New Delhi,2013.
5. Krishnaraju. N "Design of Reinforced Concrete Structures ", CBS Publishers & Distributors Pvt. Ltd., New Delhi.
6. Ramachandra, "Limit state Design of Concrete Structures "Standard Book House, New Delhi

Indian Standards:

1. IS: 456: 2000, Plain and Reinforced Concrete Code of Practice
2. SP 16: 1978, Design Aids for Reinforced Concrete to IS: 456
3. IS 875 (Part 1): 1987 Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures – Dead Loads – Unit Weights of Building Materials and Stored Materials
4. IS 875 (Part 2): 1987 Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures – Imposed Loads c.

PCC-CED309 ENGINEERING HYDROLOGY

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

1. To understand the physical processes that determines the exchange of water at the Earth's surface.
2. To become familiar with the physical properties that govern the movement of water through the unsaturated zone and how these can be observed in the field and modelled mathematically.
3. To understand the physical factors that control evaporation and their representation using energy fluxes and diffusive transfer.
4. To be familiar with the various physical and empirical models used to calculate evaporation & evapotranspiration and the data need to support their use.
5. To be able to understand the processes which influence runoff from catchments and the methods for estimating the runoff
6. To use measured/estimated data like precipitation, runoff, infiltration, for hydrologic design

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Understand the process and mathematical representation of hydrologic cycle
2. Differentiate the measure and apply precipitation for hydrologic design
3. Understand the importance of catchment characteristics for runoff estimation
4. Evaluate the hydrologic abstractions and also learn about the factors affecting various hydrologic abstractions
5. Apply statistical tools to hydrologic data and implementing the knowledge of precipitation and runoff measurement in hydrologic design
6. Implementing the knowledge of precipitation and runoff measurement in hydrologic design

Course Content:

Unit-I: Introduction

Hydrologic cycle, hydrologic system model, Water budget: analysis and synthesis, atmospheric circulation.

Precipitation

Formation of precipitation – types of precipitation – Precipitable water – Precipitation in a cloud system - Rainfall measurement and characteristics – Estimating missing rainfall data – Rain gauge consistency – Average annual rainfall – Development of a design storm – probable maximum precipitation

Unit-II: Watershed Characteristics

Watershed definition and delineation - Watershed geomorphology – channel geomorphology – travel time estimation

Unit-III: Hydrologic Abstractions

Infiltration: Definition and factors affecting infiltration – Infiltration Estimation: Horton's model, Green-Ampt Model, Infiltrometer, SCS Method. Evaporation and Transpiration: Definition, factors affecting evaporation, methods for estimation of evaporation – EPT: Definition, estimation of EPT

Unit-IV: Unit Hydrograph

Sources of streamflow, streamflow hydrograph and hydrograph characteristics, excess rainfall and direct runoff, Abstractions: Using infiltration indices and SCS method – Peak discharge. Unit hydrograph: Definition, Assumptions and Limitations, UH derivation and Application, S-Hydrograph, Synthetic UH, UH for different rainfall durations

Unit-V: Frequency Analysis

Return period, extreme value distributions, Frequency analysis using frequency factors, Probability plotting – Risk Assessment

Unit-VI: Hydrologic Design

Design Storms: Design precipitation depth, IDF curves, Design precipitation hyetographs from IDF curves, Calculation of probable maximum precipitation. Design Flows: Simulating design flows, flood plain analysis, flood forecasting.

Reference Books:

1. Ven Te Chow, David R Maidment, Larry W. Mays, Applied Hydrology. McGraw Hill International Editions, (2010)
2. Subramanya, Engineering Hydrology, Tata McGraw Hill Co., Graw Hill Co., (2010).
3. Hydrology and Water Resources Engineering, S.K. Garg, JBA publishers, (2015)

SEMESTER – VII

PCC-CED401 CONSTRUCTION PLANNING AND MANAGEMENT

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

1. To train the students in the field work so as to have a firsthand knowledge of practical problems related to Construction Management in carrying out engineering tasks
2. To optimize the time of construction of a project-by-project planning tool.
3. To update the planners at site for material resources, time scheduling and project cost.
4. To give knowledge of risk management and remedial measures.
5. To make students aware of different construction equipment.

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Understand basic concept of management in construction.
2. Plan, schedule and control the construction of the project.
3. Use project planning tools in construction activities.
4. Carry out cost analysis and project updating.
5. Study risk analysis and resource allocation at site.
6. Understand different types of construction equipment its uses and output.

Course Content:

UNIT I: Project Management
Introduction, Project planning, scheduling, controlling, Role of decision in project management, Project management Process and role of Project Manager.

UNIT II: Project Planning Tools
Bar Charts and Milestones Chart: Introduction, Development of bar chart, Short comings and remedial measures, Milestone charts.

UNIT III: CPM & PERT:
CPM & PERT, Elements of network, Time estimates, frequency distribution, mean, variance and standard deviation, probability distribution.
Network Analysis: Slack, Float, Critical path, crashing of activity.

UNIT IV: Cost Analysis & Updating
Introduction, Projects cost: Direct cost, Indirect cost, slope of direct cost curve, total project cost and optimum duration, cost optimization.
Project Updating: Introduction, updating process, data required for updating, steps in process updating.

UNIT V: Risk analysis and Resource allocation

Certainty, risk and uncertainty, risk management, identification and nature of construction risks, contractual allocation of risk, types of risks, minimizing risks and mitigating losses, use of expected values, utility in investment decisions, decision trees, sensitivity analysis.

Resource Allocation: Resource usage profiles, Resource smoothing and levelling.

UNIT VI: Construction Equipment

Types of compaction Equipment's, Types of Excavation and digging Equipment's, Types of hoisting equipment's, Types of Material handling Equipment's and Types of heavy earth moving equipment's.

Reference Books:

1. Project Planning and Control with PERT and CPM by B. C. Punmia, K.K. Khandelwal, Laxmi Publication.
2. Sharma S.C. Construction equipment and management, Khanna Publishers,New Delhi.
3. Peurifoy,R.L., Ledbetter.W.B and schexnayder,C, construction planning and equipment methods, McGraw Hill, Singapore.
4. Callahan,M.T., Quackenbush, D.G., and rowing,J.E., Construction project scheduling, McGraw Hill ,New York.
5. Cleland, D.I. and Ireland, L.R., project management :Strategic design and implementation, , McGraw-Hill, New York.
6. Fisk, D.R. Construction Project Administration, Prentice hall International, London.

PCC-CED402 DESIGN OF STEEL STRUCTURES

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective: To provide a coherent development to the students for the courses in sector of Designing of the Steel Structures. To present the foundations of many basic Engineering concepts related Design of Steel Structures. To give an experience in the implementation of engineering concepts which are applied in field of Steel Structures. To involve the application of scientific and technological principles of planning, analysis, design of buildings.

Course Outcomes (CO): On completion of this course, the students will be able to

1. The students will gain an experience in the implementation of Design of Steel Structures on engineering concepts which are applied in field Structural Engineering.
2. The students will get a diverse knowledge of Design of Steel engineering practices applied to real life problems
3. The students will learn to understand the theoretical and practical aspects of Design of Steel Structure along with the planning and design aspects.
4. Explain structural properties of steel and its designation as per Indian Standards
5. Select different types of bolted and welded joints
6. Supervise fabrication and erection of steel structure like trusses, columns and girders

Course Contents:

UNIT I:

Introduction to steel and steel structures, properties of steel, structural steel sections. Introduction to design: Design loads and load combinations, limit state design concepts. Connections bolted and welded (direct loads)

UNIT II:

Tension members-Types of sections – net area- design of tension members- concept of shear lag-use of lug angle-connections in tension members

UNIT III:

Compression members- design of struts- solid and built up columns for axial loads-- design of lacings and battens-column bases- slab base – gusseted base

UNIT IV:

Design of beams- laterally restrained and unrestrained – simple and compound beams- plate girders subjected to uniformly distributed loads – design of stiffeners.

UNIT V:

Design of roof trusses- types-design loads and load combinations- assessment of wind loads- design of purlins. Moment resistant/Eccentric connections (in plane and out of plane)

UNIT VI:

Design of timber structures: types of timber - classification - allowable stresses-design of beams-flexure, shear, bearing and deflection considerations-Design of columns. Design of composite beam sections with timber and steel.

Text Books & References:

1. Subramanian N, Design of steel Structures, Oxford University Press, 2011
2. P. Dayaratnam., Design of Steel Structures ,Wheeler Publishing, 2003
3. Punmia B. C., Jain A. K. and Jain A. K., Design of Steel Structures, Laxmi Publications (P) Ltd, 2017
4. Raghupathi, Steel Structures, Tata McGraw Hill, 2006
5. Ramchandra S and Virendra Gehlot, Design of Steel Structures Vol. II, Standard Book House, 2007
6. William T Segui., Steel Design , Cenage Learning, 6e, 2017
7. IS 800 – 2007, Code of practice for Structural steel design, BIS

PCC-CED403 IRRIGATION ENGINEERING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

1. To motivate the students to identify, formulate, solve the complex problem to manage the water resource related issues.
2. To prepare the students to synthesize data and technical concepts to apply in water resources engineering.
3. To develop the ability of the students to conduct appropriate experiments, analyse and interpret data and use engineering judgement to draw conclusions in water resources problems.
4. To get the exposure about the concept of irrigation and flood control.
5. To provide the students an opportunity to work as a part of a project team.
6. To train the students for a successful career in water resources engineers

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Understand the different methods of irrigation and find the optimum methods of irrigation for judicious use of water resources.
2. Examine different distribution system of irrigation canal and the basic design of lined and unlined irrigation canal.
3. Apply the mathematics, science and technology to design the minor irrigation structures to develop the command area.
4. Understand application of systems concept, advanced optimization techniques to cover the socio-technical aspects in the field of water resources
5. Study types and classes of hydrologic simulation models and design procedures for safe and effective passage of flood flows for design of hydraulic structures
6. Apply the application of fluid mechanics and use of computers in solving a host of problems in hydraulic engineering

Course Content:

UNIT I: Introduction

Irrigation-necessity, impact of irrigation on human environment, need and historical development of irrigation in India, National water policy- Haryana Scenario, crops and crop seasons with crop water requirement.

UNIT II: Soil-Water Relationship and Irrigation Methods

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 III: 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.

Canal Outlets

Classification, requirements of a good outlet, design of pipe, APM and open flume outlet, flexibility proportionality, setting and sensitivity of outlet.

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.

UNIT IV: 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 V: 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 VI: 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.

Reference 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 Publisherts, Delhi, 1995.
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

PROFESSIONAL ELECTIVE COURSE

Professional Elective I

1. Highway Construction and Management.
2. Traffic Analysis and Transportation Planning.
3. Port, Docks and Harbour Engineering.
4. Metro and Tunnel Engineering.

PEC-CED301-1 HIGHWAY CONSTRUCTION AND MANAGEMENT

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective: To teach the soil classification of highways, bituminous materials and pavement, highway maintenance and some special roads

Course Outcomes (CO): On completion of this course, the students will be able to

1. Identify various types of soils, aggregates and the methods to modify their properties as per requirement.
2. Understand properties of bituminous, low cost, marginal and waste materials used in road construction.
3. Acquire knowledge of bituminous mix design and construction of flexible and rigid pavement layers.
4. Knowledge of operation of different equipment used in highway construction.
5. Describe various methods for different types of pavements.
6. Learn about the hill road's construction and maintenance.

UNIT I:
Highway research Soil classification systems board classification of soils, Indian Standard soil classification Soil stabilizers: Bituminous materials, Cementing agents, Chemical stabilizers Aggregates: Types of road aggregates, Requirements of a good road aggregate, Tests for road aggregates.

UNIT II:
Bituminous Materials: Introduction, Types of Bituminous materials, Tests on Bitumen, Cutback and Emulsions. Paving Mixes: Granular mix design, Fly ash and its characterization. Performance-based mix design Approaches. Use of Fly-ash in road embankment and cement concrete mixes, Innovative Materials.

UNIT III:
Construction of bituminous pavements: various types of bituminous constructions. Prime coat, tack coat, seal coat and surface dressing. Construction of premix carpet, BM, DBM and AC. Mastic asphalt. Design of Bituminous Mix, Marshal Method of bituminous mix design.
Construction of other types of pavements: reinforced cement concrete pavements, prestressed concrete pavements, roller compacted concrete pavements and fibre reinforced concrete pavements.

UNIT IV:
Machinery for Earthwork and Construction of Pavements: bitumen boiler, sprayer, pressure distributor, hot-mix plant, cold-mix plant, tipper trucks, mechanical paver or finisher, rollers. The machinery involved in construction, slip-form pavers, and joints in CC pavements. Introduction to various IRC and MORTH specifications.

UNIT V:

Highway maintenance: pavement distresses, condition and evaluation survey, Present serviceability index, Methods of measuring condition, skid resistance, Principles of maintenance, Methods of structural evaluation. Maintenance operations. Maintenance of WBM, bituminous surfaces and cement concrete pavements. Functional and structural evaluation of pavements, pavement maintenance and maintenance management.

UNIT VI:

Special problems in construction & maintenance of hill roads, Alignment of hill roads and Construction of hill roads. Maintenance of Hill roads, Drainage –Construction of surface and subsurface drainage systems for roads.

Reference books:

1. Khanna and Justo "Highway Engineering"- Nemchand & Bros, Roorkee
2. Khanna and Justo, "Highway Materials Testing"-Nem Chand and Bros., Roorkee.
3. Peurifoy, R.L., and Clifford,JS "Construction Planning Equipment and Method"- McGraw Hill Book Co. Inc.
4. MoRTH 'Specifications for Roads and Bridges Works'- Indian Roads Congress
5. "Soil Mechanics for Road Engineers"- HMSO Publication
6. "Bituminous materials in Road Construction"- HMSO Publication
7. MoRTH "Manual for Construction and Supervision of Bituminous Works"- 2001.
8. MoRTH "Manual for Maintenance of Roads"- 1989.
9. Maintenance, repair, rehabilitation of rigid pavements, IRC: SP 83, IRC: 42-1994, IRC:15-2002, IRC SP :11-1988, 55-2001, 57-2001, 58-2001, IRC 19-1977, 27-1967, 29-1988, 34-1970, 36-1970,48-1972,61-1976, 63-1976, 68-1976, 81-1997,82-1982, 84-1983,93-1985, 94-1986, 95-1987, 98-1997, 105-1988.

PEC-CED301-2 TRAFFIC ANALYSIS AND TRANSPORTATION PLANNING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
To teach the overview of the basics of the traffic planning process, trip distribution, trip generation, modal split analysis and traffic assignment.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Describe the transportation planning process and four-step travel demand forecasting process.
2. Carry out the plan and organize a data collection program for travel demand modelling.
3. Analyse travel data and prepare inputs for travel demand model development.
4. Learn how to prepare and apply a basic trip generation model
5. Classify and apply basic trip distribution models for given data
6. Knowledge about the performance of basic traffic assignment procedures on a given network.

UNIT I:
Transport planning process: Scope – Urban transportation systems - Systems approach to transportation planning – Long term vs Short term – Simultaneous vs sequential approaches – Aggregate vs disaggregate approaches.

UNIT II:
Transportation Planning Surveys: Transport survey – definition of the study area and traffic zones – External cordon line – Sample size – Home interview survey and cordon line surveys - inventory of existing transport facilities, land use and economic activities.

UNIT III:
Trip Generation: Factors governing trip generation: physical, social and economic – multiple regression analysis – category analysis

UNIT IV:
Trip Distribution: Presentation of Trip distribution data – PA matrix to OD matrix - Growth factor methods – Gravity model and its calibration – opportunities model.

UNIT V:
Modal Split Analysis: Factors influencing mode choice – Modal split models – Trip end and trip interchange –Disaggregate mode choice models - Discrete choice models.

UNIT VI:
Traffic Assignment: Traffic assignment – general principles – description of highway network – Moore's shortest path algorithm - assignment techniques – all nothing assignment – capacity restrained assignment – diversion curves.

Reference Books

1. L.R. Kadiyali, Traffic Engineering and Transport planning, Khanna Publishers, New Delhi, (2011).
2. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, Principles of Highway
3. Engineering and Traffic Analysis, John Wiley & Sons, (2012).
4. Papacostas and Prevedouros, Transportation Engineering and Planning, Pearson, India,(2015).

PEC-CED301-3 PORT, DOCKS AND HARBOUR ENGINEERING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
To teach the water transportation system including ports, docks and harbours.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Describe different types water transportation system.
2. Understand the term port and different types of ports.
3. Analyse the harbours and site selection of harbour.
4. Learn about harbour works
5. Knowledge about the docks and repair harbour docks.
6. Classify control system of water transportation.

UNIT I:
Introduction to Water Transportation: History, Scope, Merits, Developments of Water Transportation in India, Inland waterways, River, Canal, Inland water transportation, Harbor, Port, Dock, Development of Ports & Harbors, classification, Harbor site selection, Harbor dimensioning.

UNIT II:
Ports, Requirement of good port, ports development in India, size of seaport, site selection criteria and layout of seaport, Dry ports, Bulk cargo, Transshipment ports, Port of call, Surveys to be carried out for seaport planning, regional and intercontinental transportation development, forecasting cargo & passenger demand, regional connectivity, cargo handling capacity of port.

UNIT III:
Harbours, classification of harbours, selection of site and planning of harbours, location of harbour, traffic estimation, master plan, ship characteristics, harbour design, turning basin, harbour entrances.

UNIT IV:
Harbour works: definitions, breakwaters, types of breakwaters, composite and vertical wall breakwaters, jetty, dock fenders, classification of fenders, piers, wharves, dolphins, trestle, moles and Mooring accessories.

UNIT V:
Docks and Repair Facilities Harbor docks, Wet docks, Dry docks, Repair docks, Lift docks, Floating docks, Slipways.

UNIT VI
Necessity, Types of navigation aids, Requirement of signals, Fixed and floating navigation aid, Channel and entrance demarcation, buoys, beacons, lighthouse, electronic communication devices

Reference Books:

1. R. Srinivasan and S. C. Rangwala, Harbour, Dock and Tunnel Engineering, 1995, Charotar Pub. House, Anand
2. S. P. Bindra, A Course in Docks and Harbour Engineering, 1992, Dhanpat Rai& Sons, New Delhi
3. IS Codes: 4651 (Part I to V), 7314, 9527 (Part I, III, IV, VI), 10020 (Part IV).
4. Alonzo Def. Quinn, Design and Construction of Ports and Marine Structure, McGraw - Hill Book Company, New York
5. Ashford N. and Wright P.H., Airport Engineering, John Wiley and Sons, Inc., New York

PEC-CED301-4 METRO AND TUNNEL ENGINEERING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
To teach the metro systems and different types of tunnelling system in metro.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Understand overview of metro systems.
2. Analyse vehicle dynamics and structure; tunnel ventilation systems; air -conditioning for stations and buildings and electrical system.
3. Study electronic signalling systems and Automatic fare collection.
4. Know basics of construction planning & management, construction quality & safety systems.
5. Classify various types of tunnelling methods.
6. Acquire knowledge about the different types of tunneling machines.

UNIT - I
General: Overview of Metro Systems; Need for Metros; Routing studies; Basic Planning and Financials, Need of Regional Rapid Transit Systems (RRTS), Case Study of Delhi Metro and Delhi Meerut RRTS.

UNIT - II
Construction methods for Viaduct spans and bridges, Underground tunnels, Elevated and underground Stations; Depots; Tunnel Ventilation systems.

UNIT - III
Initial Surveys & Investigations; Basics of Construction Planning & Management in Metro Systems, Construction Quality & Safety Systems, Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way. Facilities Management

UNIT - IV
Signaling systems; Operation Control Centre; SCADA and other control systems; Rolling stock, vehicle dynamics and structure; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators. OHE, Traction Power; Substations- TSS and ASS; Standby and Back-up systems; Green buildings, Carbon credits and clear air mechanics.

UNIT V:
Sections of tunnels: advantages, limitations and suitability of each section. Shaft. Pilot tunnel. Driving tunnel in rocks: sequence of construction operations, full-face method, heading and bench method, drift method. Driving tunnels in soft ground: sequence of construction operations, needle beam method, shield tunneling, compressed air tunneling.

UNIT VI:

Tunnelling Equipment: Crawler excavator, wheel loaders, crawler loaders, tunnel boring machines, immersed tube, different types of drilling & blasting equipment, different types of explosives, muck removal techniques and equipment, miscellaneous.

Reference books:

1. L.R. Kadiyali, N. B. Lal, “Traffic Engineering and Transport Planning”, Khanna Publishers, New Delhi, India, (2011).
2. Railway Engineering, Satish Chandra, Oxford Publishing 2013.
3. Construction Planning Equipment and Method", Peurifoy RL and Clifford JS (8th Edition) 2010, McGraw Hill Book Co Inc, ISBN:13:978-0073401126.
4. Construction Equipment and its Management”, SC Sharma 2002, Khanna Publishers, ISBN-13:978-8174091376
5. IRC SP:96-2012, IRC -97-2013, IRC-SP:86:2010, IRC SP:39-1192

Professional Elective II

1. Environmental Impact Assessment
2. Solid and Hazardous Waste Management
3. Air & Noise Pollution Control
4. Environmental Systems and Legislation

PEC-CED302-1 ENVIRONMENTAL IMPACT ASSESSMENT

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

The basic concepts of EIA, such as the identification, measurement, prediction, assessment, and communication of impacts, methodologies, such as checklists, matrices, networks and overlays, environmental cost-benefit analysis, sustainable development, life cycle assessment, and environmental risk analysis, auditing, including its definition, types, and methodologies and case studies on EIA

Course Outcomes (CO): On completion of this course, the students will be able to

1. Define the basic concept of EIA.
2. Evaluate EIA Methodologies.
3. Analyse the environmental impacts of concerned projects
4. Categorize the type of EIA required for concerned projects.
5. Propose proper mitigation measures to avoid environmental impacts
6. Understand the selection criteria of pumps and water fixtures in buildings.

Course Contents:

UNIT I:

Basic Concepts of Environmental Impact Assessment: Description of the project and the environmental setting, identification of impacts, measurement and monitoring, prediction and assessment of impacts and communication of impacts**.**

UNIT II:

Environmental Impact Assessment Methodologies: Checklists, matrices, networks and overlays, Environmental cost benefit analysis, Sustainable development. Life Cycle Assessment, Environmental Risk Analysis, Definition of Risk.

UNIT III:

Environmental auditing: Definition and types of audits, EMS audits, performance audits; compliance audits, registration audits ISO 14000 series of standards and environmental auditing, Methodologies for Environmental Auditing.

UNIT IV:

EIA related to the following sectors - Infrastructure –construction and housing.

UNIT V:

Acts: Water act, Water Cess act, Air act, Environment Protection act and their amendments, Wildlife act and Forest acts.

UNIT VI:

Energy Balance & Management Review; Operational Control; Case Studies on EIA.

Text Books

1. A K Srivastava, Environment impact Assessment, APH Publishing,2014
2. John Glasson, RikiTherivel& S Andrew Chadwick "Introduction to EIA" University College London Press Limited,2011
3. Larry W Canter, "Environmental Impact Assessment", McGraw HillInc, New York, 1995.
5. Ministry of Environment & Forests, Govt. of India 2006 EIA Notification
6. Rau G J and Wooten C.D "EIA Analysis Hand Book" Mc GrawHill
7. Robert A Corbett "Standard Handbook of Environmental Engineering" McGrawHill, 1999.

PEC-CED302-2 SOLID AND HAZARDOUS WASTE MANAGEMENT

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

To equip students with a holistic understanding of solid waste management, encompassing the generation, categorization, characterization, collection, transportation, processing, treatment, and disposal of solid wastes, with special emphasis on hazardous wastes, and the relevant environmental legislation and regulations.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Define solid waste management
2. Evaluate environment and health impacts of solid waste mismanagement
3. Analyse the legal, institutional and financial aspects of management of solid wastes.
4. Determine engineering, financial and technical options for waste management
5. Review the waste management rules and guidelines.
6. Understand problems of municipal waste, biomedical waste, hazardous waste, e-waste, industrial waste etc.

Course Contents:

UNIT I:

Solid Wastes: Origin, Analysis, Composition and Characteristics.

UNIT II:

Integrated Solid Waste Management System: Collection, Storage, Segregation, Reuse and Recycling possibilities, Transportation, Treatment/Processing and Transformation Techniques,

Final Disposal.

UNIT III:

Management of: Municipal, Biomedical, Nuclear, Electronic and Industrial Solid Wastes and the rules and regulations.

UNIT IV:

Introduction to Hazardous wastes, Definition of Hazardous waste, The magnitude of the problem;

UNIT V:

Hazardous waste: Risk assessment, Environmental legislation, Characterization and site assessment, Waste minimization and resource recovery, Transportation of hazardous waste, Physical, chemical and biological treatment, Ground water contamination, Landfill disposal, Current Management Practices,

UNIT VI:

Transportation of hazardous waste, Physical, chemical and biological treatment, Ground water contamination, Landfill disposal, Current Management Practices.

Text Books

1. Tchobanoglous, G., Theisen, H., & Vigil, S.A; Integrated Solid Waste Management: McGraw Hill,NewYork
2. Solid Waste Engineering, Principle & Management issues by VenTe Chow
3. Bhide, A.D., B.B. Sundaresan, Solid Waste Management in developing countries.
4. Manual on Municipal solid Waste Management, CPHEEO, Govt.ofIndia.
5. Guidelines for Management and Handling of Hazardous wastes MOEF (1991), Govt. of India.
6. Datta, M; Waste Disposal in Engineered Landfills, Narosa Publishers, Delhi.
8. Waste Management "Asian and Pacific Center for Transfer of Technology (N.D.) India", September 1993.

PEC-CED302-3 AIR & NOISE POLLUTION CONTROL

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

The sources, classification, and effects of air and noise pollutants, meteorological factors that affect air pollution dispersion, Ambient air quality standards and air sampling and measurement techniques, Air pollution control technologies for particulate and gaseous pollutants, The basics of acoustics and noise measurement, Noise rating systems and noise abatement and control measures.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Define the scope of Air & Noise Pollution.
2. Evaluate different types of lapse rates.
3. Analyse the control of air and noise pollution.
4. Determine noise quality parameters.
5. Calculate the stack height through gaussian plume modelling.
6. Understand the effect of air pollution on all life and property.

Course Contents:

UNIT I:

Air pollution: Composition and structure of atmosphere, global implications of air pollution. Classification of air pollutants: particulates, hydrocarbon, carbon monoxide, oxides of sulphur, oxides of nitrogen and photochemical oxidants. Indoor air pollution. Effects of air pollutants on humans, animals, property and plants.

UNIT II:

Air pollution chemistry, meteorological aspects of air pollution dispersion; temperature lapse rate and stability, wind velocity and turbulence, plume behaviour, dispersion of air pollutants, the Gaussian Plume Model, stack height and dispersion.

UNIT III:

Ambient air quality and standards, air sampling and measurements. Control of particulate air pollutants using gravitational settling chambers, cyclone separators, wet collectors, fabric filters (Baghouse filter), electrostatic precipitators (ESP).

UNIT IV:

Control of gaseous contaminants: Absorption, Adsorption, Condensation and Combustion, Control of sulphur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons. Automotive emission control, catalytic convertor, Euro-I, Euro-II and Euro-III specifications, Indian specifications.

UNIT V:

Noise pollution: Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources

UNIT VI:

Characteristics of sound and its measurement, Noise Rating Systems, Noise Abatement & Control

Text Books

1. Peavy, Rowe and Tchobanoglous: Environmental Engineering.
2. Martin Crawford: Air Pollution Control Theory.
3. Wark and Warner: Air Pollution: Its Origin and Control.
4. Rao and Rao: Air Pollution Control Engineering.
5. Nevers: Air Pollution Control Engineering.
6. Mycock, McKenna and Theodore: Handbook of Air Pollution Control Engineering and Technology. Suess and Craxford: W.H.O. Manual on Urban Air Quality Management
7. C.S. Rao, Air pollution and control
8. Advanced Air and Noise Pollution Control by Lawrence K. Wang, Norman C. Pereira & Yung IseHung.
9. Noise Pollution and Control by S. P.Singhal, Narosa Pub House
10. Textbook of Noise Pollution and Its Control by S. C. Bhatia, Atlantic; Edition1,

PEC-CED302-4 ENVIRONMENTAL SYSTEMS AND LEGISLATION

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

To equip students with a comprehensive understanding of the Indian legal and regulatory framework for environmental protection, enabling them to identify and understand the key provisions of the relevant legislation, apply it to practical situations, advise organizations on compliance, identify and assess environmental risks, and develop and implement SHE management systems.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Define the environmental Legislation
2. Review the laws and policies both at the national and international level relating to environment.
3. Analyse the pollution control acts and guidelines.
4. Determine environmental protection rules.
5. Review all environmental systems.
6. Understand the solid waste guidelines.

Course Contents:

UNIT I:

Elements of a good Safety, Health and Environmental Systems. Concepts of Management systems

UNIT II:

Water (prevention and control of pollution) act 1974 as amended unto 1988, Water (Prevention and control of pollution) rules 1975, Water (Prevention and control of pollution) (Procedures for Transaction of Business) rules 1975., Water (Prevention and control of pollution) cess Act, 1977 as amended by amendment act, 1991, Water (Prevention and control of pollution) cess rules, 1978.

UNIT III:

Air (Prevention and control of pollution) act, 1981 as amended by amendment act, 1987, Air (Prevention and control of Pollution) rules, 1982.

UNIT IV:

Environment (Protection) act, 1986, Environment (Protection) rules, 1986, Hazardous wastes (Management and Handling) rules, 1989.

UNIT V:

Basel convention, Manufacture, storage and import of hazardous chemical rules, 1989. Scheme of labelling of environment friendly products (ECO –Marks).

UNIT VI:

Public liability insurance act, 1991, Public Liability insurance rules, 1991, Municipal solid waste act/ rule 2000, Biomedical waste act/ rule-2004.

Text Books

1. Pollution Control Acts, rules and notifications issued by CPCB [Ministry of and Environment and forest, Government of India], Paryavaran Bhawan, CGO Complex, New Delhi-110003.
2. Jacobson, M.Z. "Atmospheric Pollution: History, Science and Regulation", Cambridge University Press.
3. Stanley E.M. "Environmental Chemistry", Lewis Publishers.
4. Mohanty, S.K. "Environment & Pollution Law Manual", Universal Law Pub.
5. Sengar, D.S. "Environmental Law", PHI.

Professional Elective III

1. Geo-Environmental Engineering
2. Advanced Foundation Engineering
3. Soil Dynamics and Machine Foundation
4. Ground Improvement Techniques

PEC-CED303-1 GEO-ENVIRONMENTAL ENGINEERING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
To understand the application of geo environmental engineering concepts in remediation of various environmental challenges

Course Outcomes (CO): On completion of this course, the students will be able to

1. Understand the role of geo-environmental engineering in addressing environmental issues
2. Learn key terms associated with geo-environmental engineering
3. Describe various types of contaminants in soil and their mechanisms
4. Illustrate various techniques of containment of contaminants in soil
5. Utilize environmental waste in geotechnical applications
6. Suggest remedial measures against soil erosion

Course Contents:

UNIT I:
Surface & subsurface contamination, biological & chemical contamination sources & effect of subsurface contamination, Fate & transport of underground contamination, advection, dispersion, diffusion, sorption, volatilization, chemical reaction, biodegradation radioactive decay. Geo-environmental soils characterization & remediation methods.

UNIT II:
Contaminants of solid waste in landfills, characteristics of solid wastes, types of landfills, site selection, shape of size of landfills, liners, covers characteristics of solid wastes, types of landfills, site selection, shape and size of land fill, liners, covers and Leachete collection, waste containment principles, Types of barrier materials, planning & design aspects related to waste disposal. Land fill in ash ponds, infilling ponds & in rocks. Stability of landfills, sustainable waste management. Monitoring surface contamination, stabilization & modification of waste. Case studies in waste handling, soil-waste interaction.

UNIT III:
Contamination of slurry waste; Slurry transported wastes, slurry ponds, operation, embankment construction & planning, design aspects, environmental impact & control.

UNIT IV:
Vertical barriers system & cutoff walls, slurry trench cutoff, backfill design & potential defects, use of bentonite & cement in slurry. Constructional features, use of geosynsthetics in land-fills, barriers & cutoff, installation of soil mixed wall barrier by deep soil mixing.

UNIT V:
Environmental monitoring around landfills, detection, control & remediation of subsurface contamination; engineering properties & geotechnical reuse of waste materials. Demolition waste dumps, regulations.

UNIT VI:

Soil erosion and land conservation; causes of soil erosion, factors contributing to erosion, erosion control measures.

***References Books*:**

1. Reddi, L. N. and Inyang, H. F, Geoenvironmental Engineering - Principles and Applications, Marcel Dekker Inc, 2000Geotechnical Practice for Waste Disposal (1993): D.E. Daniel Chapman and Hall, London.
2. A. Bagchi, John Wiley and Pone N.Y. Sharma, H. D. and Lewis, S. P, Waste Containment Systems, Waste Stabilization and
3. Landfills: Design and Evaluation, John Wiley & Sons Inc., 1994Construction and Monitoring of Landfills (1994).
4. Fang, H-Y, Introduction to Environmental Geotechnology, CRC Press, 1997
5. Daniel, D. E, Geotechnical Practice for Waste Disposal, Chapman and Hall, 1993
6. Rowe, R. K., Quigley, R. M. and Booker, Clay Barrier Systems for Waste Disposal Facilities, J. R., E & FN Spon, 1995
7. Rowe, R. K, Geotechnical and Geoenvironmental Engineering Handbook, Kluwer Academic Publishers, 2001

PEC-CED303-2 ADVANCED FOUNDATION ENGINEERING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective: To learn various types of foundation systems and their design methods.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Identify and propose the suitable scheme for soil exploration
2. Learn design principles of various types of foundations
3. Understand various types of foundation testing methods
4. Propose and design suitable type of foundation as per standards
5. Identify and design various types of Earth retaining structures
6. Analyze and Design of reinforced earth structures

Course Contents:

UNIT-1
Introduction, Boreholes, Sampling, Standard Penetration test, Cone penetration test, Plate Load Test, Pressure meter test, Dilatometer test, Geophysical exploration methods.

UNIT-II
Introduction, Bearing capacity - correction factors, Eccentrically loaded foundations, closely spaced foundations, bearing capacity of layered soils, combined footing, raft footing, rigid and flexible mat, Bearing capacity, Differential settlement, buoyancy raft, structural design of mat foundations

Unit-III
Deep Foundations, Piles, Methods of construction of bored cast-insitu pile, Pile installation, Laterally loaded piles and different types of load tests on piles. Application of stress-wave theory

UNIT-IV
Well Foundations, Types, components, construction methods, design methods (Terzaghi, IS and IRC approaches), check for stability, base pressure, side pressure and deflection.

UNIT-V
Retaining Walls, Design of gravity and cantilever walls, design of cantilever and anchored sheet pile walls. Support systems for flexible retaining walls – anchors, struts, construction methods, stability calculations. Construction of diaphragm walls, barrettes, caissons, soldier piles and lagging

UNIT-VI
Reinforced earth, geotechnical properties of reinforced soil, shallow foundation on soil with reinforcement, retaining walls with reinforcements, design considerations

***References Books*:**

1. Braja. M. Das. Principles of Foundation Engineering, 2011, Cengage Learning. 7th Edition, (2010).
2. Murthy, V N. S. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering. New York: Marcel Dekker, 2003
3. J. E. Bowles, Foundation Analysis and Design, McGraw-Hill Book Company, 5th Edition (2013).
4. Purushothama Raj. Soil Mechanics & Foundation Engineering, darling Kindersley publishing, (2011)
5. Swamisaran, Reinforced soil and its Engineering applications, I.K. International Pvt. Ltd., (2010)
6. N. Som, Theory and Practice of Foundation Design, Prentice Hall, New Delhi, 2003.

PEC-CED303-3 SOIL DYNAMICS AND MACHINE FOUNDATION

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
To understand the fundamentals of soil dynamics and apply its principles in foundation design

Course Outcomes (CO): On completion of this course, the students will be able to

1. Distinguish different types of vibrations and their responses
2. Examine the mechanism of wave propagation and dynamic properties of soil
3. Perform the soil modeling for cyclic loading
4. Understand the principle of vibration isolation
5. Evaluate the stiffness and damping of shallow foundations
6. Analyze and design machine foundation

Course Contents:

UNIT I:
Introduction to fundamentals of vibration, sources of vibrations, basics concepts of vibration, classification of vibrations, vibration analysis procedure, simple harmonic motion. undamped free vibration of SDOF systems, damping – linear, non-linear damping, equivalent viscous damping. damped free vibration of SDOF systems, response of damped SDOF system under harmonic force and rotating unbalanced force

UNIT II:
Wave propagation in elastic medium, shear and dilational waves, rod waves – natural frequencies and mode shapes, Rayleigh waves and their significance in soil dynamics, attenuation of shear waves

UNIT III:
Dynamic soil properties - G_{max}, G_{sec}, G_{tan}, G/G_{max} and damping, factors affecting dynamic soil properties, lab tests - resonant column test, bender element test, cyclic triaxial / simple shear / torsional shear tests, field tests – seismic reflection and refraction tests, seismic crosshole and downhole tests, SASW/MASW tests, block vibration test, cyclic plate load test, SPT and DCPT

UNIT IV:
Soil modeling for cyclic loading, linear viscoelastic model – stress-strain relationship – Kelvin model – Maxwell model. nonlinear stress-strain model – hyperbolic model, Masing model, Ramberg-Osgood model.

UNIT V:
Dynamic stiffness of shallow foundations, circular rigid mat foundation on elastic half space excited vertically, laterally, torsion or rocking – effective stiffness and damping of such systems, effect of foundation shape and embedment on stiffness and damping constants, finite soil layer and depth to bedrock on system of rigid foundations, principles of vibration isolation – active and passive isolation, methods of isolation, design of wave barriers

UNIT VI:

analysis and design of machine foundations, block foundations for reciprocating engines and low speed rotary machines, block foundations for forge hammers and other impact machines, frame foundations for high-speed rotary machineries, spring mounted foundations.

***References Books*:**

1. Das B.M and Ramanna G.V. (2011), Principles of soil dynamics 2nd Edition, Cengage learning, Stanford, USA.
2. Kramer, S. L. (2010), Geotechnical Earthquake Engineering, Pearson Education Inc., New Delhi.
3. Prakash, S. and Puri, V. K. (2008), Foundation for machines: Analysis and Design, John Wiley & Sons, New York.
4. Saran, S. (1999), Soil Dynamics and Machine Foundations 2nd Edition, Galgotia Publications Pvt. Ltd., New Delhi, India.

PEC-CED303-4 GROUND INPROVEMENT TECHNIQUES

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
To teach the overview of soil properties and fundamental of soil mechanics in relation to soil hydraulics, compaction, consolidation, stress distribution and shear strength.

Course Outcomes (CO): On completion of this course, the students will be able to

1. Understand the soil stabilization with additives such as lime, cement, bitumen and soil-lime-fly ash
2. Decide the use of in-situ densification methods in granular soils such as Terra-Probe and vibro-flotation techniques
3. Explain the in-situ densification methods in cohesive soil, pre-loading and de-watering
4. Learn the concept of grouting, grout techniques, grouting equipment and methods of their applications
5. Interpret the application of underpining of foundations and underpinning methodology
6. Distinguish the application of geotextiles in roads, walls, embankments, drains, and for landfill covers and liners

Course Content

UNIT I:
Principles of compaction, engineering behaviour of compacted clays, field methods of compaction, quality control, design of soil-lime, soil-cement, soil-bitumen and soil-lime-fly ash mixes.

UNIT II:
In-situ densification methods in granular soils, deep compaction, Terra-Probe, Vibroflotation techniques, ground suitability for Vibroflotation, Mueller resonance compaction, dynamic compaction, depth of improvement.

UNIT III:
In-situ densification methods in cohesive soil, pre-loading and de-watering, vertical drains, electrical method, thermal method.

UNIT IV:
Grouting, suspension grout, solution grout, grouting equipments and methods, grouting design and layout, ultimate bearing capacity and settlement of granular piles, method of construction, load test, dewatering systems.

UNIT V:
Underpinning of foundations, situations for underpinning, methodology

UNIT VI:

Types, functions and specifications of geotextiles, precautions in transportation and storage, geogrids in roads, walls, and embankments, geonets and geocomposites as drains and filters, geosynthetic covers and liners for landfills.

***Text and Reference Books*:**

1. Gopal, R. and ASR Rao, Basic and applied soil mechanics, 2nd edition, New age International publishers (2004)
2. Purushotham S. Raju, Ground Improvement Technique, Laxmi Publications
3. Shashi K. Gulhati and Manoj Dutta, Geotechnical Engineering, Tata McGraw-Hill Publishing CompayLimited,New Delhi (2008)
4. Arora, K. R., Soil Mechanics and Foundation Engineering, 5th edition, Standard publishers (2000)
5. Sivakumar Babu, G. L., An introduction to Soil Reinforcement and Geosynthetics, Universities Press (India) Private Limited (2006)
6. Donald, H. Gray & Robbin B. Sotir, Bio Technical & Soil Engineering Slope Stabilization, John Wiley
7. Rao G.V. & Rao G.V.S., Engineering with Geotextiles, Tata McGraw Hill

Professional Elective IV

1. Sustainable Construction Practices
2. Design of Prestressed Structures
3. Earthquake Resistant Design
4. Composite Structures

PEC-CED304-1 SUSTAINABLE CONSTRUCTION PRACTICES

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
To understand the sustainable development and construction practices, environmental impact, waste management and material recycling.

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Understand the concept of sustainability, design and technologies for sustainable development.
2. Study the environmental impact assessment and life cycle assessment
3. Analyse the methods for waste management and recycling, eco-friendly materials and environmental policies
4. Study the carbon cycle of key construction materials and their contribution in emission.
5. Apply the use of low cement concrete, recycled aggregates etc.
6. Know the concept of energy conservation, Green Buildings, their rating and policy framework.

Course Content:

UNIT I:
Overview of Sustainability, Design for Sustainability, Sustainable Technology Development, Life Cycle Assessment, Materials Extraction and Resource Implications, Environmental Impacts During Processing.

UNIT II:
Waste Management and Materials Recycling, Green Chemistry, Environmental Protection, Environmentally Friendly Materials, Materials for Green and Renewable Energy.

UNIT III:
Renewable Energy Policy, Environmental Justice, legislation, Various Policies for Sustainability, etc.

UNIT IV:
Carbon cycle and role of construction material such as concrete and steel, etc. CO2 contribution from cement and other construction materials. Construction materials and indoor air quality. No/Low cement concrete. Recycled and manufactured aggregate.

UNIT V:
Control of energy use in building, ECBC code, codes and practices in various countries, OTTV concepts and calculations, features of LEED and TERI Griha ratings.

UNIT VI:
Role of insulation and thermal properties of construction materials, influence of moisture content and modeling. Performance ratings of green buildings. Zero energy building.

Reference Books:

1. "Sustainable Building Design Manual – Volume II", Published by TERI, New Delhi, 2004.
2. Kibert, C. J., "Sustainable Construction: Green Building Design and Delivery", John Wiley & Sons, 2013.
3. Steven V. Szokolay., "Introduction to Architectural Science – The Basis of Sustainable Design", Elsevier, 2007.
4. Sandy Halliday, "Sustainable Construction", Routledge, (Taylor & Francis Group), 2013.
2. Dejan Mumovic and Mat Santamouris (Ed), "A Handbook of Sustainable Building Design and Engineering", Earthscan Publishing, 2009.
3. Osman Attmann, "Green Architecture: Advanced Technologies and Materials", McGraw Hill, 2010.

PEC-CED304-2 DESIGN OF PRESTRESSED STRUCTURES

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
To study essential concepts of prestressing, structural behaviour of precast structures, prestressing of various structural components. Design and detailing of prefabricated units of Industrials structures, multi-storeyed buildings, water tanks etc.

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Understand the concepts of prestressing.
2. Study the structural behaviour of precast structures.
3. Analyse the designing and detailing of prefabricated units.
4. Know the prestressing methods of various structural components.
5. Study the designing of prefabricated structures
6. Application of prefabricated structures

Course Content:

UNIT I:
Types of prestressing, prestressing systems and structural schemes, Disuniting of structures, Structural behaviour of precast structures.

UNIT II:
Handling and erection stresses, Application of prestressing of roof members; floor systems two-way load bearing slabs, Wall panels, hipped plate and shell structures.

UNIT III:
Dimensioning and detailing of joints for different structural connections; construction and expansion joints.

UNIT IV:
Production, Transportation & erection- Shuttering and mould design Dimensional tolerances- Erection of R.C. Structures, Total prefabricated buildings.

UNIT V:
Designing and detailing prefabricated units for industrial structures, Multi-storey buildings, and Water tanks, silos bunkers etc.

UNIT VI:
Application of prestressed concrete, prefabricated components, precast pavement blocks, etc.

Reference Books:

1. Hass, A.M. Precast Concrete Design and Applications, Applied Science Publishers, 1983.
2. Promyslolw. V., Design and Erection of Reinforced Concrete Structures, MIR Publishers, Moscow 1980.
3. Koncz.T., Manual of Precast Concrete Construction, Vol.I II and III, Bauverlag, GMBH, 1971.
4. Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precast Concrete, Netherland Betor Verlag, 1978.

PEC-CED304-3 EARTHQUAKE RESISTANT STRUCTURES

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

1. To introduce the basics of Earthquake Engineering
2. To introduce the engineering seismology, building geometrics & characteristics, structural irregularities.
3. To introduce tips on earthquake engineering - do's and don'ts

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Understand the basics of Earthquake Engineering
2. Study the dynamics of structural system under earthquake load
3. Analyze the influence of the structural / geometrical design in building characteristics
4. Demonstrate the cyclic loading behaviour of RC steel and pre-stressed concrete elements
5. Apply Codal provisions on different types of structures.
6. Study the seismic performances of buildings in various conditions

Course Content:

UNIT I:
Elements of Engineering Seismology - Theory of Vibrations -Indian Seismicity -Earthquake History - Behaviour of structures in the past Earthquakes.

UNIT II:
Seismic Design Concepts - Cyclic loading behaviour of RC, Steel and Prestressed Concrete elements - Response Spectrum Design spectrum - capacity based design.

UNIT III:
Provision of Seismic Code frames, shear walls, Braced frames, Combinations, Torsion.

UNIT IV:
Performance of Regular Buildings 3D Computer Analysis of Building Systems (Theory only)

UNIT V:
Design and Detailing of frames, Shear walls and Frame walls.

UNIT VI:
Seismic performance, Irregular Buildings, Soil performance, liquefaction, Modern Concepts - Base Isolation - Adoptive systems - Case studies.

Reference Books:

1. Pankaj Agarwal and Manish ShriKhande, Earthquake Resistant Design of Structures, Prentice-Hall of India, New Delhi, 2003.
2. Bullen K.E., Introduction to the Theory of Seismology, Great Britain at the University Printing houses, Cambridge University Press 1996.

PEC-CED304-4 COMPOSITE STRUCTURES

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

1. To introduce the concept of composite construction and their applications in engineering
2. To discuss shear connector types, degree of shear connector, interaction and their strength
3. To introduce design of composite beams under propped and un-propped condition
2. To introduce design of different types of composite deck slabs
3. To discuss effects of temperature, shrinkage and creep and cyclic loading on composite sections

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Understand the concepts of composite construction in engineering.
2. Study the behavior of shear connectors, degree of shear connection and their interaction.
3. Design composite beams under propped and un-propped condition.
4. Analyse the different types of composite deck slabs.
5. Determine the effects of temperature, shrinkage and creep and cyclic loading on composite sections
6. Study the composite slabs and design of composite floor system

Course Content:

UNIT I:
Introduction, types, advantages, comparison, and applications of composite sections.

UNIT II:
Limit states of composite sections, introduction to plastic analysis, mechanism of composite members.

UNIT III:
Shear connectors, types of shear connectors, degree of shear connection, partial and complete shear connections, strength of shear connectors, experimental evaluation of shear connectors.

UNIT IV:
Analysis and design of composite beams without profile sheet, propped condition, un-propped condition, deflection, design of partial shear connection.

UNIT V:
Design of composite beam with profile sheet, propped and un-propped condition, deflection of composite beams, design of partial shear connection.

UNIT VI:
Introduction of Composite slabs, profiled sheeting, sheeting parallel to span, sheeting perpendicular to span, analysis and design of composite floor system.

Reference Books:

1. Johnson R.P., “Composite Structures of Steel and Concrete”’ Volume-I, Black Well Scientific Publication, U.K., 1994
2. Teaching Resources for “Structural Steel Design”. Vol.2 of 3, Institute of Steel Development and Growth (INSDAG), 2000
3. Narayanan R., “Composite Steel Structures – Advances, Design and construction, Elsevier, Applied Science, U.K., 1987
4. Owens, G.W & Knowles, P., Steel Designers Manual,” (fifth edition), Steel Concrete Institute (U.K), Oxford Blackwell Scientific Publication, 1992.
5. IS 11384 – 1985 Indian Standard Code of Practice for Composite Construction in Structural Steel and Concrete, Bureau of Indian Standards, New Delhi

Professional Elective V

1. Ground Water Flow and Pollution Modelling
2. GIS and Remote Sensing
3. Draught and Flood
4. Ground Water Engineering

PEC-CED405-1 GROUND WATER FLOW AND POLLUTION MODELLING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

1. To learn about the importance of groundwater occurrence, movement and its importance in hydrologic cycle
2. To derive groundwater flow equations using soft computing techniques
3. To analyse groundwater contamination transport modelling
4. To be able to comprehend groundwater pollution, its causes and methods for controlling groundwater pollution

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Methodology and basic tools of water quality modelling
2. Different modelling approaches their scope and limitations
3. Fate and transport of pollutants in different water bodies
4. Techniques of analysis to assess population dynamics
5. Numerical modelling and finite difference methods.
6. Solve groundwater flow equations through numerical methods and computational modelling

Course Content:

UNIT I: Subsurface Processes and Concepts
Subsurface processes and concepts for groundwater resources evaluation.

UNIT II: Unsaturated zone properties
Soil moisture levels, retention curves, flow through unsaturated porous media, infiltration and wetting front.

UNIT III: Problems, Sources, causes and processes of Groundwater Pollution
Groundwater contamination, sources and causes of groundwater pollution. pollution dynamics, hydrodynamics dispersions, biodegradations, radioactivity decay, reactive processes, multiphase contamination, NAPLs, VOCs, site specific groundwater quality problems in Indian context.

UNIT IV: Groundwater Flow Modelling and Simulation
Numerical models, finite difference methods, numerical modelling of steady and transient flows in saturated and unsaturated domains, contamination transport modelling, application of FEM and BIEM in groundwater modelling, regional aquifer simulation.

UNIT V: Groundwater Management
Contaminated groundwater systems and their rehabilitation, development and optimization based management of aquifer systems, stochastic models, random field concepts in groundwater models, application emerging techniques to groundwater management.

UNIT VI: Contemporary issues

Contemporary issues in groundwater flow and pollution modelling include the declining groundwater level and quality, the need for improved modelling capabilities, the impact of climate change, and the migration of pollutants.

Reference Books:

1. Rich L.G. (1972) Environmental Systems Engineering, McGraw Hill Inc. USA.
2. Thoman R.V.(1980)Systems Approach to Water Quality Management, McGraw Hill Inc. USA
3. Canter and Knox (1985) Ground Water Pollution Control, Lewis Publication, Michigan, USA.
4. Sun, N. (1995) Mathematical Modelling, John Wiley and Sons, USA.
5. Schnoor, J.L. (1996) Environmental Modelling, John Wiley and Sons, USA

PEC-CED405-2 GIS AND REMOTE SENSING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

1. To understand the basic concepts of remote sensing.
2. To learn basic concepts of Geo-graphical Information Systems (GIS).
3. To know various applications of Remote Sensing and GIS applications in Engineering Hydrology.
4. To know the importance of decision-making system.
5. To understand the importance of Remote Sensing and GIS in Hydro-Environment Engineering.
6. To understand the importance of digital elevation model (DEM) in various water resources engineering applications.

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Identify the Indian remote sensing satellites and their platforms
2. Present available GIS and Remote Sensing software like ARC GIS, QGIS and ERDAS Imagine.
3. Develop Digital Elevation Model (DEM)
4. Develop Land use land cover analysis
5. Generate spectral library
6. Understand the importance of GIS and Remote Sensing in Civil Engineering

Course Content:

UNIT I: Basic concepts of Remote Sensing
Introduction to Remote Sensing, Electromagnetic Spectrum and radiation, Remote Sensing Platforms, Satellite Sensors, Orbits in Remote Sensing

UNIT II: Sensors and Scanning Systems
Indian Remote Satellites (IRS), Spectral characteristics earth surface features i.e, vegetation, water and soil, Understanding the spectral curves to create spectral library

UNIT III: Digital Image processing
Elements of image interpretation, Concepts of digital image processing, Image registration, Feature extraction techniques, Image classification, Land use and land cover analysis

UNIT IV: Basic concepts of GIS
Introduction to GIS, History of development of GIS, Elements of GIS - Computer hardware and software, Map reading, various maps in GIS
Spatial Analysis tools
Map overlay operations, Vector and Raster data model, Data storage and database management, Spatial data analysis techniques

UNIT V: Introduction and Principles of Photogrammetry
Type of Photogrammetry, Stereoscopic Instruments / views, Vertical Photography, Ortho-photos, Oblique Photographs, Topographic Mapping , Digital Elevations/ terrain Modelling

UNIT VI: Applications of remote sensing and GIS

Application of remote sensing and GIS in Civil Engineering, Case studies and Contemporary issues

Reference Books:

1. Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, New Delhi, Second Edition, (2012)
2. Thomos Lille sand, Ralph W. Kiefer and Jonathan Chripman, Remote Sensing and Image Interpretation, Wiley Publisher, 7th Edition, (2015).
3. Peter A. Burrough, Rachael A. McDonnell and Christopher D. Lloyd, Oxford University Press, 3rd Edition, (2015).
4. Kang-tsung Chang, Introduction to Geographic Information Systems, McGraw-Hill Education; 8th Edition, (2015).
5. G S Srivastava, An Introduction to Geoinformatics, McGraw Hill Education (India) Private Limited, (2014).
6. Paul Wolf, Bon DeWitt and Benjamin Wilkinson, Elements of Photogrammetry with Application in GIS, McGraw-Hill Education; 4th Edition, (2014).

PEC-CED405-3 DRAUGHT AND FLOOD

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
To provide student knowledge of shortage and excess of precipitation and its impact on human life.

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Understand methods of design structures required to drought and flood
2. Identify flood problems
3. Design of subsurface drainage systems
4. Design of surface drainage systems
5. Estimate the design floods and analyse the flood routing techniques
6. Apply engineering measures for flood forecasting, warning and flood fighting techniques

Course Content:

UNIT I: Drought
Definition, causes, types, indices, management, water harvesting

UNIT II: Flood Problems
Causes of flood, alleviation, Estimation of design floods, Methods of computations, Flood routing through reservoirs and channels, Puls method, Muskingum method, Flood mitigation, Various types of storages, Reservoir operation, river improvement works

UNIT III: Flood forecasting, warning and fighting
Forecasting techniques, engineering measures for flood fighting

UNIT IV: Spillway designs
Functions of spillway, types of spillways

UNIT V: Design of subsurface drainage systems
Necessity of subsurface drainage systems, design of underdrains

UNIT VI: Design of surface drainage systems
Necessity of surface drainage systems, design of underdrains

Reference Books:

1. Engineering Hydrology by K. Subramanya.
2. Hydrology for Engineers by Linsely, Kohler, Paulhus.
3. Flood Control and Drainage Engineering by S.N. Ghosh
4. Water Resources Engineering by Larry W. Mays
5. Land drainage Principles, methods and applications by A K Bhattacharya and AM Micael

PEC-CED405-4 GROUND WATER ENGINEERING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

1. To learn about the importance of groundwater occurrence, movement and its importance in hydrologic cycle
2. To become familiar with aquifer types and aquifer parameters
3. To derive groundwater flow equations for confined and unconfined aquifers under steady and unsteady flow conditions
4. To understand well hydraulics, and in-situ tests for determining drawdown and flow through wells
5. To be able to comprehend groundwater pollution, its causes and methods for controlling groundwater pollution

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Understand the occurrence, movement, types, and various parameters of groundwater system
2. Solve the equations for steady and unsteady flow through confined and unconfined aquifers
3. Understand about the types of wells and their functioning
4. Identify the process and methods for analyzing results from a pumping test
5. Understand the causes and sources of groundwater pollution and the remedial measures to be adopted to control groundwater pollution
6. Solve groundwater flow equations through numerical methods

Course Content:

UNIT I: Occurrence of Ground Water

Groundwater in hydrological cycle, Properties of rocks and water bearing formations affecting ground water flow, Ground water basins, Vertical distribution of ground water, Ground water potential and its exploitation in India.

UNIT II: Groundwater Movement

Darcy's law, Permeability and its determination, Flow rates and directions of flow of ground water, Dispersion of tracers in ground water, Unsaturated flows, General equations governing steady/unsteady flow through confined and unconfined aquifers.

UNIT III: Hydraulics of Water Wells

Flow in confined aquifers towards wells in steady and unsteady state. Flow through leaky or semiconfined aquifers into wells, Dupuits assumption for unconfined aquifers, Steady and unsteady flows into wells, Theis, Jacob's and Chow's methods of solution of unsteady flows, Method of superposition in groundwater flow-method of images, Solutions of flow towards wells near a recharge boundary or impermeable boundary, Use of observation wells, Multiple well systems, Partially penetrating wells.

UNIT IV: Design and Construction of Wells

Selection of Aquifer, well depth and well diameter, selection of screen-type and design of well screen, Provision of artificial gravel pack and shrouded wells, Test holes and well logs, Method of construction of shallow and deep wells including drilling, Completion and development of wells, Pumping equipment, resting the wells for yield, Maintenance and protection of wells, Rehabilitation of old and abandoned wells.

UNIT V: Surface Investigations of Groundwater

Geological methods, Remote sensing, Geophysical exploration, electrical Resistivity method, Seismic Refraction method, Gravity and magnetic methods, Water Witching.

Subsurface Investigation of Groundwater

Test drilling measurement of water levels, Geophysical logging, Resistivity logging, Spontaneous potential logging, Radiation logging, Temperature logging, Caliper logging, Fluid conductivity logging, Fluid Velocity logging, miscellaneous logging and other subsurface techniques.

UNIT VI: Artificial Recharge of Groundwater

Concept of artificial recharge: Methods of artificial recharge-water spreading, Waste water recharge for reuse, Recharge mounds, Induced recharge, Artificial recharge for energy purposes.

Saline Water Intrusion in Aquifers

Occurrence of saline water intrusion, Ghyben-Herzberg Relation between fresh and saline water shape and structure of fresh water and salt water interface, upcoming saline water, fresh water and salt water relations on oceanic islands, Control of salt water intrusion, Recognition of sea water in the ground water.

Quality of Ground Water

Sources of salinity, Measures of water quality, Chemical analysis-graphical representation, physical and Biological analysis.

Reference Books:

1. Karamouz, M, Ahmadi, A, and Akhbari, M, Groundwater Hydrology: Engineering, Planning and Management, CRC Press, 2011.
2. Todd, D.K., and Mays, L. W., Groundwater Hydrology, John Wiley & Sons, Singapore, 2011.
3. Davis, S.N., and De Weist, R.J.M., Hydrogeology, John Wiley & Sons, New York, 1966.
4. Domenico, Concepts and Models in Groundwater Hydrology, McGraw Hill Inc. New York, 1972

Professional Elective VI

1. Disaster Management and Mitigation
2. Solid and Hazardous Waste Management
3. Retrofitting and Structural Health Monitoring
4. Fire and Safety Engineering

PEC-CED406-1 DISASTER MANAGEMENT AND MITIGATION

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
To introduce the concept of disaster, type of disasters, its management and mitigation.

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Understand the concept of disasters, level of disasters and natural and manmade disasters.
2. Study of the various type of disasters.
3. Analysis the hazard assessment
4. Conceptualise the structural and non-structural measure to resist disaster
5. Learn the coping mechanism for disasters
6. Planning of disaster management.

Course Content:

UNIT I:
Understanding Disaster: Concept of Disaster - Different approaches- Concept of Risk -Levels of Disasters - Disaster Phenomena and Events (Global, national and regional) Hazards and Vulnerabilities: Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential or natural hazards.

UNIT II:
Types of disasters- floods, cyclones, lightening, thunderstorms, hailstorms, avalanches, droughts, cold and heat waves, epidemics, pest attacks, forest fire, chemical, industrial, radiological and nuclear disasters, building collapse, rural and urban fire, road and rail accidents etc.

UNIT III:
Hazard assessment - Dimensions of vulnerability factors; vulnerability assessment -Vulnerability and disaster risk - Vulnerabilities to flood and earthquake hazards Disaster Management Mechanism: Concepts of risk management and crisis managements- Disaster Management Cycle- Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief

UNIT IV:
Capacity Building: Capacity Building: Concept - Structural and Non-structural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels

UNIT V:
Coping with Disaster: Coping Strategies; alternative adjustment processes – Changing Concepts of disaster management – Industrial Safety Plan; Safety norms and survival kits -Mass media and disaster management

UNIT VI:

Planning for disaster management: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India - Organizational structure for disaster management in India - Preparation of state and district disaster management plan. Case studies: Natural and man-made disasters, preparedness and planning.

Reference Books:

1. 1 D B N Murthy Disaster Management: Text & Case Studies, Deep & Deep Pvt. Ltd.
2. 2 S L Goel, Encyclopedia of Disaster Management, Deep & Deep Pvt. Ltd.
3. 3 G K Ghosh, Disaster Management, A P H Publishing Corporation.
4. Satish Modh, Citizen's Guide to Disaster Management Macmilan.
5. Manual on Disaster Management, National Disaster Management, Agency Govt of India.
6. Disaster Management by Mrinalini Pandey Wiley 2014.
7. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015

PEC-CED406-2 SOLID AND HAZARDOUS WASTE MANAGEMENT

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
To study about the managing various solid wastes and risk assessment of hazardous waste. Also to study the waste production minimizing techniques.

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Understand to manage various types of solid waste.
2. Analyse the assessment of risk of hazardous waste.
3. Identify the ways to minimize the production of waste.
4. Quantify the risk and provide methods to reduce it.
5. Study disposal of landfill and current landfill management practices
6. Perform the environmental audit and risk assessment

Course Content:

UNIT I:
Solid Wastes: Origin, Analysis, Composition and Characteristics. Integrated Solid Waste Management System: Collection, Storage, Segregation, Reuse and Recycling possibilities, Transportation,

UNIT II:
Treatment / Processing and Transformation Techniques, Final Disposal. Management of: Municipal, Biomedical, Nuclear, Electronic and Industrial Solid Wastes and the rules and regulations.

UNIT III:
Introduction to Hazardous wastes, Definition of Hazardous waste, the magnitude of the problem; Hazardous waste: Risk assessment.

UNIT IV:
Environmental legislation, Characterization and site assessment, Waste minimization and resource recovery, Transportation of hazardous waste, Physical, chemical and biological treatment,

UNIT V:
Ground water contamination, Landfill disposal, Current Landfill Management Practices

UNIT VI:
Environmental audit, Pollution Prevention, Facility Development and operation, Site Remediation: Quantitative risk assessment, site and subsurface characterization, Containment, remedial alternatives.

Reference Books:

1. Pankaj Agarwal and Manish ShriKhande, Earthquake Resistant Design of Structures, Prentice-Hall of India, New Delhi, 2003.
2. Bullen K.E., Introduction to the Theory of Seismology, Great Britain at the University Printing houses, Cambridge University Press 1996.

PEC-CED406-3 RETROFITTING AND STRUCTURAL HEALTH MONITORING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

To understand the structural assessment and evaluation of damages, durability of structure, identification of failures and strengthening of structures using various retrofitting techniques.

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Understand the cause of deterioration of concrete structures.
2. Able to assess the damage for different type of structures
3. Summarize the principles of repair and rehabilitation of structures
4. Recognize ideal material for different repair and retrofitting technique
5. Perform notable applications of structural health monitoring in Civil applications
6. Propose the life of structure and structural components

Course Content:

UNIT I:
Introduction and Definition for Repair, Retrofitting, Strengthening and rehabilitation. Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake.

UNIT II:
Damage Assessment: Purpose of assessment, Rapid assessment, Investigation of damage, valuation of surface and structural cracks. Damage assessment procedure, destructive, non-destructive and semi destructive testing systems. Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.

UNIT III:
Maintenance and Retrofitting Techniques: Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding (ERB) technique, near surface mounted (NSM) technique, External post- tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building

UNIT IV:
Materials for Repair and Retrofitting: Artificial fibre reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.

UNIT V:

Introduction- Qualitative and non-continuous methods of evaluation of structures- SHM definition- Detecting the existence of the damage on the structure- Locating the damage Identifying the types of damage, Quantifying the severity of the damage, Sensors- Feature extraction through signal processing and statistical classification.

UNIT VI:

Data acquisition systems-Data transfer and storage mechanism-Data management- Data interpretation and diagnosis, System Identification-Structural model update-Structural condition assessment, Prediction of remaining service life, Different sensors - accelerometers, strain gauges, displacement transducers, level sensing stations, anemometers, temperature sensors and dynamic weight-in-motion sensors.

Case studies- Structural Health Monitoring for bridges

Reference Books:

1. Sidney, M. Johnson, “Deterioration, Maintenance and Repair of Structures”
2. Denison Campbell, Allen & Harold Roper, “Concrete Structures – Materials, Maintenance and Repair”- Longman Scientific and Technical.
3. R.T.Allen and S.C. Edwards, “Repair of Concrete Structures”-Blakie and Sons Raiker R.N., “Learning for failure from Deficiencies in Design, Construction and Service”- R&D Center (SDCPL).
4. Dov Kominetzky.M.S., " Design and Construction Failures", Galgotia Publications Pvt. Ltd., 2001
5. Ravishankar.K., Krishnamoorthy.T.S, " Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.
6. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.
7. Gambhir.M.L., "Concrete Technology", McGraw Hill, 201
8. 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.
9. Shen-En Chen, R. Janardhanam, C. Natarajan, Ryan Schmidt, Ino-U.S. Forensic Practices - Investigation Techniques and Technology, ASCE, U.S.A., 2010.
10. Natarajan C., R. Janardhanam, Shen-En Chen, Ryan Schmidt, Ino-U.S. Forensic Practices - Investigation Techniques and Technology, NIT, Tiruchirappalli, 2010.
11. Gary L. Lewis, Guidelines for Forensic Engineering Practice, ASCE, U.S.A., 2003.
12. Joshua B.Kardon, Guidelines for Forensic Engineering Practice, ASCE, U.S.A., 2012.

PEC-CED406-4 FIRE AND SAFETY ENGINEERING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
To understand the fire control and fire safety to mitigate man-made disaster.

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Understand the concept of fire engineering.
2. Able to understand application of various firefighting equipment.
3. Know various fire control technologies.
4. Recognize the fire-resistant construction practices
5. Analyse the design requirements for building design in fire safety
6. Know the legislative guidelines for fire safety management

Course Content:

UNIT I:
Basic concepts of Fire Engineering: Classification of fire, causes, of fire, detection, prevention, extinguishing methods, first aid, fire, fighting equipment.

UNIT II:
Fixed firefighting installations using water: Hydrant or fire water system, Classification of hydrant system, Sprinkling system, Major foam pourer system, Steam drenching system, Emulsification, Fixed firefighting installations not using water: CO2 flooding system, Complete DCP spraying system, Complete Halon flooding system

UNIT III:
Fire Control Technology: Hose, Types of hose, Characteristics, Rope, Lines, knots and ladders, Pumps, primers, tenders and water relays

UNIT IV:
Fire resistant construction: General requirement, fire resistance rating of different materials, factors affecting means of escape and structural fire safety, compartmentation, smoke extraction systems, fire separation wall

UNIT V:
Fire Safety Design of Buildings: Aims, Principles, technical requirements, passive and active fire protection, Emergency and escape lighting, Fire detection and alarm systems, Signage, Firefighting shafts, Fire hydrants, Norms and standards as per National Building Code

UNIT VI:
Safety Management and legislation: Functions of safety management, Factories Act 1948, Workmen compensation Act 1923

Reference Books:

1. 1 Fire Protection and Prevention by Brendra Mohan San, UBS Publishers & Distributors Pvt Ltd. Edition: 1st Edition 2008
2. 2 Handbook of Fire Technology by R.S. Gupta, Orient Longman Publishers, 2nd Edition 2005
3. 3 Handbook of Fire and Explosion Protection Engineering by Dennis P Nolan, Crest Publishing House, 1st Edition 2007
4. National Building Code, Bureau of Indian Standards.

OEC-CED301-1 NON-CONVENTIONAL ENERGY RESOURCES AND UTILISATION

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
The objective of the course "Non-Conventional Energy Resources and Utilisation" is to provide students with a comprehensive understanding of the various types of non-conventional energy resources, their potential, principles of operation, and methods of utilization. The course aims to equip students with the knowledge and skills necessary to evaluate, design, and implement sustainable energy solutions using non-conventional resources.

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Understand the importance and need for non-conventional energy resources in the current global energy scenario.
2. Identify and evaluate various types of non-conventional energy resources such as solar, wind, biomass, geothermal, and tidal energy.
3. Explain the principles of operation of different systems used for harnessing non-conventional energy resources.
4. Design and analyze systems for the utilization of non-conventional energy resources considering efficiency, cost-effectiveness, and environmental impact.
5. Apply the knowledge gained to propose sustainable energy solutions for real-world problems.
6. Develop an awareness of the societal and environmental implications of energy production and utilization, promoting a sense of responsibility towards sustainable development.

Course Content:

UNIT 1:
Energy resources and their utilization: Indian and global energy sources, Energy exploited, Energy planning, Energy parameters (energy intensity, energy-GDP elasticity), Introduction to various sources of energy, Solar thermal, Photovoltaic, Water power, Wind energy, Biomass, Ocean thermal, Tidal and wave energy, Geothermal energy, Hydrogen energy systems, Fuel cells, Decentralized and dispersed generation. Solar radiations: Extra-terrestrial radiation, Spectral distribution, Solar constant, Solar radiations on earth, Measurement of solar radiations, Solar radiation geometry, Flux on a plane surface, Latitude, Declination angle, Surface azimuth angle, Hour angle, Zenith angle, Solar altitude angle expression for angle between incident beam and the normal to a plane surface (no derivation), Local apparent time, Apparent motion of sun, Day length, Solar radiation data for India.

UNIT 2:
Solar energy: Solar thermal power and it's conversion, Solar collectors, Flat plate, Performance analysis of flat plate collector, Solar concentrating collectors, Types of concentrating collectors, Thermodynamic limits to concentration, Cylindrical collectors, Thermal analysis of solar collectors, Tracking CPC and solar swing. Solar thermal energy storage, Different systems, solar pond. Applications, Water heating, Space heating & cooling, Solar distillation, solar pumping, Solar

Cooking, Green Houses, Solar Power plants, solar photovoltaic system: Photovoltaic effect, Efficiency of solar cells, Semiconductor materials for solar cells, Solar photovoltaic system, Standards of solar photovoltaic system, Applications of PV system, PV hybrid System.

UNIT 3:

Biogas: Photosynthesis, Bio gas production, Aerobic and anaerobic bio-conversion process, Raw materials, Properties of bio gas, Producer gas, Transportation of bio gas, bio gas plant technology & status, Community biogas plants, Problems involved in bio gas production, Bio gas applications, Biomass conversion techniques, Biomass gasification, Energy recovery from urban waste, Power generation from liquid waste, Biomass cogeneration, Energy plantation, Fuel properties, Biomass resource development in India. Wind energy: Properties of wind, Availability of wind energy in India, wind velocity, Wind machine fundamentals, Types of wind machines and their characteristics, Horizontal and Vertical axis wind mills, Elementary design principles, Coefficient of performance of a wind mill rotor, Aerodynamic considerations in wind mill design, Selection of a wind mill, Wind energy farms, Economic issues, Recent development.

UNIT 4:

Electrochemical effects and fuel cells: Principle of operation of an acidic fuel cell, Reusable cells, Ideal fuel cells, Other types of fuel cells, Comparison between acidic and alkaline hydrogen-oxygen fuel cells, Efficiency and EMF of fuel cells, Operating characteristics of fuel cells, Advantages of fuel cell power plants, Future potential of fuel cells, Tidal power: Tides and waves as sources of energy, Fundamentals of tidal power, Use of tidal energy, Limitations of tidal energy conversion systems. Hydrogen Energy: Properties of hydrogen in respect of its use as source of renewable energy, Sources of hydrogen, Production of hydrogen, Storage and transportation, Problems with hydrogen as fuel, Development of hydrogen cartridge, Economics of hydrogen fuel and its use.

UNIT 5:

Thermoelectric systems: Kelvin relations, power generation, Properties of thermoelectric materials, Fusion Plasma Generators, Geothermal energy: Structure of earth's interior, Geothermal sites, earthquakes & volcanoes, Geothermal resources, Hot springs, Steam ejection, Principal of working, Types of geothermal station with schematic representation, Site selection for geothermal power plants. Advanced concepts, Problems associated with geothermal conversion. Ocean energy: Principle of ocean thermal energy conversion, Wave energy conversion machines, Power plants based on ocean energy, Problems associated with ocean thermal energy conversion systems, Thermoelectric OTEC, Developments of OTEC, Economics. Impact of renewable energy generation on environment, Kyoto Protocol, Cost of electricity production from different energy sources, Energy options for Indian economy.

REFERENCE/TEXT BOOKS:

1. Bansal Keemann, Meliss, “Renewable energy sources and conversion technology", Tata McGrawHill.
2. Kothari D.P., “Renewable energy resources and emerging technologies", Prentice Hall of IndiaPvt.Ltd.
3. Ashok V. Desai, "Non conventional Energy", New Age International Publishers Ltd.

OEC-CED301-2 SOLID WASTE MANAGEMENT

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
The objective of the course "Solid Waste Management" is to provide students with a comprehensive understanding of the principles and practices involved in managing solid waste. The course aims to equip students with the knowledge and skills necessary to design, implement, and evaluate effective solid waste management systems.

Course Outcomes (CO): Upon successful completion of this course, the students will be able to

1. Understand the importance and need for effective solid waste management in the context of public health, environmental protection, and resource conservation.
2. Identify and classify different types of solid waste and understand their sources, characteristics, and impacts.
3. Explain the principles and techniques involved in waste collection, transportation, processing, recycling, and disposal.
4. Design and evaluate solid waste management systems considering factors such as waste generation rates, waste composition, available technologies, cost-effectiveness, regulatory requirements, and environmental impact.
5. Apply the knowledge gained to propose sustainable solid waste management solutions for real-world problems.
6. Develop an awareness of the societal implications of waste management decisions, promoting a sense of responsibility towards sustainable development.

Course Content:

UNIT 1:
Sources And Types of Municipal Solid Wastes: Sources and types of solid wastes - Quantity – factors affecting generation of solid wastes; characteristics – methods of sampling and characterization; Effects of improper disposal of solid wastes – public health effects. Principle of solid waste management – social & economic aspects; Public awareness; Role of NGOs; Legislation.

UNIT 2:
On-Site Storage & Processing: On-site storage methods – materials used for containers – on-site segregation of solid wastes – public health & economic aspects of storage – options under Indian conditions – Critical Evaluation of Options

UNIT 3:

Collection And Transfer: Methods of Collection – types of vehicles – Manpower requirement – collection routes; transfer stations – selection of location, operation & maintenance; options under Indian conditions.

UNIT 4:

Off-Site Processing: Processing techniques and Equipment; Resource recovery from solid wastes – composting, incineration, Pyrolysis - options under Indian conditions.

UNIT 5:

DISPOSAL: Dumping of solid waste; sanitary landfills – site selection, design and operation of sanitary landfills – Leachate collection & treatment.

Text Books/Reference Books:

1. George Tchobanoglous et.al., Integrated Solid Waste Management‖, McGraw-Hill Publishers, 1993.
2. B.Bilitewski, G.HardHe, K.Marek, A.Weissbach, and H.Boeddicker, Waste Management‖, Springer, 1994
3. Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2000
4. R.E.Landreth and P.A.Rebers, Municipal Solid Wastes – problems and Solutions‖, Lewis Publishers, 1997.
5. Bhide A.D. and Sundaresan, B.B., Solid Waste Management in Developing Countries‖, INSDOC, 1993

OEC-CED301-3 ENERGY STUDIES

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
The objective of the course "Energy Studies" is to provide students with a comprehensive understanding of the various types of energy resources, their potential, principles of operation, and methods of utilization. The course aims to equip students with the knowledge and skills necessary to evaluate, design, and implement sustainable energy solutions.

Course Outcomes: Upon successful completion of this course, students will be able to:

1. Understand the importance and need for sustainable energy resources in the current global energy scenario.
2. Identify and evaluate various types of energy resources such as fossil fuels, nuclear energy, and renewable energy sources.
3. Explain the principles of operation of different systems used for harnessing energy resources.
4. Design and analyze systems for the utilization of energy resources considering efficiency, cost-effectiveness, and environmental impact.
5. Apply the knowledge gained to propose sustainable energy solutions for real-world problems.
6. Develop an awareness of the societal and environmental implications of energy production and utilization, promoting a sense of responsibility towards sustainable development.

Course Content:

UNIT 1:
Introduction to Energy Science: Scientific principles and historical interpretation to place energy use in the context of pressing societal, environmental and climate issues; Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment

UNIT 2:
Energy Sources: Overview of energy systems, sources, transformations, efficiency, and storage. Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental trade-offs of different energy systems; possibilities for energy storage or regeneration, high efficiency batteries.

UNIT 3:
Energy& Environment: Energy efficiency and conservation; introduction to clean energy technologies and its importance in sustainable development; Carbon footprint, energy consumption and sustainability; introduction to the economics of energy; How the economic system determines production and consumption; linkages between economic and environmental outcomes; How future energy use can be influenced by economic, environmental, trade, and research policy.

UNIT 4:

Engineering Projects connected with the Energy Sources: Coal mining technologies, Oil exploration offshore platforms, Underground and under-sea oil pipelines, solar chimney project, wave energy caissons, coastal installations for tidal power, wind mill towers; hydro power stations above-ground and underground along with associated dams; Nuclear reactor containment buildings and associated buildings, Spent Nuclear fuel storage and disposal systems.

UNIT 5:

Engineering for Energy conservation: Concept of Green Building and Green Architecture; Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates; Embodied energy analysis and use as a tool for measuring sustainability. Energy Audit of Facilities and optimization of energy consumption.

Text/Reference Books:

1. Boyle, Godfrey (2004), Renewable Energy (2nd edition). Oxford University Press
2. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press
3. Schaeffer, John (2007), Real Goods Solar Living Sourcebook: The Complete Guide to Renewable Energy Technologies and Sustainable Living, Gaiam
4. Jean-Philippe; Zaccour, Georges (Eds.), (2005), Energy and Environment Set: Mathematics of Decision Making, Loulou, Richard; Waaub, XVIII,
5. Ristinen, Robert A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A. (2006) Energy and the Environment, 2nd Edition, JohnWiley
6. UNDP (2000), Energy and the Challenge of Sustainability, World Energy assessment
7. E H Thorndike (1976), Energy & Environment: A Primer for Scientists and Engineers, Addison-Wesley Publishing Company
8. Related papers published in international journals

OEC-CED301-4 ENVIRONMENTAL SCIENCE

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective: The objective of the course "Environmental Science" is to provide students with a comprehensive understanding of the principles and concepts related to the environment, including the physical and biological aspects, and the impact of human activities. The course aims to equip students with the knowledge and skills necessary to evaluate, design, and implement sustainable solutions for environmental issues.

Course Outcomes: Upon successful completion of this course, students will be able to:

1. Understand the fundamental principles and concepts of environmental science, including ecosystems, biodiversity, pollution, climate change, and sustainability.
2. Identify and evaluate the impact of human activities on the environment and understand the importance of sustainable practices.
3. Explain the principles and techniques involved in environmental assessment, conservation, and management.
4. Design and evaluate strategies for managing environmental issues considering factors such as scientific knowledge, socio-economic factors, ethical considerations, and regulatory requirements.
5. Apply the knowledge gained to propose sustainable solutions for real-world environmental problems.
6. Develop an awareness of the societal implications of environmental decisions, promoting a sense of responsibility towards sustainable development.

Course Content:

UNIT 1:
Plant Physiology covering, Transpiration; Mineral nutrition

UNIT 2:
Ecology covering, Ecosystems- Components, types, flow of matter and energy in an ecosystem; Community ecology- Characteristics, frequency, life forms, and biological spectrum; Ecosystem structure- Biotic and a-biotic factors, food chain, food web, ecological pyramids;

UNIT 3:
Population Dynamics covering, Population ecology- Population characteristics, ecotypes; Population genetics- Concept of gene pool and genetic diversity in populations, polymorphism and heterogeneity.

UNIT 4:
Environmental Management covering, Principles: Perspectives, concerns and management strategies; Policies and legal aspects- Environment Protection Acts and modification, International Treaties; Environmental Impact Assessment- Case studies (International Airport, thermal power plant).

UNIT 5:

Biotechnology covering, Basic concepts: Totipotency and Cell manipulation; Plant & Animal tissue culture- Methods and uses in agriculture, medicine and health.

UNIT 6:

Biostatistics covering, Introduction to Biostatistics: -Terms used, types of data; Measures of Central Tendencies- Mean, Median, Mode, Normal and Skewed distributions; Analysis of Data- Hypothesis testing and ANNOVA (single factor)

Text/Reference Books:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons.
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd editionWm, C. Brown Publishers.

OEC-CED302-1 RESEARCH AND IPR

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
The objective of the course "Research and Intellectual Property Rights (IPR)" is to provide students with a comprehensive understanding of the principles and practices involved in conducting research and managing intellectual property rights. The course aims to equip students with the knowledge and skills necessary to design, implement, and evaluate effective research projects, and to understand and apply the principles of intellectual property rights in their professional practice.

Course Outcomes: Upon successful completion of this course, students will be able to:

1. Understand the fundamental principles and concepts of research methodology, including research design, data collection and analysis, and interpretation of results.
2. Identify and evaluate various types of intellectual property rights, including patents, copyrights, trademarks, and trade secrets.
3. Explain the process of obtaining and enforcing intellectual property rights, both nationally and internationally.
4. Design and conduct a research project from inception to completion, demonstrating competence in all stages of the research process.
5. Apply the principles of intellectual property rights in the protection and commercialization of their own research outcomes.
6. Develop an awareness of the ethical considerations in conducting research and managing intellectual property rights, promoting a sense of responsibility towards ethical research practice.

Course Content:

UNIT 1:
Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT 2:
Effective literature studies approaches, analysis Plagiarism, and Research ethics.

UNIT 3:
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT 4:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Text/Reference Books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for Science& engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step-by-Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd,2007.

OEC-CED302-2 SOFT SKILLS FOR ENGINEERS

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
The objective of the course "Soft Skills for Engineers" is to equip engineering students with essential soft skills that are crucial for professional success. These include communication skills, teamwork and collaboration, problem-solving, critical thinking, leadership, and ethics. The course aims to enhance students' interpersonal skills, improve their ability to work in diverse teams, and develop their capacity for leadership.

Course Outcomes: Upon successful completion of this course, students will be able to:

1. Communicate effectively in both written and verbal form, adapting their communication style to suit different audiences and contexts.
2. Collaborate effectively in a team, demonstrating the ability to listen, contribute, and lead in a group setting.
3. Solve problems creatively and critically, using a systematic approach to identify issues, generate solutions, and make decisions.
4. Think critically, analyzing and evaluating information to form reasoned judgments.
5. Demonstrate leadership skills, including the ability to motivate others, manage conflict, and achieve common goals.
6. Understand and apply ethical principles in professional contexts, demonstrating integrity, accountability, and respect for diversity.

Course Content:

UNIT 1:
CORPORATE INTERACTION, LEADERSHIP & COMMUNICATION
Part I. Audio/Video Lessons and Observation/Listening Skills (Practical)Interviews Lectures by Eminent Engineers, scientists and technocrats.
Other inspiring speeches on social issues as well as related to the corporate world and industry.
Part-II. Group Discussions, Corporate Dialogue/Role Play (conflict and resolution);Mock-interviews. Discussions with briefs on CSR and IPR and role of important international bodies like WTO and IMF; Presentations; Technical/Business vocabulary; Body Language.
Part-III: Leadership & Participation: Review of social, political and corporate scene; Leadership skills, Attitudes, Sensitivity training. Learning/'Take-aways' from scenarios/situations. Crisis-handling; Negotiation-Conflict resolution exercises; Communication Skills; Seven Cs of Communication; Barriers of/to Effective Communication

UNIT 2:
CREATIVE COMPOSITION& TECHNICAL WRITING: Exercises in creative writing:USP and image building; Setting Goals; Charting Objectives; Minutes of a Meeting; Reports; Interoffice Memorandum; Resume and Covering Letter.

UNIT 3:

SEMANTICS & SYNTAX: Idioms & Proverbs, Vocabulary building, Crosswords, Neologisms, Portmanteau words, Correct sentences/usage.

UNIT 4:

DISSERTATION & PRACTICAL ASSESSMENT: Short Multimedia Dissertation on any topic of student‘s interest; Group Discussion and Mock-interview.

Reference Book:

1. Stephen Robbins and Seema Sanghi. Organizational Behaviour. Pearson. Latest edition.
2. Kotler, Philip and Kevin Lane Keller. Marketing Management. 13 th edition.2008 Eastern Economy Edition
3. Wehmeier, Sally. Oxford Advanced Learner’s Dictionary. Oxford UP.2005
4. Ghosh, BN. Managing Soft Skills for Personality Development. Tata McGraw-Hill 2012
5. Rizvi, M Ashraf. Effective Technical Communication. Tata Mc Graw-Hill.2005
6. Bretag, Crossman and Bordia. Communication Skills. Tata Mc Graw-Hill.2009
7. Sites: Youtube and Wikipedia in general.

OEC-CED302-3 HUMAN RESOURCE MANAGEMENT

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
The objective of the course "Human Resource Management" is to provide students with a comprehensive understanding of the principles and practices involved in managing human resources in an organization. The course aims to equip students with the knowledge and skills necessary to effectively manage and develop people in a professional setting.

Course Outcomes: Upon successful completion of this course, students will be able to:

1. Understand the fundamental principles and concepts of human resource management, including recruitment, selection, training, development, compensation, and performance management.
2. Identify and evaluate the role of human resource management in achieving organizational objectives.
3. Explain the legal and ethical considerations in human resource management.
4. Design and implement effective human resource management strategies and practices that align with organizational goals.
5. Apply the knowledge gained to solve real-world human resource management problems.
6. Develop an awareness of the importance of diversity, equity, and inclusion in the workplace.

Course Content:

UNIT 1:
Human Resource Management: concept and scope; Roles, responsibilities and competencies of HR manager; Challenges to HR professionals; Human Resource Planning & Forecasting: significance and process.

UNIT 2:
HR Sourcing: Recruitment, Selection and Induction. Job Analysis: job Description and job Specification; Job Design: concept and methods; Job Evaluation-concept &methods; Performance appraisal and counselling.

UNIT 3:
Training: training process and methods; Career planning and Development; Succession planning; Employee Compensation: basic concepts & determinants;

UNIT 4:
Industrial Relations and Grievance Handling; Employee welfare; Dispute Resolution; International Human Resource Management; Contemporary Issues in HRM. HR Audit &Accounting, ethics & corporate social responsibility.

Reference Book:

1. K. Aswathapa Human resource Management: Text and cases, 6th edition, Tata McGraw Hill, New Delhi,2012

2. Uday Kumar Haldar &Juthika Sarkar(2012) Human resource Management New Delhi, Oxford University Press.

3. De Cenvo, Da & Robbins S.P.(2010) Fundamentals of Human Resource Management, 9th edition, New York, John Wiley & Sons.

4. Gary Dessler (2008) Human Resource Management, 11th edition New Delhi: Pearson Prentice Hall.

5. Tanuja Agarwala, Strategic Human resource Management, Oxford University Press 2007.

OEC-CED302-4 ENGINEERING ECONOMICS

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
The objective of the course "Engineering Economics" is to provide students with a comprehensive understanding of the economic concepts and principles that are relevant to engineering practice. The course aims to equip students with the knowledge and skills necessary to make informed decisions about the economic viability of engineering projects.

Course Outcomes: Upon successful completion of this course, students will be able to:

1. Understand the fundamental principles and concepts of economics as they apply to engineering, including cost estimation, financial analysis, and economic decision making.
2. Identify and evaluate the economic implications of engineering decisions, considering factors such as cost, benefit, risk, and uncertainty.
3. Explain the principles and techniques involved in economic analysis of engineering projects, including present worth analysis, annual cash flow analysis, rate of return analysis, and benefit-cost analysis.
4. Design and conduct an economic analysis of an engineering project, demonstrating competence in all stages of the process.
5. Apply the knowledge gained to make informed decisions about the economic viability of engineering projects.
6. Develop an awareness of the ethical considerations in engineering economics, promoting a sense of responsibility towards sustainable development.

Course Content:

UNIT 1:
Basic Principles and Methodology of Economics. Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macro-economic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes

UNIT 2:
Public Sector Economics –Welfare, Externalities, Labour Market. Components of Monetary and Financial System, Central Bank –Monetary Aggregates; Commercial Banks & their functions; Capital and Debt Markets. Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve.

UNIT 3:
Elements of Business/Managerial Economics and forms of organizations. Cost & Cost Control – Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cash flows). Business Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method.

UNIT 4:

Indian economy - Brief overview of post-independence period – plans. Post reform Growth, Structure of productive activity. Issues of Inclusion – Sectors, States/Regions, Groups of people (M/F), Urbanization. Employment–Informal, Organized, Unorganized, Public, Private. Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors.

Reference Books:

1. Mankiw Gregory N. (2002), Principles of Economics, Thompson Asia
2. V. Mote, S. Paul, G. Gupta(2004), Managerial Economics, Tata McGraw Hill
3. Misra, S.K. and Puri (2009), Indian Economy, Himalaya
4. Pareek Saroj (2003), Textbook of Business Economics, Sunrise Publishers

OEC-CED403-1 SOCIETAL & GLOBAL IMPACT

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
The objective of the course "Civil Engineering – Societal & Global Impact" is to provide students with a comprehensive understanding of the societal and global impacts of civil engineering projects. The course aims to equip students with the knowledge and skills necessary to design, implement, and evaluate civil engineering projects that are socially responsible and globally sustainable.

Course Outcomes: Upon successful completion of this course, students will be able to:

1. Understand the fundamental principles and concepts of civil engineering as they relate to societal and global contexts.
2. Identify and evaluate the societal and global impacts of civil engineering decisions, considering factors such as sustainability, equity, and social justice.
3. Explain the principles and techniques involved in assessing the societal and global impacts of civil engineering projects.
4. Design and conduct a societal and global impact assessment of a civil engineering project, demonstrating competence in all stages of the process.
5. Apply the knowledge gained to make informed decisions about the societal and global implications of civil engineering projects.
6. Develop an awareness of the ethical considerations in civil engineering practice, promoting a sense of responsibility towards sustainable development.

Course Content:

UNIT 1:
Introduction to Course and Overview; Understanding the past to look into the future: Pre-industrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and Ecological Footprint of India Vs other countries and analysis;

UNIT 2:
Understanding the importance of Civil Engineering in shaping and impacting the world; The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering, Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various

Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability;

UNIT 3:

Environment- Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), Multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and non- stationarity; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability, Built environment – Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability

UNIT 4:

Civil Engineering Projects – Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to
employment(projects, facilities management), Quality of products, Health & Safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development;

Text/Reference Books:

1. Žiga Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht
2. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economical and Working Environment, 120th ASEE Annual Conference and Exposition
3. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.
4. Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio.

OEC-CED403-2 ESTIMATION AND COSTING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
The objective of the course "Estimation and Costing" is to provide students with a comprehensive understanding of the principles and practices involved in estimating and costing in construction projects. The course aims to equip students with the knowledge and skills necessary to accurately estimate costs and resources for construction projects.

Course Outcomes: Upon successful completion of this course, students will be able to:

1. Understand the fundamental principles and concepts of estimation and costing in construction.
2. Identify and evaluate different types of costs involved in a construction project, including material, labor, equipment, and overhead costs.
3. Explain the process of preparing detailed estimates and cost plans for construction projects.
4. Design and conduct an estimation and costing exercise for a construction project, demonstrating competence in all stages of the process.
5. Apply the knowledge gained to make informed decisions about budgeting, resource allocation, and cost control in construction projects.
6. Develop an awareness of the ethical considerations in estimation and costing, promoting a sense of responsibility towards fair pricing and cost management.

Course Content:

UNIT 1:
Estimation / Measurements for various items- Introduction to the process of Estimation; Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works; BIM and quantity take-offs; adding equipment costs; labour costs; rate analysis; Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Use of Computers in quantity surveying

UNIT 2:
Specifications-Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures. Rate analysis-Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity.

UNIT 3:
Tender- Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, extra work and Changes, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc. Preparing Bids- Bid Price build up: Material, Labour,

Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management

UNIT 4:

Introduction to Acts pertaining to-Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights.

Reference Book:

1. M Chakravarty, Estimating, Costing Specifications & Valuation
2. Joy P K, Handbook of Construction Management, Macmillan
3. B.S. Patil, Building & Engineering Contracts
4. Relevant Indian Standard Specifications.
5. UBS Publishers & Distributors, Estimating and Costing in Civil Engineering: Theory and Practice including Specification and Valuations,2016
6. Dutta, B.N., Estimating and Costing in Civil Engineering (Theory & Practice), UBS Publishers, 2016

OEC-CED403-3 METRO SYSTEMS AND ENGINEERING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:

The objective of the course "Metro Systems and Engineering" is to provide students with a comprehensive understanding of the principles and practices involved in the design, construction, operation, and maintenance of metro systems. The course aims to equip students with the knowledge and skills necessary to contribute effectively to the field of metro systems engineering.

Course Outcomes: Upon successful completion of this course, students will be able to:

1. Understand the fundamental principles and concepts of metro systems engineering, including system design, construction methods, operation protocols, and maintenance practices.
2. Identify and evaluate the key components of a metro system, such as track layout, signaling systems, rolling stock, power supply, and station design.
3. Explain the process of planning, designing, constructing, operating, and maintaining a metro system.
4. Design and conduct an analysis or evaluation exercise for a metro system project, demonstrating competence in all stages of the process.
5. Apply the knowledge gained to solve real-world problems related to metro systems engineering.
6. Develop an awareness of the societal implications and environmental considerations in metro systems engineering, promoting a sense of responsibility towards sustainable development.

Course Content:

UNIT 1:

General: Overview of Metro Systems; Need for Metros; Routing studies; Basic Planning and Financials.

UNIT 2:

Civil Engineering- Overview and construction methods for: Elevated and underground Stations; Viaduct spans and bridges; Underground tunnels; Depots; Commercial and Service buildings. Initial Surveys & Investigations; Basics of Construction Planning & Management, Construction Quality & Safety Systems. Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way. Facilities Management

UNIT 3:

Electronics And Communication Engineering- Signalling systems; Automatic fare collection; Operation Control Centre (OCC and BCC); SCADA and other control systems; Platform Screen Doors.

UNIT 4:

Mechanical & TVS, AC: Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators. ELECTRICAL:

OHE, Traction Power; Substations- TSS and ASS; Power SCADA; Standby and Back-up systems; Green buildings, Carbon credits and clear air mechanics.

Reference Book:

1.. Railway Transportation Systems: Design, Construction and Operation, Christos. Pyrgidis, CRC Press, 2018

OEC-CED403-4 SAFETY ENGINEERING

L	T	P	Total
3	0	0	3

Sessional: 25 marks
Theory: 75 marks
Total: 100 marks
Duration of exam: 3 hours

Course Objective:
The objective of the course "Safety Engineering" is to provide students with a comprehensive understanding of the principles and practices involved in designing and operating systems in a manner that protects the safety and health of workers, the public, and the environment. The course aims to equip students with the knowledge and skills necessary to identify, evaluate, and control hazards in various engineering contexts.

Course Outcomes: Upon successful completion of this course, students will be able to:

1. Understand the fundamental principles and concepts of safety engineering, including hazard identification, risk assessment, and safety control measures.
2. Identify and evaluate potential hazards in various engineering contexts, considering factors such as equipment design, operational procedures, and environmental conditions.
3. Explain the process of conducting a comprehensive safety analysis, including the use of tools and techniques such as fault tree analysis, failure mode and effects analysis, and hazard and operability study.
4. Design and implement effective safety control measures in an engineering context, demonstrating competence in selecting appropriate personal protective equipment, designing safety systems, and developing safe operational procedures.
5. Apply the knowledge gained to solve real-world problems related to safety engineering.
6. Develop an awareness of the ethical considerations in safety engineering, promoting a sense of responsibility towards protecting the safety and health of workers, the public, and the environment.

Course Content:

UNIT 1:
Introduction-Safety-Goalsof safety engineering. Need for safety. Safety and productivity Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. History of safety movement. Theories of accident causation, Safety organization- objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety. Safety policy. Safety Officer-responsibilities, authority. Safety committee need, types, advantages

UNIT 2:
Accident prevention Methods- Engineering, Education and Enforcement, Safety Education & Training - Importance, Various training methods, Effectiveness of training, Behavior oriented training. Communication-purpose, barrier to communication. Housekeeping: Responsibility of management and employees. Advantages of good housekeeping. 5 s of housekeeping. Work permit system- objectives, hot work and cold work permits. Typical industrial models and methodology. Entry into confined spaces.

UNIT 3:

Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate. Cost of accidents- Computation of Costs- Utility of Cost data. Plant safety inspection, types, inspection procedure. Safety sampling techniques. Job safety analysis (JSA), Safety surveys, Safety audits. Safety Inventory Technique.

UNIT 4:

Accident investigation -Why? When? Where? Who? & How? . Basics- Man Environment & Systems. Process of Investigation -Tools-Data Collection-Handling witnesses- Case study. Accident analysis - Analytical Techniques-System, Safety-Change Analysis-MORT Multi Events Sequencing-TOR.

Text/References Books:

1. N.V. Krishnan, Safety Management in Industry, Jaico Publishing House,1997
2. Ronald P. Blake, Industrial Safety: Prentice Hall, New Delhi,1973 3)
3. David L. Goetsch, Occupational Safety and health, Prentice Hall
4. Ted S. Ferry, Modern Accident Investigation and Analysis, John Wiley & Sons
5. Willie Hammer, Occupational Safety Management and Engineering, Prentice Hall
6. Alan Waring, Safety Management System, Chapman & Hall
7. JohnV. Grimaldi and RollinH. Simonds, Safety Management, All India Traveller Book Seller.
8. Accident Prevention Manual for Industrial Operations: National Safety Council, Chicago.

VALUE ADDED COURSES WITH EFFECT FROM 2021-22

VAC01 Human Values and Professional Ethics

The above 02 value added courses is compulsory for students. It may be taught through digital aided learning / class room teaching. Its duration is 31-35 hours. Minimum 75% attendance is compulsory for students and its evaluation will be done by concerned Dept. through Viva-Voce examination. These are recommended in I year.

VAC01: HUMAN VALUES AND PROFESSIONAL ETHICS

Course Objective:

The objective of the course "Human Values and Professional Ethics" is to instill in students a strong understanding of ethical principles and human values, and their application in a professional context. The course aims to develop students' ability to make ethical decisions, understand the impact of their actions on others, and foster a commitment to social responsibility in their professional practice.

Course Outcomes: Upon successful completion of this course, students will be able to:

1. Understand the fundamental principles and concepts of ethics and human values.
2. Identify and evaluate ethical issues in various professional contexts.
3. Apply ethical principles and human values in decision-making processes.
4. Demonstrate the ability to reflect on ethical dilemmas and make decisions that respect human values.
5. Develop an awareness of the societal implications of professional decisions, promoting a sense of responsibility towards sustainable development.
6. Cultivate a commitment to ethical behavior and social responsibility in their professional practice.

Course Content:

UNIT I

Human Values: Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II

Ethics: Senses of Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy –Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion.

UNIT III

Professionals as Social Experimentation: Social Experimentation – Professionals as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV

Safety, Responsibilities and Rights: Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality –

Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) Gender inequality, causes and consequences. Discrimination, Social understandings, Women and Men in the Organization, Consequences of sexual harassment.

UNIT V

Global Issues: Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Professionals as Managers – Consulting Engineers – Professionals as Expert Witnesses and Advisors Moral Leadership – Code of Conduct – Corporate Social Responsibility.

Textbooks:

Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003. 2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

Reference's books:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi,
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi 2013.

Web sources:

1. www.onlineethics.org
2. www.globalethics.org
3. www.ethics.org