

**DEENBANDHU CHHOTU RAM UNIVERSITY OF  
SCIENCE & TECHNOLOGY, MURTHAL  
SONEPAT**

**SCHEME OF STUDIES & EXAMINATIONS  
B.Tech in CIVIL ENGINEERING**

**Choice Based Credit System  
(Effective from Session 2018-19)**

## **PROGRAMME SPECIFIC OUTCOMES**

- **A recognition of the need for, and an ability to engage in continuing professional development and life-long learning.**
- **An ability to apply design and development principles in the construction of Civil Engineering of varying complexity.**
- **An ability to recognize the importance of Civil Engineering professional development by successfully competing through the challenges for a rewarding careers**

**Deenbandhu Chhotu Ram University of Science & Technology, Murthal (Sonapat)**

**B.Tech. 1<sup>ST</sup> YEAR (SEMESTER – I) (Common for all branches)  
Choice Based Credit System (Scheme Of Studies & Examinations w.e.f. 2018-19)**

S. No.	Course Code	Course Title	Teaching Schedule			Marks of Class work	Examination Marks		Total Marks	Credits	Duration of Exam
			L	T	P		Theory	Practical			
1	HUM101C	ENGLISH LANGUAGE SKILLS (Gr.-A)	2	0	0	25	75	0	100	2	3
2		MATHEMATICS-I	3	1		25	75	0	100	4	3
3		PHYSICS (Gr.-A) OR CH101C CHEMISTRY (Gr.-B)	3	1		25	75	0	100	4	3
4	EE101C	BASIC ELECTRICAL ENGINEERING (Gr.-A) OR EE103C ELECTRICAL AND ELECTRONICS ENGG (For CHE only)	3	1		25	75	0	100	4	3
	CSE101C	OR PROGRAMMING FOR PROBLEM SOLVING (Gr.-B)	3	0		25	75	0	100	3	
5	ME101C	ENGINEERING GRAPHICS & DESIGN (Gr.-A) OR ME103C WORKSHOP/ MANUFACTURING PRACTICES (Gr.-B)	1	0	4	25	0	75	100	3	3
6	HUM103C	ENGLISH LANGUAGE LAB (Gr.-A)	0	0	2	25	0	75	100	1	3
7		PHYSICS LAB (Gr.-A) OR CH103C CHEMISTRY LAB (Gr.-B)	0	0	2	25		75	100	1	3
8	EE181C	BASIC ELECTRICAL ENGINEERING LAB(Gr.-A)/ EE183C ELECTRICAL AND ELECTRONICS ENGG .LAB (For CHE only)	0	0	2	25		75	100	1	3
	CSE103C	OR PROGRAMMING FOR PROBLEM SOLVING LAB (Gr.-B)	0	0	4	25		75	100	2	
9	MC101C	INDUCTION PROGRAM*	6	0	0	25	75	00	100	0	1.5
<b>Total</b>			<b>18</b>	<b>3</b>	<b>10</b>	<b>225</b>	<b>375</b>	<b>300</b>	<b>900</b>	<b>20</b>	
			<b>16</b>	<b>2</b>	<b>10</b>	<b>175</b>	<b>300</b>	<b>225</b>	<b>700</b>	<b>17</b>	

**MATHEMATICS AND PHYSICS COURSES FOR DIFFERENT BRANCHES**

COURSE CODE	COURSE TITLE
<b>MATHEMATICS –I</b>	
MATHS101C	MATHEMATICS –I (For computer Science & Engg)
MATHS103C	MATHEMATICS –I (For Bio-technology)
MATHS105C	MATHEMATICS –I ( common for all branches except CSE & BT)
<b>PHYSICS and PHYSICS LAB (Any One Combination)</b>	
PHY101C PHY111C	INTRODUCTION TO ELECTROMAGNETIC THEORY IEMT LAB (For ME, AE, Aero & ECE)
PHY103C PHY113C	MECHANICS MECHANICS LAB (For CE)
PHY105C PHY115C	OPTICS, FIBRE OPTICS, MAGNETISM AND QUANTUM MECHANICS OFMQ LAB (For CHE, BT & BME)
PHY107C PHY117C	WAVES, OPTICS AND QUANTUM MECHANICS WAVES, OPTICS AND QUANTUM MECHANICS LAB (For EE)
PHY109C PHY119C	SEMICONDUCTOR PHYSICS SEMICONDUCTOR PHYSICS LAB (For CSE)

**Note:**

- \*Effective from the Academic Session 2019-20. Every student has to participate in the MANDATORY INDUCTION PROGRAM OF 07 working day DURATION at the start of regular teaching of first semester. It comprises physical activity, creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept/ Branch & Innovations. The remaining equivalent of two weeks (14 days) will be covered during first semester and there will be an examination at semester end.

2. All the branches are to be divided into groups 'A' and 'B' as per the suitability of the institute/college, so that there is an equitable distribution of teaching load in odd and even semesters.

For DCRUST Murthal: GROUP A: BME, BT, CSE, ECE.

GROUP B: CE, CHE, EE, ME.

3. Induction Program Chief coordinator/ coordinators/Mentors shall be assigned a load of 2 hours per week.
4. For student admitted in B. Tech. 1st Semester (C-Scheme) in 2019 and all trailing students, Examinations and evaluation of students shall be conducted as per guidelines AICTE Examinations Reforms covering the entire syllabus. The students shall be made aware about the reforms.

**Deenbandhu Chhotu Ram University of Science & Technology, Murthal (Sonapat)**

**B.Tech. 1<sup>ST</sup> YEAR (SEMESTER – II) (Common for all branches)  
Choice Based Credit System (Scheme Of Studies & Examinations w.e.f. 2018-19)**

S. No.	Course Code	Course Title	Teaching Schedule			Marks of Class work	Examination Marks		Total Marks	Credits	Duration of Exam
			L	T	P		Theory	Practical			
1	HUM101C	ENGLISH LANGUAGE SKILLS (Gr.-B)	2	0	0	25	75	0	100	2	3
2		MATHEMATICS-II	3	1		25	75	0	100	4	3
3		PHYSICS (Gr.-B) OR CHEMISTRY (Gr.-A)	3	1		25	75	0	100	4	3
4	EE101C	BASIC ELECTRICAL ENGINEERING (Gr.-B) OR ELECTRICAL AND ELECTRONICS ENGG (For CHE only)	3	1		25	75	0	100	4	3
	CSE101C	OR PROGRAMMING FOR PROBLEM SOLVING (Gr.-A)	3	0		25	75	0	100	3	
5	ME101C OR ME103C	ENGINEERING GRAPHICS & DESIGN (Gr.-B) OR WORKSHOP/ MANUFACTURING PRACTICES (Gr.-A)	1	0	4	25	0	75	100	3	3
6	HUM103C	ENGLISH LANGUAGE LAB (Gr.-B)	0	0	2	25	0	75	100	1	3
7		PHYSICS LAB (Gr.-B) OR CHEMISTRY LAB (Gr.-A)	0	0	2	25		75	100	1	3
8	EE105C/ EE107C	BASIC ELECTRICAL ENGINEERING LAB/ ELECTRICAL AND ELECTRONICS ENGG. LAB (For CHE only)(Gr.-B) OR PROGRAMMING FOR PROBLEM SOLVING LAB (Gr.-A)	0	0	2	25		75	100	1	3
	CSE103C		0	0	4	25		75	100	2	
9	*CE 102C	IN-HOUSE PRACTICAL TRAINING (level-1)*				100				1	
10	HSMC - 102 C	UNIVERSAL HUMAN VALUES II	3			25		75	100	3	
<b>Total</b>			<b>15</b>	<b>3</b>	<b>10</b>	<b>325</b>	<b>300</b>	<b>375</b>	<b>900</b>	<b>24</b>	
			<b>13</b>	<b>2</b>	<b>10</b>	<b>275</b>	<b>225</b>	<b>300</b>	<b>700</b>	<b>21</b>	

**MATHEMATICS AND PHYSICS COURSES FOR DIFFERENT BRANCHES**

COURSE CODE	COURSE TITLE
<b>MATHEMATICS –II</b>	
MATHS102C	MATHEMATICS –II (For computer Science &Engg)
MATHS104C	MATHEMATICS –II (For Bio-technology)
MATHS106C	MATHEMATICS –II ( common for all branches except CSE & BT)



**DeenbandhuChhotu Ram University of Science & Technology, Murthal (Sonapat)**  
**SCHEME OF STUDIES & EXAMINATIONS**  
**B.Tech. 2<sup>nd</sup> YEAR (SEMESTER – III: CIVIL ENGINEERING)**  
**Tentative Choice Based Credit Scheme w.e.f. 2019-20**

S. No.	Course No.	Course Title	Teaching Schedule			Marks of Class work	Examination Marks		Total	Credit	Duration of Exam
			L	T	P/D		Theory	Practical			
1	MC 201C OR MC 203C	CONSTITUTION OF INDIA (GROUP-A) OR ENVIRONMENTAL SCIENCES (GROUP-B)	2	-	-	25	75	-	100	0	3
2	ECE 209C	BASIC ELECTRONICS	2	-	-	25	75	-	100	2	3
3	BT 221C	BIOLOGY FOR ENGINEERS	3	-	-	25	75	-	100	3	3
4	Maths	MATHS III (TRANSFORM AND DISCRETE MATHEMATICS)	2	-	-	25	75	-	100	2	3
5	CE 201C	STRENGTH OF MATERIALS	3	1	-	25	75	-	100	4	3
6	CE 203C	SURVEYING	3	1	-	25	75	-	100	4	3
7	CE 205C	FLUID MECHANICS	3	1	-	25	75	-	100	4	3
8	CE 207C	BUILDING CONSTRUCTION AND MATERIALS	3	-	2	25	75	-	100	4	3
9	CE 209C	STRENGTH OF MATERIALS LAB	-	-	2	25		75	100	1	3
10	CE 211C	SURVEYING LAB	-	-	2	25		75	100	1	3
11	CE 213C	FLUID MECHANICS LAB	-	-	2	25		75	100	1	3
12	ECE 289C	BASIC ELECTRONICS LAB	-	-	2	25		75	100	1	3
<b>Total</b>			<b>21</b>	<b>3</b>	<b>10</b>	<b>300</b>	<b>600</b>	<b>300</b>	<b>1200</b>	<b>27</b>	

MOOC

Humanities and Social Sciences

**Note:**

- 1 The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
- 2 Electronics gadgets including Cellular phones are not allowed in the examination

**DeenbandhuChhotu Ram University of Science & Technology, Murthal (Sonapat)**  
**SCHEME OF STUDIES & EXAMINATIONS**  
**B.Tech. 2<sup>nd</sup> YEAR (SEMESTER – IV: CIVIL ENGINEERING)**  
**Tentative Choice Based Credit Scheme w.e.f. 2019-20**

S. No.	Course No.	Course Title	Teaching Schedule			Marks of Class work	Examination Marks		Total	Credit	Duration of Exam
			L	T	P		Theory	Practical			
1	MC 203C OR MC 201C	ENVIRONMENTAL SCIENCES(GROUP-A) OR CONSTITUTION OF INDIA (GROUP-B)	2	-	-	25	75	-	100	0	3
2	ME	BASICS OF THERMODYNAMICS	2	1	-	25	75	-	100	3	3
3	MGT 201C	ENGINEERING ECONOMICS	3	-	-	25	75	-	100	0	3
4	CE 202C	STRUCTURAL ANALYSIS - I	3	1	-	25	75	-	100	4	3
5	CE 204C	OPEN CHANNEL FLOW	3	1	-	25	75	-	100	4	3
6	CE206C	GEOMATIC ENGG	3	-	-	25	75	-	100	3	3
7	CE208C	TRANSPORTATION ENGINEERING - I	3	1	-	25	75	-	100	4	3
8	CE 210C	STRUCTURAL ANALYSIS – I LAB	-	-	2	25		75	100	1	3
9	CE 212C	OPEN CHANNEL FLOW LAB	-	-	2	25		75	100	1	3
10	CE 214C	GEOMATIC ENGINEERING LAB	-	-	2	25		75	100	1	3
11	CE216C	TRANSPORTATION ENGINEERING – I LAB	-	-	2	25		75	100	1	3
12	GFCE 202C	GENERAL FITNESS IN CIVIL ENGINEERING	-	-	-	-	-	75	75	-	3
<b>Total</b>			<b>19</b>	<b>4</b>	<b>8</b>	<b>275</b>	<b>525</b>	<b>375</b>	<b>1175</b>	<b>22</b>	

MOOC :

Human Resources and Development

**Note:**

- 1 The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
- 2 Electronics gadgets including Cellular phones are not allowed in the examination.
- 3 Each student has to undergo Survey Camp of 2 weeks to be conducted by the Department during summer vacation and its evaluation shall be carried out in the V Semester.

**DeenbandhuChhotu Ram University of Science & Technology, Murthal (Sonapat)**

**SCHEME OF STUDIES & EXAMINATIONS**

**B.Tech. 3<sup>rd</sup> YEAR (SEMESTER – V: CIVIL ENGINEERING)**

**Tentative Choice Based Credit Scheme w.e.f. 2020-21**

S. No.	Course No.	Course Title	Teaching Schedule			Marks of Class work	Examination Marks		Total	Credit	Duration of Exam
			L	T	P		Theory	Practical			
1	CE301C	DESIGN OF STEEL STRUCTURES – I	3	1		25	75	-	100	4	3
2	CE 303C	STRUCTURAL ANALYSIS - II	3	1		25	75	-	100	4	3
3	CE305C	REINFORCED CONCRETE DESIGN –I	3	1		25	75	-	100	4	3
4	CE307C	CONSTRUCTION ENGINEERING AND MANAGEMENT	3	-		25	75	-	100	3	3
5	CE309C	GEO-MECHANICS	3	1		25	75	-	100	4	3
6	CE 311C	TRANSPORTATION ENGINEERING - II	3	-		25	75	-	100	3	3
7	CE	DE – I (SP)	4	-		25	75	-	100	4	3
8	HUM301C	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	3	-		25	75	-	100	-	3
9	CE313C	REINFORCED CONCRETE DESIGN – I LAB	-	-	2	25		75	100	1	3
10	CE315C	GEO-MECHANICS LAB	-	-	2	25		75	100	1	3
11	CE317C	SURVEY CAMP*	-	-	2*	25		75	100	1	3
<b>Total</b>			<b>25</b>	<b>4</b>	<b>6</b>	<b>275</b>	<b>600</b>	<b>225</b>	<b>1100</b>	<b>29</b>	

**Note:**

- The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator are prohibited in the examination.
- Electronics gadgets including Cellular phones are not allowed in the examination
- \* Assessment of survey camp held after fourth semester.
- DE-I (SP) For only those students opting for degree with specialization
- Student can undertake 20% of the courses of this scheme (Hons./Minor Degree with Specialization in the above listed emerging areas) through online platforms SWAYAM/MOOCs/NPTEL etc. with due permission of the chairperson.
- Any students of the B. Tech. of the University can opt for this scheme (Hons./Minor Degree with Specialization in the above listed emerging areas), however, minimum 10 students are required for running a particular specialization.

**DeenbandhuChhotu Ram University of Science & Technology, Murthal (Sonapat)**

**SCHEME OF STUDIES & EXAMINATIONS**

**B.Tech. 3<sup>rd</sup> YEAR (SEMESTER – VI: CIVIL ENGINEERING)**

**Tentative Choice Based Credit Scheme w.e.f. 2020-21**

S. No.	Course No.	Course Title	Teaching Schedule			Marks of Class work	Examination Marks		Total	Credit	Duration of Exam
			L	T	P		Theory	Practical			
1	CE302C	ESTIMATING AND COSTING	2	-	2	25	75	-	100	3	3
2	CE304C	DESIGN OF STEEL STRUCTURES - II	3	1		25	75	-	100	4	3
3	CE 306C	REINFORCED CONCRETE DESIGN – II	3	0		25	75	-	100	3	3
4	CE 308C	FOUNDATION ENGINEERING	3	0		25	75	-	100	3	3
5	CE310C	ENVIRONMENTAL ENGINEERING - I	3	-		25	75	-	100	3	3
6	CE	DE-I	2	1		25	75	-	100	3	3
7	CE	DE-II	3	-		25	75	-	100	3	3
8.	CE	DE-II(SP)	4	-		25	75	-	100	4	3

9	CE312C	FOUNDATION ENGINEERING LAB	-	-	2	25		75	100	1	3
10	CE314C	ENVIRONMENTAL ENGINEERING – I LAB	-	-	2	25		75	100	1	3
11	CE316C/ CE318C	MATERIAL TESTING LAB**	-	-	4	25		75	100	2	3
12	GFCE302C	GENERAL FITNESS FOR CIVIL ENGINEERING	-	-	-	-	-	75	75	-	3
<b>Total</b>			<b>23</b>	<b>2</b>	<b>10</b>	<b>275</b>	<b>600</b>	<b>300</b>	<b>1175</b>	<b>30</b>	

Note:

- 1 The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator are prohibited in the examination.
- 2 Electronics gadgets including Cellular phones are not allowed in the examination
- 3 \* Assessment of survey camp held after fourth semester.
- 4 DE-II (SP) For only those students opting for degree with specialization
- 5 Student can undertake 20% of the courses of this scheme (Hons./Minor Degree with Specialization in the above listed emerging areas) through online platforms SWAYAM/MOOCs/NPTEL etc. with due permission of the chairperson.
- 6 Any students of the B. Tech. of the University can opt for this scheme (Hons./Minor Degree with Specialization in the above listed emerging areas), however, minimum 10 students are required for running a particular specialization.

Deenbandhu Chhotu Ram University of Science & Technology, Murthal (Sonapat)

SCHEME OF STUDIES & EXAMINATIONS

B.Tech. Final YEAR (SEMESTER – VII: CIVIL ENGINEERING)

Tentative Choice Based Credit Scheme w.e.f. 2021-22

S. No.	Course No.	Course Title	Teaching Schedule			Marks of Class work	Examination Marks		Total	Credit	Duration of Exam
			L	T	P		Theory	Practical			
1		OE-I	3	-		25	75	-	100	3	3
2		OE-II	3	-	-	25	75	-	100	3	3
3	CE 401C	PROJECT	-	-	12	75	-	225	300	6	3
4	CE 403C	COLLOQUIUM	-	-	2*	50			50	1	-
5	CE 405C	PROFESSIONAL TRAINING	-	-	2*	50	-	-	50	1	-
<b>Total</b>			<b>6</b>	<b>0</b>	<b>16</b>	<b>225</b>	<b>150</b>	<b>225</b>	<b>600</b>	<b>14</b>	
OR											
1	CE 407C	Internship	-	-	-	250		350	600	14	3
<b>TOTAL</b>						<b>250</b>		<b>350</b>	<b>600</b>	<b>14</b>	<b>3</b>

Note:

- 1 The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
- 2 Electronics gadgets including Cellular phones are not allowed in the examination.
- 3 Students will be permitted to opt for any one elective run by the other department. However, the department shall offer those elective for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. The minimum strength of the students should be 20 to run an elective.
- 4 Assessment of Professional Training, undergone at the end of VI semester, will be based on seminar, viva-voce, report and certificate of Professional Training obtained by the student from the industry, institute, research lab, training center etc.
- 5 Internship/project coordinator will be assigned the load of maximum of 2 hrs. per week including his own guiding load of one hr. However, the guiding/supervising teacher will be assigned maximum of one period of teaching load irrespective of number of students/groups under him/her.

Code		OPEN ELECTIVE I
1	HUM-402C	SOFT SKILLS AND INTER PERSONAL COMMUNICATION
2	HUM-405C	INTRODUCTION TO FRENCH LANGUAGE
3.	HUM – 406C	INTRODUCTION TO GERMAN LANGUAGE
4	MGT-401 C	HUMAN RESOURCES MANAGEMENT
5.	MGT 402C	HUMAN VALUES, ETHICS AND IPR
		OPEN ELECTIVE II
1	CSE 451C	CYBER SECURITY
2.	CSE 201C	COMPUTER NETWORK
3.	CH-	INDUSTRIAL SAFETY

4.	CE 406C	DISASTER MANAGEMENT
5	ECE327C	CONSUMER ELECTRONICS
<b>OPEN ELECTIVE III</b>		
1	CSE 409C	ARTIFICIAL INTELLIGENCE
2.	EE	ELECTRICAL AND HYBRID VEHICLES
3.	MGT 404C	ENTREPRENURSHIP
4	EE	SMART GRID
5	CH	NANO SCIENCE AND NANO TECHNOLOGY

**Deenbandhu Chhotu Ram University of Science & Technology, Murthal (Sonapat)**  
**SCHEME OF STUDIES & EXAMINATIONS**  
**B.Tech. Final YEAR (SEMESTER – VIII: CIVIL ENGINEERING)**  
**Tentative Choice Based Credit Scheme w.e.f. 2021-22**

S. No.	Course No.	Course Title	Teaching Schedule			Marks of Class work	Examination Marks		Total	Credit	Duration of Exam
			L	T	P		Theory	Practical			
1	CE 402C	IRRIGATION ENGINEERING	3	0		25	75	-	100	3	3
2	CE 404C	ENVIRONMENTAL ENGINEERING – II	3	0		25	75	-	100	3	3
3	ECE 404C	INSTRUMENTATION AND SENSOR TECHNOLOGY FOR CIVIL ENGINEERING APPLICATIONS	2	-		25	75	-	100	2	3
4	CE 406C	DISASTER MANAGEMENT	3	-	-	25	75	-	100	3	3
5	CE	DE-III	3	-	-	25	75	-	100	3	3
6	CE	DE-IV	3	-	-	25	75	-	100	3	3
7		DE-III(SP)	4	-	-	25	75	-	100	4	3
8		DE-IV(SP)	4	-	-	25	75	-	100	4	3
9	CE 408C	ENVIRONMENTAL ENGINEERING – II LAB	-	-	2	25		75	100	1	3
10	ECE-486C	INSTRUMENTATION AND SENSOR TECHNOLOGY FOR CIVIL ENGINEERING APPLICATIONS LAB	-	-	2	25		75	100	1	3
11	CE410C OR CE412C	SOFTWARE APPLICATIONS IN STRUCTURE/EARTHQUAKE ENGINEERING LAB** OR SOFTWARE APPLICATIONS IN HIGHWAY ENGINEERING LAB**			4	25		75	100	2	3
12	GFCE402C	GENERAL FITNESS FOR CIVIL ENGINEERING	-	-	-	-	-	75	75	-	3
<b>Total</b>			<b>25</b>	<b>-</b>	<b>8</b>	<b>275</b>	<b>600</b>	<b>300</b>	<b>1175</b>	<b>29</b>	

**Note:**

- The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator are prohibited in the examination.
- Electronics gadgets including Cellular phones are not allowed in the examination
- \* Assessment of survey camp held after fourth semester.
- DE-III (SP) and DE-IV (SP) For only those students opting for degree with specialization
- Student can undertake 20% of the courses of this scheme (Hons./Minor Degree with Specialization in the above listed emerging areas) through online platforms SWAYAM/MOOCs/NPTEL etc. with due permission of the chairperson.
- Any students of the B. Tech. of the University can opt for this scheme (Hons./Minor Degree with Specialization in the above listed emerging areas), however, minimum 10 students are required for running a particular specialization.

**List Of Departmental Elective I(SP), II(SP), III(SP) & IV(SP)**

**List Of Departmental Elective I, II, III & IV**

S. no.	Code	Subject	S. no.	Code	Subject
	<b>STRUCTURAL ENGINEERING</b>		1	CE 352C	WATER AND AIR QUALITY MODELING
1	CE 351C	CONCRETE TECHNOLOGY	2	CE354C	ROCK MECHANICS
2	CE 361C	MASONARY STRUCTURES	3	CE356C	GROUNDWATER ENGINEERING

3.	CE 372C	STRUCTURAL ANALYSIS BY MATRIX METHOD	4	CE358C	CONSTRUCTION COST ANALYSIS
4	CE474C	EARTHQUAKE RESISTANT STRUCTURES	5	AR318C	BUILDING STANDARDS AND OFFICE MANAGEMENT
5	CE476C	DESIGN OF BRIDGES	6	CE360C	LOW VOLUME ROADS
6	CE480C	DYNAMICS OF STRUCTURES	7	CE 362C	GEOTECHNICAL DESIGN
7	CE484C	ADVANCED STRUCTURAL DESIGN AND DETAILING	8	CE364C	BUILDING CONSTRUCTION PRACTICE
	<b>EARTHQUAKE ENGINEERING</b>		9	CE366C	TRANSPORTATION ECONOMICS
1	CE 351C	CONCRETE TECHNOLOGY	10	CE368C	CONSTRUCTION ENGINEERING MATERIALS
2	CE 372C	STRUCTURAL ANALYSIS BY MATRIX METHOD	11	CE450C	BASICS OF COMPUTATIONAL HYDRAULICS
3.	CE474C	EARTHQUAKE RESISTANT STRUCTURES	12	CE452	DESIGN OF PRESTRESSED CONCRETE STRUCTURES
4	CE480C	DYNAMICS OF STRUCTURES	13	CE454C	CONTRACTS MANAGEMENT
5	CE484C	ADVANCED STRUCTURAL DESIGN AND DETAILING	14	CE456C	ASSET MANAGEMENT
	<b>TRANSPORTATION ENGINEERING</b>		15	CE458C	GROUND IMPROVEMENT
1	CE353C	TRAFFIC ENGINEERING AND MANAGEMENT	16	CE460C	RURAL WATER SUPPLY AND ONSITE SANITATION SYSTEMS
2	CE363C	ENVIRONMENTAL IMPACT ASSESSMENT AND LIFE CYCLE ANALYSES	17	CE462C	INFRASTRUCTRE PLANING AND DESIGN
3.	CE365C	HIGHWAY CONSTRUCTION AND MANAGEMENT	18	CE464C	SOLID AND HAZARDOUS WASTE MANAGEMENT
4	CE374C	DOCK AND HARBOUR ENGINEERING	19	CE466C	CONSTRUCTION EQUIPMENT & AUTOMATION
5	CE376C	AIRPORT PLANNING AND DESIGN OF AIRFIELD PAVEMENTS	20	CE468C	WATER POWER ENGINEERING
6	CE472C	TRANSPORT PLANNING	21	CE470C	ENERGY EFFICIENT BUILDINGS
7	CE482C	ROAD SAFETY AND ENVIRONMENT	22	CE478C	PUBLIC TRANSPORTATION SYSTEMS
8	CE486C	APPLIED STAISTICS TO TRANSPORTATION ENGINEERING			

MC101C

INDUCTION PROGRAM

B.TECH. (All ENGINEERING DISCIPLINES/ BRANCHES)

SEMESTER-I

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>6</b>	<b>0</b>	<b>0</b>	<b>0</b>

Credits	Class-work Marks: 25
0	Exam. Marks: 75
	Total Marks: 100
	Duration of Objective Type Examination: 1.5 Hrs.

**Course Outcomes:**

At the end of this course, students will demonstrate the ability to:

1. Understand self.
2. Inculcate Human Values.
3. Feel inspired for intensive & extensive studies, co-curriculars, career, & life.
4. Nurture a hobby.
5. Dismantle upsets quickly & move forward in life.

**Course Curriculum:**

1. Each student has to participate in the mandatory Audit (Non-credit) Course INDUCTION PROGRAM of 21 days.
2. Out of these 21 days, initial 07 working days duration shall be dedicated solely to the Induction Program before the start of regular teaching of first semester.
3. The remaining two weeks (14 working days) will be spread over the rest of first semester by allotting 6 periods per week (preferably 2 periods each on Tues., Wed. & Thurs.), however, these periods shall necessarily be in the same slots for all engineering disciplines / branches so that if a common activity is to be planned, the same may be effected / actualized at the Univ. / Institute level.
4. Induction Program comprises of:
  - a) Physical Activities,
  - b) Creative Arts,
  - c) Mentoring And Universal Human Values (UHV's),
  - d) Literary Activities,
  - e) Proficiency Modules,
  - f) Lectures And Workshops by Eminent People,
  - g) Visits to local Areas,
  - h) Familiarization With Respective Dept./ Branch & Institute,
  - i) Co-Curricular Activities in Univ. / College.
5. Each student will maintain a Diary to jot down salient points & scribble associated points lest these may wither & wane away from memory, because each student has to clear an Objective Type Test at the end of this Audit Course.
6. Also, students may keep recording their feedback / rating, on a scale of 1 to 10, of each speaker/ session/ activity in their diary, to reproduce the same in feedback session. The Mentors of resp. groups & Activity In-charges shall from time to time sign on these diaries to monitor progress & attendance.
7. It is expected that students, while coming on to sports arenas, will come in proper sports attire (sports shoes, etc.). They may also carry, in a bag/ carry-bag, their formal dress for subsequent sessions.
8. Each **Universal Human Values (U.H.V.) Discussion Group** shall consist of 20 Students + 2 Senior Student Guides + 1 Faculty Mentor.

9. **Venue & Schedule:** For cost-effectiveness, the Venue for the Lectures, Proficiency Modules, & common activities, etc. may be kept as Convention Centre/ Auditorium of the Univ./ resp. Institute. The venue for dept.-specific activities may be decided by Chairpersons of resp. Depts. offering these modules.
10. Wake-up call for hostellers shall be from 6:30 a.m.-7:00 a.m. and they shall perform Physical Activities from 7:00 a.m. to 8:00 a.m. in the morning and also for 1 hour in the evening on each working day. If the schedule of Physical Activities for hostellers cannot be followed with rigor by all day-scholars, then a separate schedule for the same may be suitably worked out by the Univ. / resp. Institute.
11. **Evaluation Scheme:**
  - a) The Internal Assessment / Sessional / Class-work Marks shall be awarded for 25 marks by the mentor (for each group of about 20 students of respective branch/ discipline) based on candidate's regularity, attendance, diary work, assignments & enthusiastic participation in various activities of the Induction Program. These marks shall be collected (from each of the mentors of a group of about 20 students of resp. branch) by the senior-most mentor (or by the Class In-charge of 1<sup>st</sup> Year of the concerned branch/ discipline, as decided by Univ./ concerned Institute) who may upload the Sessional / Internal Assessment / Class-work Marks on the Univ. portal.
  - b) There will be an end-semester examination of 75 marks based on selected chapters of the Text Books / References, and the B.Tech. Ordinance of the Univ., and on the life and achievements of State & National Heroes.
  - c) Any student failing in the Sessional / Class-work / Internal Assessment and / or in the end-semester examination of Induction Program shall have to reappear and pass as per provisions of the B.Tech. Ordinance.
12. Any student failing of the Induction Program shall have to Preparing for the Conduct of the Program:
  - a) Univ. / Each Institute may appoint a Faculty in-charge called Chief Coordinator, Induction Program, who shall prepare the Schedule of 1<sup>st</sup> Week & shall be responsible, along with his team (which shall necessarily include Faculty Mentors defined in this paragraph, besides other members), for its execution. Further, each Dept. may appoint one Faculty Mentor for each group of 20 first year students of each branch. The senior-most amongst such Faculty Mentors of a Dept. / branch (or the Class In-charge of 1<sup>st</sup> year of respective branch) shall, in association with other mentor(s), if any, of respective branch shall prepare, within the overall mandate of the Induction Program, the Schedule for the rest of the Semester & shall be responsible for its execution & also for Internal Assessment/ Class-work Marks award and upload. The Chief Coordinator may hold meetings of mentors periodically.
  - b) Training program(s) for Chief Coordinator & faculty mentors may be conducted by Univ./ resp. Institute on how to mentor students based on universal human values, & imparting holistic education & larger vision of life.

**Text Books / References:**

1. Dr. J.S. Saini, "A Pithy Guide for Induction Program", Internal Report, DCRUST, Murthal, Sonipat (Haryana), 2019.
2. Rajeev Sangal, Gautam Biswas, Timothy Gonsalves, Pushpak Bhattacharya, "Motivating UG Students Towards Studies", IIT Director's Secretariat, IIT, Delhi, 2016.
3. "A Guide to Induction Program", Model Curriculum for Undergraduate Degree Courses in Engineering & Technology, vol.-1, Jan. 2018.
4. "A Detailed Guide on Student Induction Program", AICTE, Vasant Kunj, New Delhi, July 30, 2018.
5. R.R. Gaur, R. Sangal, G.P. Bagaria, "A Foundation Course in Human Values & Professional Ethics", Pub.: Excel Books.
6. Chapters 1, 2, 3 & 17 of Joseph Murphy, "The Power of Your Sub-Conscious Mind", Samaira Book Publishers, Ghaziabad, U.P. India (also available at [www.ichoosetoheal.com](http://www.ichoosetoheal.com)).
7. Dr. Spencer Johnson, "Who Moved My Cheese", Vermillion Press.
8. Dr. Birender Hooda, "General Warm Up Exercise Structure And Cardiovascular Fitness Threshold of Training & Target Zones for Aerobic Exercise", Internal Report, DCRUST, Murthal, 2018.
9. Dr. J.S. Saini, "Reading the Mind and Jogging the Brain (A Compilation)", Internal Report, DCR Univ. of Sci. & Tech., 2019.
10. Dr. J.S. Saini, "Health System", Internal Report, DCR Univ. of Sci. & Tech., 2019.

NOTES:

1. For the semester examination, 75 Objective Type Questions are to be set by the examiner, to be answered in 1.5 hours by the examinees. Each question shall carry 1 mark; there shall be no negative marking. The questions shall be set based on the clause 11(b).
2. The students will be allowed to use non-programmable scientific calculator. However, programmable calculators, mobile phones or other electrical/ electronic items, and sharing / ex-change of calculators are prohibited in the examination.

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## B.Tech.Semester –I/II (Common for all Branches)

Course code: CH101C  
Course Name: Engineering Chemistry  
L T P Credits  
3 1 - 4

Class Work Marks: 25  
Examination Marks: 75  
Total Marks: 100  
Duration of Exam: 3 Hours

### UNIT-I

**Atomic and molecular structure:**Schrodinger equation. Particle in a box solutions 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(derivation excluded). Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Molecular orbital energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene .Crystal field theory and the energy level diagrams for transition metal ions .Band structure of solids and the role of doping on band structures.

**Periodic properties:** 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.

### UNIT-II

**Stereochemistry:**Representations of 3 dimensional structures, structural isomers and stereoisomers.Configurations , symmetry chirality, enantiomers, diastereomers. Optical activity,absolute configurations and conformational analysis.

**Organic reactions and synthesis of a drug molecule:**Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule (Asprin/Paracetamol).

### UNIT-III

**Intermolecular forces and potential energy surfaces:** Ionic, dipolar and van der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces (with example).

**Use of free energy in chemical equilibria:** 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 equilibria, oxidation reduction and solubility equilibria.Waterchemistry.Corrosion.Use of free energy considerations in metallurgy through Ellingham diagrams.

### UNIT-IV

**Spectroscopic techniques and applications :**Principles of spectroscopy and selection rules. Electronic spectroscopy.Fluorescence and its applications in medicine.Vibrational and rotational spectroscopy of diatomic molecules and its applications. Nuclear magnetic resonance and magnetic resonance imaging,surfacecharacterisation techniques. Diffraction and scattering.

### **Suggested Text Books:**

- (i) University chemistry, by B. H. Mahan
- (ii) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
- (iii) Fundamentals of Molecular Spectroscopy, by C. N. Banwell
- (iv) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
- (v) Physical Chemistry, by P. W. Atkins
- (vi) Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5<sup>th</sup> Edition.
- (vii) Organic chemistry, by R.T Morrison, R.N Boyd and S.K Bhattacharjee, Pearson Publication.

### **Course Outcomes**

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to: Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces. Rationalise 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. Rationalise periodic properties such as ionization potential, electro-negativity, oxidation states and electronegativity.

**NOTE: 1.** For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.** The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE:** For examiner for paper setting:- In semester examinations, examiner is required to set up question paper covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

## B. Tech. (Semester – II) Physics Theory

### Civil Engineering

Course Code	Branch Name	Course Title	Teaching Schedule			Marks of Class Work	Examination Marks		Total	Credit	Duration of Exam
			L	T	P		Theory	Practical			
PHY103C	CE	Mechanics	3	1	-	25	75	-	100	4	3

#### Syllabus:

### Mechanics

**Prerequisites:** (i) High-school education

#### UNIT I

##### Vector Mechanics of Particles

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

##### Mechanics of Particles in Motion and Harmonic Motion

Potential energy function;  $F = -\text{Grad } V$ , 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 manoeuvres;

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

Harmonic oscillator; Damped harmonic motion – over-damped, critically damped and lightly-damped oscillators; Forced oscillations and resonance.

#### UNIT III

##### Rigid Body Mechanics

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.

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.

#### **UNIT IV**

##### **Statics of Solids**

Free body diagrams with examples on modelling of typical supports and joints; Condition for equilibrium in three- and two- dimensions; Friction: limiting and non-limiting cases; Forced displacement relationship; Geometric compatibility for small deformations; Illustrations through simple problems on axially loaded members like trusses.

#### **Suggested Reference Books**

- (i) Engineering Mechanics, 2<sup>nd</sup>ed. — MK Harbola
- (ii) Introduction to Mechanics — MK Verma
- (iii) An Introduction to Mechanics — D Kleppner & R Kolenkow
- (iv) Principles of Mechanics — JL Synge & BA Griffiths
- (v) Mechanics — JP Den Hartog
- (vi) Engineering Mechanics - Dynamics, 7<sup>th</sup>ed. - JL Meriam
- (vii) Mechanical Vibrations — JP Den Hartog
- (viii) Theory of Vibrations with Applications — WT Thomson

**NOTE: 1.** For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.** The students will be allowed to use non-programmable scientific calculator. However, sharing / exchange of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE:** For examiner for paper setting:- In semester examinations, examiner is required to set up question paper covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

## BASIC ELECTRICAL ENGINEERING

Course Code: EE101C

### B. Tech. Semester – I/II (Common for all Branches except Chemical Engineering)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>:</b>	<b>25 Marks</b>
<b>3</b>	<b>1</b>	<b>--</b>	<b>4</b>	<b>Examination</b>	<b>:</b>	<b>75 Marks</b>
				<b>Total</b>	<b>:</b>	<b>100 Marks</b>
				<b>Duration of Examination</b>	<b>:</b>	<b>3 Hours</b>

#### COURSE OUTCOMES:

1. Students will be able to analyze dc and ac circuits.
2. Students will be able to solve, design and synthesise electrical networks mathematically.
3. Obtain basic knowledge of electric installations.
4. Imbibe elementary knowledge of electric machines.

#### UNIT-1

**D.C. Circuits & Theorems:** Basics of electric circuit elements, Kirchoff's laws & its applications including those based on dependent sources, Nodal and Loop methods of Analysis, Star-Delta and delta-star transformations. Network Theorems: Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum Power transfer theorem. **(11 Hours)**

#### UNIT-2

**Single A.C. Circuits:** Sinusoidal signal, instantaneous & peak values, average and RMS values, form factor, peak factor. Concept of Phasors: Rectangular & Polar, Trigonometric & Exponential forms. Behaviour of R, L, C components in ac circuits. Time domain analysis of first-order RL and RC circuits. Series and parallel circuits: Active and reactive power, power factor, Resonance in series and parallel circuits. Q-factor, cut off frequencies and bandwidth. Three Phase Circuits: Phase and line voltages and currents, balanced star and delta circuits. **(11 Hours)**

#### UNIT-3

**Electrical Machines:** Construction, working principle, type, & equation of Single phase Transformer, Ideal Transformer, Phasor diagrams of Single-phase Transformer at no load and on load, Equivalent circuit, losses, efficiency. Three phase Transformer connections. single phase Autotransformer. Rotating Machines: Construction, operating principle of d.c. motors and its torque speed characteristics. Construction and working principle & type of single phase Induction motor & Three-phase Induction motor, concept of slip & torque-speed characteristics, construction and working of synchronous generators. **(11Hours)**

#### UNIT-4

**Electrical and electronics components:** Components of LT Switchgear: Switch Fuse Unit (SFU), MCB(Miniature Circuit Breaker), ELCB(Earth Leakage Circuit Breaker), MCCB( Moulded Case Circuit Breaker), Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics of Batteries. Elementary calculations for energy consumption. Introduction to power factor improvement and battery backup. **(11 Hours)**

#### TEXT BOOKS:

1. Del Toro, "Principles of Electrical Engineering", PHI, New-Delhi. 2<sup>nd</sup> edition.
2. D.P.Kothari& I. J. Nagarath, "Basic Electrical Engg", TMH, New Delhi, 3<sup>rd</sup> edition.
3. B.L. Theraja& A. K. Theraja, "Electrical Technology", (Vol-I, Vol-II), S.Chand.
4. Edward Hughes, "Electrical & Electronics Technology", Pearsons.

## REFERENCE BOOKS:

1. T.K. Nagsarkar & M.S. Sukhija, "Basic Electrical Engineering", OXFORD Uni. Press. 2004.
2. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press.
3. D.C. Kulshreshtha, "Basic Electrical Engineering", Mc Graw Hill.
4. Hayt & Kemmerly, "Engineering Circuit Analysis", Mc Graw Hill.
5. "Schaum's Outline of Electric Circuits", Mc Graw Hill.
6. A.K. Sawhney, "A Course in Electronic Measurements and Instrumentation", Dhanpat Rai & Co.

**NOTE: 1.** For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.** The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE:** For examiner for paper setting:- In semester examinations, examiner is required to set up question paper covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

## BASIC ELECTRICAL ENGINEERING LABORATORY

Course Code: EE181C

B. Tech. Semester – I/II (Common for all Branches)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work Marks</b>	<b>: 25</b>
--	--	2	1	<b>Examination Marks</b>	<b>: 75</b>
				<b>Total Marks</b>	<b>: 100</b>

## LIST OF EXPERIMENTS

1. To study frequency response of a series R-L-C circuit and determine resonant frequency & Q-factors for various Values of R, L, C.
2. To study frequency response of a parallel R-L-C circuit and determine resonant frequency & Q-Factors for various values of R, L, C.
3. To perform Open circuit & Short circuit Tests on single phase Transformer.
4. To plot torque- speed characteristic of DC motors.
5. Power and Power Factor Measurement by two wattmeter method.
6. To measure energy with single phase energy meter.
7. Demonstration of Components of LT switch gear like MCB, MCCB, SFU, ELCB and earthing.
8. To obtain torque-slip characteristics of three phase induction motor.
9. To perform voltage control of synchronous generator through field excitation.
10. To study transient and steady state time response of RLC series circuits.

## Laboratory Outcomes

1. Get an exposure to common electrical components and their ratings.
2. Understand the usage of common electrical measuring instruments.
3. Student will be able to understand and design resonant circuits.
4. Understand the basic characteristics of transformers and electrical machines.

**Note:**

1. At least 10 experiments are to be performed by students in the semester.
2. At least 8 experiments should be performed from the above list; remaining two experiments may either be performed from the above list or designed and set by the Dept. as per the scope of the syllabus.

**CH103C CHEMISTRY LAB (COMMON FOR ALL BRANCHES)**

**B. Tech 1<sup>st</sup> Sem. /2<sup>nd</sup> Semester**

**03 Hrs. / week**

**Duration of Exam: 03 Hrs.**

**Credit:1.5**

**Sessional Marks: 25**

**External Marks: 25**

**LIST OF EXPERIMENTS:-**

1. Determination of surface tension of given solvent by stalgmometer.
2. Removal of  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  hardness from given water sample using ion exchange column.
3. Calculate the  $R_f$  value of given sample using thin layer chromatography.
4. Calculate the strength of strong acid by titrating it with strong base using conductometer.
5. Calculate the emf value of given cell.
6. Prepare the sample of urea formaldehyde and phenol formaldehyde.
7. Determination of chloride content in given water sample.
8. To study the kinetics of ethyl acetate with NaOH.
9. Preparation of aspirin.
10. Calculate the saponification value of given oil sample.
11. Chemical analysis of two anions and two cations in given sample of salt.
12. Determination of the partition coefficient of a substance between two immiscible Liquids.
13. Determine the alkalinity of given water sample .
14. Study the adsorption phenomena using acetic acid and charcoal.
15. Lattice structures and packing of spheres.
16. Determine the viscosity of given liquid using Ostwald viscometer.

**Course 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

**Note: At least 10-12 experiments are to be performed by the students.**

1. Each laboratory class/section shall not be more than about 20 students.

2. To allow fair opportunity of practical hands on experience to each student, each experiment may either be done by each student individually or in groups of not more than 3-4 students. Larger groups are strictly discouraged/disallowed.

3. Pre-experimental & post experimental quiz/questions may be offered for each lab experiment to reinforce & aid comprehension of the experiment.

### **Suggested Books:**

1. A Text book on Experiments and Calculation –Engineering Chemistry by S.S.Dara, S.Chand & Company Ltd.
2. Essential of Experimental Engineering chemistry, Shashi Chawla, Dhanpat Rai Publishing Co.
3. Theory & Practice Applied Chemistry – O.P.Virman, A.K. Narula ( New Age).

**CE102C**

### **IN-HOUSE TRAINING (LEVEL-1)**

### **B.TECH. (All ENGINEERING DISCIPLINES/ BRANCHES)**

### **SEMESTER-I**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>

Credits	Class-work Marks: 100
1	Duration of Training: 40-50 Hrs.
	Total Marks: 100

### **Course Outcomes:**

At the end of this course, students will demonstrate the ability to:

1. Compose, edit, analyse various documents and presentations on a computer.
2. Get started with simulation of engineering systems via softwares, such as AutoCAD etc.
3. Understand basics of Civil Engineering and building components.
4. Present PPT on a topic related to contemporary technology.

### **Course Curriculum:**

1. Each student has to participate in the mandatory Course IN-HOUSE TRAINING (LEVEL-1) of 40 to 50 hours duration spread over 6 to 10 working days.

2. Each student will maintain a Diary to jot down salient points & scribble associated points lest these may wither & wane away from memory, because each student has to get the Diary regularly signed by the Training Coordinator.
3. Chairperson of each Department may design the syllabus as per the need of students. Syllabi may be different for every Academic Year.

**4. SYLLABUS:**

**UNIT I: Introduction to Civil Engineering:** Introduction to Engineering, Basic concept of Civil Engineering, Scope and application, Different Branches of C.E., Future scope after C.E.

**UNIT II: Building Drawing:** Introduction to types of buildings, Basic dimensioning and location of rooms in a building, Preparation of a plan for a residential house, Drawing of plan, elevation and section of residential house using Auto-CAD.

**UNIT III: MS Office:** Introduction to various components of MS-Office, Use and application of MS Word, MS Excel and MS PowerPoint.

**UNIT IV: Communication Skills:** Improvement of presentation skills of students using power point presentation, report preparation and writing.

All the students will be divided into three groups for the classes and laboratories. Each unit will include both theoretical as well as laboratory sessions. Assignment will be given to students. Assessment of students will be done on overall knowledge on topics and assignment.

**MC 203C (Environmental Studies)**

(Common for all branches of B.Tech and B.Arch GROUP-B)

<b>L</b>	<b>T</b>	<b>P/D</b>	<b>Credits</b>		<b>Field Work</b>	<b>:</b>	<b>25Marks</b>
<b>3</b>	<b>--</b>	<b>--</b>	<b>0</b>		<b>Examination(Theory/Practical)</b>	<b>:</b>	<b>75Marks</b>
					<b>Total</b>	<b>:</b>	<b>100 Marks</b>
					<b>Duration of Examination</b>	<b>:</b>	<b>3 Hours</b>

**UNIT I**

**10 lectures**

The Multidisciplinary Nature of Environmental Studies, .Introduction to Environment: Definition, Scope, and importance of environmental studies; need for public awareness.

Environmental Pollution: Definition, Cause and effects of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Role of an individual in prevention of pollution, Pollution case studies

**UNIT- II**

**10 lectures**

Natural Resources: Water resources: over-utilization, floods, drought, dams-benefits and problems; Mineral resources: Use and exploitation, environmental effects; Food resources : changes caused by modern agriculture, fertilizer-pesticide problems, water logging, Energy resources : Growing energy needs, renewable and non renewable energy sources; Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

**UNIT –III****10 lectures**

Ecosystems and Biodiversity: Concept of an ecosystem, Structure and function, Energy flow, Ecological succession, ecological pyramids. Concept of Biodiversity, definition and types, Hot-spots of biodiversity; Threats to biodiversity, Endangered and endemic species of India, Conservation of biodiversity.

**UNIT –IV****08 lectures + 05 lectures**

Social Issues and Environment: Water conservation, rain water harvesting, Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, Public awareness. Population growth, variation among nations, Family Welfare Programme. Human Population and the Environment - Population growth, Population explosion, Women and Child Welfare.

Field Work - Visit to a local area to document environmental assets—river/forest/grassland/hill/mountain. Visit to a local polluted site—Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds. Study of simple ecosystems—pond, river, hill slopes, etc (Field work equal to 5 lecture hours)

**Total : 43****COURSE OUTCOMES:**

On completion of the course, the students will be able to:

- Develop concepts of basic environmental factors.
- Introduce to the students the basic understanding of ecosystem and its structural and functional aspects and vast biodiversity
- Outline aspects of environmental issues.
- Understand the knowledge of energy resources and their environmental implications

**REFERENCE BOOKS:**

1. A Textbook of Environmental Studies by [Asthana D.K.](#) and [Asthana Meera](#)
2. Fundamental Concepts in Environmental Studies by [Mishra D.D.](#)
3. Environmental Studies by [S.C Sharma M.P Poonia](#)
4. Textbook of Environmental Studies for Undergraduate by [ErachBharucha](#)
5. Environmental Studies: Third Edition by [R. Rajagopalan](#)

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE:** For examiner for paper setting:- In semester examinations, examiner is required to set up question paper

covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

## UNIVERSAL HUMAN VALUES II: SELF, SOCIETY AND NATURE

Course code: HSMC (HUM-102)

(Common for all branches of B.Tech and B.Arch GROUP-B)

<b>L</b>	<b>T</b>	<b>P/D</b>	<b>Credits</b>	<b>Field Work</b>	<b>:</b>	<b>25 Marks</b>
<b>3</b>	<b>--</b>	<b>--</b>	<b>3</b>	<b>Examination(Theory/Practical)</b>	<b>:</b>	<b>75 Marks</b>
				<b>Total</b>	<b>:</b>	<b>100 Marks</b>
				<b>Duration of Examination</b>	<b>:</b>	<b>3 Hours</b>

**Pre-requisites: Universal Human Values I: Self & Family (desirable); 4-day Harmony-2 Workshop (co-requisite).**

**OBJECTIVE:** The objective of the course is four fold:

1. Sensitization of student towards issues in society and nature.
2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals.
3. Strengthening of self reflection.
4. Development of commitment and courage to act. (For elaboration on some of the above, consult course description for Universal Human Values 1: Self and Family).

**COURSE TOPICS:** In Universal Human Values 2 course, the focus is more on understanding society and nature on the basis of self and human relationships.

1. Purpose and motivation for the course.
2. Recapitulation (from the previous course) on ideas of self, pre-conditioning, and natural acceptance.
3. Harmony in the self. Understanding human being as co-existence of self and body. Identifying needs and satisfying needs of self and body. Self observations. Handling peer pressure.
4. Recapitulation on relationships. Nine universal values in relationships. Reflecting on relationships in family. Hostel and institute as extended family. Real life examples.
5. Teacher-student relationship. Shraddha. Guidance. Goal of education.
6. Harmony in nature. Four orders of nature – material order, plant order, animal order and human order. Salient features of each. Human being as cause of imbalance in nature. (Film “Home” can be used.)
7. Human being as cause of imbalance in nature. Depletion of resources – water, food, mineral resources. Pollution. Role of technology. Mutual enrichment not just recycling.
8. Prosperity arising out of material goods and understanding of self. Separation of needs of the self and needs of the body. Right utilization of resources. lkekU; vkdkka{kk ,oa egRokdkka{kk, Understanding the purpose they try to fulfil.
9. Recapitulation on society. Five major dimensions of human society. Fulfilment of the individual as major goal. Justice in society. Equality in human relationships as naturally acceptable. Establishment of society with abhaya (absence of fear).
10. Ethical human conduct. Values, character and netikataa. 11. Professional ethics. Conduct as an engineer or scientist.

## B. Tech. 2<sup>nd</sup> Year (Semester – III)

L T P Credits  
3 1 -- 4

Class Work : 25 Marks  
Examination : 75Marks  
Total : 100 Marks  
Duration of Examination : 3 Hours

### Course Outcomes :

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

CO1	Knowledge of various types of stresses and strains and their analysis
CO2	Analyze of forces on statically determinate beams
CO3	Analyze of deformations of statically determinate beams
CO4	Analyze of columns loaded axially and eccentrically.
CO5	Analyze the determinate trusses, thin cylinders and spheres.

### Prepare CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO3	PO4	PO5	PO6	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	2	1	-	1	1	2	2	2
CO2	2	2	1	2	2	-	-	2	1	1	1	3	2
CO3	3	2	2	1	-	1	1	-	2	2	2	2	2
CO4	2	1	2	1	1	1	1	1	1	1	2	3	2
CO5	2	1	2	1	2	1	1	1	2	1	2	2	2

### UNIT - I

**Introduction:** Concept of Equilibrium General Equilibrium equations, concept of free body diagrams , Concept of stress and strain, generalized Hooke's law, Stress-strain diagram of ductile and brittle material, compound and composite bars, thermal stresses, Analysis of Principal stresses and Strains, Mohr's stress circle, Relationship among elastic constants.

**Shear force and Bending moment diagrams:** Types of load on beam and frames, classification of beams, statically determinate and indeterminate problems, shear force and bending moment diagrams: simply supported, overhung and cantilever beams subjected to any combination of point loads, uniformly distributed and varying load and moment, relationship between load, shear force and bending moment.

### UNIT - II

**Theory of pure bending:** Centroid of simple and built up section, second moment of area, derivation of flexural formula for straight beams, bending stress calculation for beams of simple and built up section, RCC beams.

**Shear Stresses in Beams:** Shear stress formula for beams, shear stress distribution in beams.

**Slope & Deflection:** Relationship between bending moment, slope & deflection, Mohr's theorem, moment area method, method of integration, Macaulay's method, calculations for slope and deflection of (i) cantilevers and (ii) simply supported beams with or without overhang under concentrated load, Uniformly distributed loads or combination of concentrated and uniformly distributed loads.

### UNIT - III

**Torsion of Circular shafts:** Basic assumptions, torsion formula, power transmitted by shafts, design of solid and Hollow shafts based on strength and stiffness.

**Columns & Struts:** Column under axial load, concept of instability and buckling, slenderness ratio, derivation of Euler's formulae for the elastic buckling load, Eulers, Rankine, Gordon's formulae Johnson's empirical formula for axial loading columns and their applications, eccentric compression of a short strut of rectangular & circular sections.

#### UNIT - IV

**Strain energy:** strainenergy under axial, bending, shear, torsion, gradual, sudden and impact loading, theories of failures

**Analysis of determinate Trusses** Introduction, determination of forces in member of trusses by method of joints, method of sections, Deflection of Joints of plane frames by castigliano's first theorem and unit load method.

**Thin cylinder and Spheres:** Introduction, stresses and strains in thin cylinders and spherical shell, volumetric change, wire wound thin cylinders, thin vessels subjected to internal pressure.

#### Text Books

1. Strength of Materials by G H Ryder, ELBS publishers
2. Elements of Strength of Materials by Timoshenko & Young, East- West Press, New Delhi
3. Mechanics of Materials by Beer and Johnston, Tata McGraw Hill.
4. Elementary Structural Analysis, Norris & Wilbur, McGraw Hill Publisher
5. Engineering Mechanics Shames

#### Reference Books

1. Strength of Materials by Sadhu Singh, Khanna Publishers
2. Basic Structural Analysis, C.S. Reddy, Tata McGraw Hill Publication.
3. Fundamentals of Solid Mechanics by M L Gambhir, Prentice Hall of India
4. Strength of Materials Ramamurtham and Narayanan, S. Chand & Co.
5. Fundamentals of Structural Analysis B D Nautiyal, New Age Publishers

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE: For examiner for paper setting:-** In semester examinations, examiner is required to set up question paper covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

#### CE 203C: SURVEYING

#### B. Tech. 2<sup>nd</sup> Year (Semester – III)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>:</b>	<b>25 Marks</b>
<b>3</b>	<b>1</b>	<b>--</b>	<b>4</b>	<b>Examination</b>	<b>:</b>	<b>75Marks</b>
				<b>Total</b>	<b>:</b>	<b>100 Marks</b>
				<b>Duration</b>	<b>of :</b>	<b>3 Hours</b>
				<b>Examination</b>		

#### COURSE OUTCOMES:

After completion of course the students will be able to

1. Know different methods and techniques used in surveying and the applications

2. Apply the concept of tachometry and levelling in surveying difficult and hilly terrains to obtain the topographical map of area.
3. To use survey instruments in carrying out survey, collect data, write reports and able to perform required calculations

	PO1	PO2	PO4	PO6	PO7	PO11	PSO1	PSO2	PSO3
CO1	1	3	2	1	1	1	1	3	2
CO2	3	3	1	2	-	1	1	3	1
CO3	3	3	1	-	1	1	1	3	2

#### UNIT - I

**Introduction to Surveying:** Definition, importance, Objectives, History of surveying and mapping, Importance, Maps and maps Numbering systems, Maps, Scale, Principles of survey, Classification of surveys, different techniques of surveying, Chain Surveying: Ranging, Chaining, Offsets, Errors in Chaining, Corrections to length measured with a tape

**Compass surveying & Plane Table Surveying:** Purpose of compass surveying, Comparison of compass surveying and chain surveying, Dip, Magnetic Declination, W.C.B., Q.B., and R.B Introduction to plane table surveying, principle, instruments, working operations, setting up the plane table, centering, leveling, Orientation, methods of plane table survey, danger circle, Lehmann's Rules, errors in plane tabling.

#### UNIT - II

**Leveling:** definitions of terms used in leveling, different types of levels, parallax, staves, adjustments, bench marks, classification of leveling, booking and reducing the levels, rise and fall method, line of collimation method, errors in leveling, permanent adjustments, Two peg test, reciprocal leveling, Corrections to curvature and refraction, cross sections and longitudinal leveling.

**Trigonometric Leveling:** Definitions & terms, curvature & refraction Methods: direct & reciprocal, eye and object correction, coefficient of refraction. **Contours:** Definition, representation of reliefs, horizontal equivalent, contour interval, characteristics of contours, methods of contouring, contour gradient, uses of contour maps.

#### UNIT - III

**Tachometry:** Definitions and terms used in tachometry, angular tachometry with staff vertical and staff inclined, Analytic lens theory, Tachometric field work, tangential method of tachometry, direct reading tachometer.

**Theodolite Traversing:** types of theodolities, measurement of angles, temporary and permanent adjustments, closed & open traverse, consecutive and independent co-ordinates, advantages & disadvantages of traversing closing error, Bowditch, Transit rules.

#### UNIT - IV

**Triangulation:** Triangulation systems, classification, strength of figure, selection of triangulation stations, grade of triangulation, field work of triangulation, triangulation computations, Introduction to EDM, Total Station and its working, survey adjustment and treatment of observation, adjustment of triangulation figures by method of least squares.

**Curves:** Definition, elements of a simple curve, different methods of setting out a simple circular curve, elements of a compound curve, reverse curves, introduction of transition curves, vertical curves and sight distances.

### Text Books

1. Surveying volume 1 and 2 by S.K. Duggal, McGraw Hill Publishers, New Delhi
2. Surveying Vol. I and II by B.C. Punmia, Luxmi Publications, New Delhi
3. Surveying and Levelling by R. Subramanian, Oxford University Press.
4. Plane Surveying by A.M. Chandra, New Age International Publishers

### Reference Books

1. Surveying by N. Singh, Tata McGraw Hill, New Delhi.
2. A Text Book of Surveying by C.Venkataramiah, Universities Press, Hyderabad

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**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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### CE205C: FLUID MECHANICS B. Tech. 2<sup>nd</sup> Year (Semester – III)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>:</b>	<b>25 Marks</b>
<b>3</b>	<b>1</b>	<b>--</b>	<b>4</b>	<b>Examination</b>	<b>:</b>	<b>75Marks</b>
				<b>Total</b>	<b>:</b>	<b>100 Marks</b>
				<b>Duration</b>	<b>of</b>	<b>: 3 Hours</b>
				<b>Examination</b>		

### COURSE OUTCOMES:

After completion of the course the students are able to -

1. Know the details of various types of flow and fluids properties.
2. Familiar with pressure measurements and flow measuring devices.
3. Apply the concept of stability of floating and submerged body.
4. Solve various problems related to fluid dynamics equations and types of losses in pipes.
5. Apply of concept of drag, lift and buoyancy on a fluid in real life.

	PO1	PO2	PO4	PO6	PO7	PO9	PO11	PSO1	PSO2	PSO3
CO1	-	-	3	-	1	-	1	-	2	1
CO2	3	3	1	2	1	-	1	1	3	1
CO3	3	3	2	2	-	-	1	1	2	1
CO4	2	2	3	2	-	1	-	1	3	2
CO5	2	2	2	2	1	1	1	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: no correlation

## UNIT - I

**Scope & development of Fluid Mechanics Fluid properties** – Density, Specific weight, Viscosity, Kinematic and Dynamic viscosity, Surface tension, Compressibility, Newtonian and Non Newtonian fluids, Types of fluids, capillary action. Kinematics of fluid motion, Classification of flow:, Continuity equations in Cartesian coordinates, Velocity Potential, Stream Function and Flow nets. Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number.

## UNIT - II

**Fluid statics** – Absolute and Gauge pressure, Measurement of pressure, Mechanical gauges, Barometers, Piezometers, Simple and Differential manometer, Inclined manometer, and Micro manometer. Hydrostatic forces on plane horizontal, Vertical and Inclined surfaces, Curved surface. Buoyant force, Archimedes principle, Metacentric height, Theoretical and Experimental determination of metacentric height. Stability of floating and submerged bodies, Dimensional Analysis and Dynamic Similitude, Buckingham's  $\pi$ -Theorem.

## UNIT - III

**Fluid dynamics and pipe flows** – Euler's equation of motion, Bernoulli's equation and its limitations, Momentum equation, Energy and Momentum correction factors, Energy losses in pipe flows, Darcy-Weisbach equation, Estimation of friction factor, Loss at sudden expansion, contraction and bends, Pipe flow computations, Hydraulic gradient and total energy lines, Pipes in series and parallel. Flow measuring devices: Venturimeter and Orifice meters, etc.

## UNIT - IV

**Laminar flow**- Navier stokes equation of motion (no derivation), Laminar flow through pipes, parallel plates, Couette flow, Flow past a sphere, Stokes law.

**Boundary layer Theory**- development of boundary layer on a flat surface, boundary layer thickness, laminar and turbulent boundary layers, separation of boundary layer and methods for prevention.

**Drag and Lift** – Definitions, Pressure drag and Friction drag, Stream line and Bluff bodies, Total drag, Drag at different Reynolds numbers, Profile drag. Drag characteristics of two dimensional bodies, Circulation, Lift and Magnus effect, Lift characteristics.

### Text Books:

1. R. J. Garde and Mirajgaonkar, "Engineering Fluid Mechanics", Nem Chand & Brothers, Roorkee.
2. K L Kumar, "Engineering Fluid Mechanics", Eurasia Publishing House.
3. R.K. Bansal, "Fluid Mechanics and Hydraulic Machine", LaxmiPublications(P) Ltd. New Delhi.

### Reference Book

1. H. Schlichting, "Boundary Layer Theory", McGraw Hill Publishing Company, New York.
2. Fox R. W. and McDonald, A T, "Introduction to Fluid Mechanics", John Wiley Wilson
3. Fluid Mechanics Through Problems, R J Garde, Nem Chand & Brothers, Roorkee
4. Hydraulics and Fluid Mechanics, P N Modi & S M Seth
5. Streeter, V L and Benjamin, W E , "Fluid Mechanics", McGraw Hill.

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**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or

other electrical/ electronic items are allowed in the examination.

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## CE 207C: BUILDING CONSTRUCTION AND MATERIALS

### B. Tech. 2nd Year (Semester – III)

**L    T    P    Credits**  
**3    --    2    4**

**Class Work                    : 25 Marks**  
**Examination                 : 75Marks**  
**Total                            : 100 Marks**  
**Duration                      of : 3 Hours**  
**Examination**

### Course Outcomes :

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

CO1	Develop the conceptual knowledge in building material and masonry.
CO2	Select appropriate material like cement, steel stones etc. in given field situation.
CO3	Develop awareness about latest building materials.
CO4	Understand the importance of drawings in Civil Engineering and will be able to draw the drawings of various structural and non-structural members.

### Prepare CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	2	2	2	2	2	2	2	3	2
CO2	2	1	2	2	2	3	2	2	2	1	2	2	3	2
CO3	2	2	2	2	2	2	2	-	1	1	1	2	3	2
CO4	2	2	2	1	2	1	-	1	2	2	2	2	3	2

#### UNIT - I

**Bricks:** Composition of good brick earth, harmful ingredient, manufacture of bricks, characteristics of good bricks, testing of bricks, classification of bricks as per IS 1077-1985.

**Rocks and Stones:** Classification of rocks, test for stones, characteristics of a good building stone, deterioration of stones, common building stones of India, comparison of the brick work and stone work.

**Timber:** Classification and identification of timber, defects in timber, characteristics of good timber, seasoning of timber and its methods, preservation of timber,

#### UNIT - II

**Cement:** Types, Manufacture, basic properties of cement compounds, grades, packing, storage, quality control and curing, additives, special cements, all testing as per IS.

**Steel:** Manufacture of steel, market forms of steel e.g. mild steel and HYSD steel bars, rolled steel sections, stainless steel mortars

**Aggregates:** Classification of Aggregates, Characteristics of Aggregate, Deleterious Materials and Organic Impurities, Soundness, Alkali-Aggregate Reaction, Thermal Properties of Aggregate, Fine Aggregate, Coarse Aggregate, Broken Brick Coarse Aggregate, Testing of Aggregates

#### UNIT - III

**Masonry,** stone masonry, basic terms, materials for stone masonry, classification, dressing of stones, joints in stone masonry, Brick Masonry, laying tools, basic terms, bonding of bricks, tools, inspection of brickwork, strength of brick work, Cavity walls, features, wall ties, construction of cavity wall, Lintels.

**Construction equipment's:** Modern equipment's used in the construction of multi storey buildings and bridges

#### UNIT - IV

**Earthwork, Damp proof course:** Points of its requirement in buildings, D.P.C. at Plinth level, in basement and roof tops etc., Basement & Retaining walls. Drawings.

**Foundation** types and suitability, spread, arch, combined, cantilevered, Raft, Grillage, Piles & wells, Footings in block cotton soil, IS Specifications and drawings.

**Stairs & Stair cases:** Suitability of location, stairs in multi-storeyed buildings, Residential and public buildings, dimensions, Requirements, classification, types of stairs, Lift & escalators, drawings.

**Text Books**

1. Building Materials by P C Varghese, PHI.
2. Engineering Materials, by S.C. Rangawala, Charotar Publishing House, Anand.
3. Building Construction by Sushil Kumar, Standard Publisher and Distributors.
4. Building Construction by B. C. Punima, Laxmi Publisher House

**Reference Books**

1. Engineering Materials, by Sushil Kumar, Metropolitan Press
2. Engineering Materials by N.C. Choudhary, Technical Publishers.
3. Materials Science, J.C. Anderson & KDB Lever, ELBS fifth Edn., 2004.
4. Indian Practical Civil Engg. Handbook, P N Khanna, Engineers Publishers, 2000.
5. National Building Code, B. I. S.

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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**CE 209C: STRENGTH OF MATERIALS LAB**

**B. Tech. 2<sup>nd</sup> Year (Semester – III)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>:</b>	<b>25 Marks</b>
--	--	2	1	<b>Examination</b>	<b>:</b>	<b>75Marks</b>
				<b>Total</b>	<b>:</b>	<b>100 Marks</b>
				<b>Duration</b>	<b>of</b>	<b>3 Hours</b>
				<b>Examination</b>		

**Course Outcomes :**

At the end of the course, the student will be able to: **A student will be able to achieve the followings if he undergoes through this laboratory course**

CO1	Testing materials' properties
CO2	Suitability of structural steel
CO3	Understand flexural and torsional behavior

**Prepare CO-PO/PSO Articulation Matrix, e.g.:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	1	2	1	1	-	1	-	2	3	2
CO2	2	1	2	1	1	-	1	2	1	1	2	3	2
CO3	3	2	2	1	-	1	1	-	2	2	2	3	3

**List of Experiments:**

1. To determine Rockwell hardness number of the specimen of steel/soft metal.
2. To determine Brinnel hardness number of the specimen of steel/soft metal.
3. To determine Vickers hardness number of the specimen of steel/soft metal.
4. To study the behavior of ductile material under tension on Universal Testing Machine
5. To study the behavior of brittle material under tension on Universal Testing machine
6. To study the behavior of brittle material under compression on Universal Testing machine
7. To determine the modulus of rigidity of brass bar on torsion testing machine
8. To determine the impact strength of M.S./C.I. specimen on Izod impact testing machine.
9. To determine the impact strength of M.S./C.I. specimen on Charpy impact testing machine.
10. To determine Young's modulus of the material of a beam simply supported at the ends and carrying a concentrated load at the center.

**Note:** Seven experiments are to be performed from the above list. Remaining three experiments should be performed as designed & set by the concerned Institution as per the scope of the syllabus.

**CE211C: SURVEYING LAB**  
**B. Tech. 2nd Year (Semester – III)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>		<b>Class Work</b>	<b>: 25 Marks</b>
--	--	2	1		<b>Examination</b>	<b>: 75 Marks</b>
					<b>Total</b>	<b>: 100Marks</b>
					<b>Duration</b>	<b>of : 3 Hours</b>
					<b>Examination</b>	

**Course outcomes:** On completion of the course, the students will be able to:

1. use conventional surveying tools such as chain/tape, compass, plane table, level in the field of civil engineering applications such as structural plotting and highway profiling
2. apply the procedures involved in field work using advanced surveying equipment and to work as a surveying team
3. take accurate measurements, field booking, plotting and adjustment of errors can be understood

	PO1	PO2	PO4	PO9	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	2	1
CO2	1	3	1	-	-	3	1
CO3	3	3	2	1	1	2	1

1: Slight (Low)    2: Moderate (Medium)    3: Substantial (High)    “-”: no correlation

## List of Experiments

1. Chain Survey of an area
2. Leveling Exercises.
3. Measurement of vertical and horizontal angles with Theodolite.
4. Tachometric Survey
5. Tachometric Constants.
6. Two point / three point problem.
7. Plane table survey of an area.
8. Setting out a simple circular curve by different methods.
9. Setting out transition curve.
10. Measurements with Total Station.

Note: Ten experiments are to be performed in the Semester taking atleast 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.

### CE213C: FLUID MECHANICS LAB B. Tech. 2<sup>nd</sup> Year (Semester – III)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
--	--	2	1	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration</b>	<b>of : 3 Hours</b>
				<b>Examination</b>	

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LABORATORY OUTCOMES: upon successful completion of this course, it is expected that students will be able to:

1. Understand the flow calculation through orifice meter and venturimeter
2. Understand the application of Bernoulli equation
3. Use appropriate type of flow measuring devices.
4. Know various types of losses in pipe flow

	PO1	PO2	PO4	PO6	PO7	PO9	PSO2	PSO3
--	-----	-----	-----	-----	-----	-----	------	------

CO1	1	2	-	2	1	2	2	1
CO2	1	2	1	-	1	-	1	2
CO3	3	1	2	2	1	1	1	-
CO4	2	2	2	2	-	1	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: no correlation

### List of Experiments

1. Verification of Bernoulli’s Theorem.
2. Calibration of Venturimeter.
3. Calibration of an orifice meter.
4. Determination of Coefficients of Contraction, Velocity and Discharge of a circular orifice.
5. Determination of friction factor for pipes.
6. Visualization of laminar and turbulent flow and estimating critical Reynold’s number.
7. Determination of metacentric height of a ship model.
8. To measure the velocity distribution over a flat surface in a wind tunnel and to determine the Reynold’s no. and boundary layer thickness along the plate.
9. To measure the pressure distribution around a cylinder in a wind tunnel and to calculate the coefficient of drag at different Reynold’s number.

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

### CE 202C: STRUCTURAL ANALYSIS I

#### B. Tech. 2nd Year (Semester – IV)

**L T P Credits**  
**3 1 -- 4**

**Class Work : 25 Marks**  
**Examination : 75Marks**  
**Total : 100Marks**  
**Duration of : 3 Hours**  
**Examination**

### Course Outcomes :

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

CO1	Identify the method of analysis for determinate and indeterminate structures.
CO2	Understand the importance of various methods for analyzing the different structural members.
CO3	Use of influence line diagram to solve various structural problems.
CO4	Understand the concept of Cables and suspension Bridges with different support conditions.

### Prepare CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO3	PO4	PO6	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	1	3	1	1	2	1	2	2	3	2
CO2	3	3	2	2	1	1	2	1	2	2	3	2
CO3	2	2	3	3	1	1	2	1	2	2	3	2
CO4	2	2	2	3	1	2	2	2	2	2	3	2

## UNIT I

**Analysis of Dams, chimneys and Retaining Walls:** Introduction, limit of eccentricity for no tension in the section, core of the section, middle third rule, wind pressure on chimneys.

**Analysis of Indeterminate Structures:** Degree of static and kinematic indeterminacies, analysis of indeterminate beams, pin jointed frames, rigid frames and trusses by method of consistent deformation, effect of lack of fit, temperature, method of least work, induced reactions on statically indeterminate beams, pin jointed frames, rigid frames and trusses due to yielding of supports, Analysis of two hinged and fixed arches.

## UNIT II

**Fixed and Continuous Beams:** Analysis of fixed beams, continuous beams and propped cantilevers by moment-area theorem and strain energy method, fixed end moments due to different types of loadings, effects of sinking and rotation of supports, bending moment and shear force diagrams for fixed beams and propped cantilevers, slope and deflection of fixed beams, analysis of continuous beams by the three moment theorem (Clapeyron's theorem) due to different types of loadings.

## UNIT III

**Rolling Loads:** Introduction to rolling loads and influence lines, Determination of shear force, bending moment at a section and absolute shear force and bending moment due to single point load, uniformly distributed load, several point loads etc.

**Influence Lines:** Construction of Influence lines for reaction, shear forces and bending moment for simply supported, overhanging and compound beams, influence lines for girders with floor beams, Influence lines for forces in members of frames.

## UNIT IV

**Arches:** Introduction, Analysis of two hinged, two hinged and fixed arches, spandrel braced arches, Influence lines for horizontal thrust, shear force and bending moment for three hinged and two hinged arches.

**Cables and suspension Bridges:** Introduction, shape of a loaded cable, cable carrying point loads and UDL, cables with ends at different level, cable subjected to temperature stresses, suspension bridge with two hinged and three hinged stiffening girders, influence lines.

### Text Books

1. Elementary Structural Analysis, Norris & Wilbur, McGraw Hill Publisher,
2. Basic Structural Analysis, C.S. Reddy, Tata McGraw Hill Publication.
3. C K WANG, " Intermediate Structural Analysis" McGraw Hill Publisher

### Reference Books

1. Structural Analysis (A unified approach), D.S. Parkash Rao, University Press.
2. Theory of structures, Punmia and Jain, Luxmi Publications.
3. Structural Analysis Thandvamoorthy TS Oxford University Press
4. Structural Analysis Devdas Menon Narosa Publishing House

**NOTE: 1.** For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.** The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE: For examiner for paper setting:-** In semester examinations, examiner is required to set up question paper covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

## CE204C : OPEN CHANNEL FLOW

B. Tech. 2nd Year (Semester – IV)

**L T P Credits**  
**3 1 -- 4**

**Class Work : 25 Marks**  
**Examination : 75Marks**  
**Total : 100 Marks**  
**Duration of : 3 Hours**  
**Examination**

---

### COURSE OUTCOMES:

Students after studying this course will be able to -

1. Understand flow patterns through channels.
2. Measure the flow through channels, gates and spillways.
3. Understand the hydraulic jump pattern and its applications.
4. Select and utilize hydraulic machine correctly according to the circumstances.
5. Know the details and importance of various hydraulic machines.

	PO1	PO2	PO4	PO6	PO7	PO9	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	2	1	-	1	-	2	2	1	2	1
CO2	3	1	-	1	2	2	1	-	3	3	1
CO3	1	2	2	2	1	2	1	2	1	2	2
CO4	2	1	1	2	2	1	2	-	-	1	2
CO5	1	1	2	1	-	2	3	1	3	1	2

#### Unit I

Flow in Open Channels: Difference between pipe flow and channel flow, Types of channels, Classification of flows, Sub Critical and Supercritical Flows, Velocity distribution in channel.

Flow Measurement: Flow over notches and weirs, Pitot tube floats and current meters for velocity measurement, Flow over Spillways, Sluice gates, Freeoverflow flow.

#### Unit II

Unsteady flow and Hydraulic jump: Froude number and types of hydraulic jump, Applications Jumps in channels. Unsteady flow equation, Pre jump and post jump depths, length of Hydraulic Jump and energy dissipation, Surges.

Concepts of Specific energy and specific Force: Specific energy and specific curve, Momentum Equation in open channels, Specific force & specific force curve Critical depth and its computation.

#### Unit III

Gradually Varied Flow: Channel transitions, Non-uniform flow in open channels, Dynamic equation for GVF, Water surface profiles in channels of different slopes GVF flow computations. Design of Channels, Most efficient channel sections.

#### Unit IV

Pumps and Turbines: 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.

**Text Books:**

1. K.G. Ranga Raju, “Flow Through Open Channels”, Tata McGraw Hill, New Delhi.
2. F. M. Hendersen, “Open Channel Flow”, McMillan, New York.

**Reference Books:**

1. K. Subramanya, “Flow in Open Channels”, Tata McGraw Hill, New Delhi.
2. R. H. French, “Open-Channel Hydraulics”, McGraw Hill Publishing Company, New York.

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE:** For examiner for paper setting:- In semester examinations, examiner is required to set up question paper covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

**CE206C: GEOMATICS ENGINEERING**

**B. Tech. 3<sup>rd</sup> Year (Semester – IV)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>:</b>	<b>25 Marks</b>
<b>3</b>	<b>-</b>	<b>--</b>	<b>3</b>	<b>Examination</b>	<b>:</b>	<b>75Marks</b>
				<b>Total</b>	<b>:</b>	<b>100</b>
						<b>Marks</b>
				<b>Duration</b>	<b>of</b>	<b>3 Hours</b>
				<b>Examination</b>		

**COURSE OUTCOMES:**

On completion of the course, the students will be able to:

1. Understand basics of advanced surveying techniques in different fields of civil engineering
2. Know the basics interaction of EMR
3. Be familiar with the data processes and analysis of RS Data
4. Figure out the use of Photogrammetry in surveying

	PO1	PO2	PO4	PO6	PO7	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	1	1	1	-	2	1
CO2	1	3	1	2	1	1	1	3	1
CO3	2	3	2	1	-	1	1	2	1
CO4	2	2	3	2	2	-	1	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: no correlation

**UNIT – I**

**Introduction to Geomatic Engineering, GIS, GPS, DEM, DTED, Large scale mapping, small scale mapping, Components of GIS, Application of GIS in civil engineering**

**Remote Sensing, Fundamentals, EMS, RS System, Active and Passive radiation – Electromagnetic Radiation – Nomenclature, Reflectance, Transmission and Absorption, Thermal Emission – Plank’s formula, Stefan – Boltzman Law, Wein’s Displacement Law; Emissivity – Kirchoff’s Law, Characteristics of Solar Radiant Energy, Application of remote sensing to various engineering fields**

## UNIT – II

**Interaction of EMR with Atmosphere** – Scattering, Refraction, Absorption, Transmission. Atmospheric Windows.

**Interaction of EMR with Earth Surface** – Spectral Reflectance Curves. Interaction of earth surface with EM radiation in visible, NIR, TIR and Microwave regions. Idealised & Real sequence of remote sensing.

## UNIT – III

**Sensors and Platforms:** Platforms, Orbital characteristics, Storage and Retrieval of data. IRS satellite systems – Introduction, Stages of development, Sensors, Types of scanning system

**Data Processing:** Initial data statistics. Pre-processing – Atmospheric, Radiometric and Geometric corrections, Image Histogram, Classification of images

## UNIT – IV

**Data analysis:** Image Interpretation Elements, Keys and Aids. Basic Instrumentation. Visual analysis of data

**Photogrammetry:** Aerial and terrestrial, applications, types and geometry of aerial photograph, flight planning, relief displacement, Stereoscopy, photogrammetric mapping, Mosaics

### Text Books

1. Geomatic Engineering, Manoj K Arora, RC Badjatiya, Nem Chand & Bros.
2. Remote Sensing and Image Interpretation, by Lillisand, T.M. & Kiefer R.W., John Wiley and Sons.
3. Introduction to Remote Sensing, by Campbell, J.B. Taylor and Francis.
4. Principles of Geographic information systems, Burrough, P.A and MacDonnel, R.a , Oxford University press
5. Concepts and Techniques of GIS, C.P.Lo, Albert K.W. Yeung, PHI

### Reference Books

1. Digital Remote Sensing, by Nag. P. & Kudrat, M. Concept Publication Company.
2. Remote Sensing and Photogrammetry – Principles and Applications, by Jhanwar, M.L. and Chouhan, T.S. VigyanPrakashan, Jodhpur.

**NOTE: 1.** For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.** The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE:** For examiner for paper setting:- In semester examinations, examiner is required to set up question paper covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

## CE208C: TRANSPORTATION ENGINEERING – I

### B. Tech. 2nd Year (Semester – IV)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>3</b>	<b>1</b>	<b>--</b>	<b>4</b>

**Class Work : 25 Marks**

**Examination : 75 Marks**

**Total : 100 Marks**

**Duration of Examination: 3 Hours**

### COURSE OUTCOMES:

After completion of this course students will be able to

1. Develop skills of highway material testing and carryout construction and maintenance procedures.
2. Design road geometrics for various types of highways.
3. Design rigid and flexible pavements.
4. Conduct various traffic engineering studies and design traffic facilities.

**CO-PO/PSO Articulation Matrix, e.g.:**

	PO1	PO2	PO4	PO6	PO7	PO8	PO9	PO11	PSO1	PSO2	PSO3
CO1	-	-	3	1	1	1	-	1	1	3	2
CO2	3	3	-	1	-	-	-	1	1	3	-
CO3	3	3	-	-	1	2	-	1	1	3	-
CO4	2	2	3	2	1	-	1	1	1	3	-

1: Slight (Low)    2: Moderate (Medium)    3: Substantial (High)    “-”: no correlation

**UNIT – I**

Highways development Planning: Introduction, Different modes of transport, Development of Transport System, Phased development of Roads in India. Highway Surveys & Alignment, Design, Drawings, Estimates & Project Report.

Highway materials and testing: sub grade, sub base and base course materials, bituminous materials, testing of soil, aggregate and bitumen.

**UNIT – II**

Geometric Design of Highways: Introduction, Highways Classification, Right of way, Land width, width of formation, width of pavement, Sight Distances, camber, horizontal and vertical Road Curves, Transition Curves.

Design of Pavements: Types of pavements, Factors affecting design of pavements, wheel load factor, Climatic Factors, Structure of Flexible pavement, Function of various components of Flexible pavement, design of flexible pavements by G.I. & CBR methods, stresses in rigid pavements, design of rigid pavements by IRC method.

**UNIT – III**

Traffic Studies: Road user characteristics, Importance of traffic studies, spot speed, speed and delay and origin and destination studies. Vehicular flow models. Stream variables: Spacing and concentration, headway and flow, mean speed. Time distance diagram of flow. Traffic operations and control devices, intelligent transport systems.

Road Safety Audits: Road Safety Audits: Safety concerns in highway projects, Systems approach, various stages of Safety Audit, Preparation of Audit Reports.

**UNIT – IV**

Highway construction: road types--earth roads, gravel roads, WBM/WMM/BBM base courses, GSB, surface treatments, premix carpet, mastic asphalt, DBM, bituminous concrete and cement concrete roads. Construction methods of bituminous and cement concrete roads, Modern Construction Equipments: earthwork, roadwork and lifting equipments: Excavators, Loaders, Dozers, Graders and scrappers; Milling Machine, Modern Paver, Compactor; Tower Crane, Tractor Crane.

Maintenance: Introduction, Maintenance of Earth, gravel, WBM, GSB, WMM Roads, Bituminous Roads, Maintenance of berms, Side Slopes, Pavement edge and draining work. Failures of flexible and rigid pavements: Maintenance, evaluation and its strengthening.

**Text Books**

1. Highway Engineering by Khanna and Justo, Nem Chand & Brothers, Roorkee
2. Highway Engineering by L.R. Kadyali, Nem Chand & Brothers, Roorkee

**Reference Books**

1. Highway Engineering by Oglesby and Hews
2. Transportation Engineering by G.V. Rao, Tata McGraw Hill Publisher, New Delhi
3. Principles of Pavement Design by E.J. Yodder
4. Traffic Engineering by Matson,Smith&Hurd

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE: For examiner for paper setting:-** In semester examinations, examiner is required to set up question paper covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

**CE210C: STRUCTURAL ANALYSIS-I LAB**

B. Tech. 2<sup>nd</sup> Year (Semester - IV)

L	T	P	Credits	Class Work	: 25 Marks
--	--	2	1	Examination	: 75 Marks
				Total	: 100 Marks
				Duration of Examination	: 3 Hours

**Course Outcomes :**

At the end of the course, the student will be able to: A student will be able to achieve the followings if he undergoes through this laboratory course

CO1	Knowledge of theorems and experiments.
CO2	understand analytical and practical behavior of the members.
CO3	understand computer applications for programming.

**Prepare CO-PO/PSO Articulation Matrix, e.g.:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	1	2	1	2	2	3	2
CO2	3	3	1	2	1	1	1	1	1	2	3	2
CO3	2	2	1	1	3	1	1	2	1	2	3	2

**List of Experiments:**

1. To verify Betti’s Law
2. To determine the flexural rigidity (EI) of a given beam.
3. To verify Moment-Area Theorems for slope and deflection of a beam.
4. To study the behavior of different types of struts.

5. To determine the elastic displacement of curved members.
6. To determine the horizontal displacement of the roller end in a curved beam.
7. To make computer programs for theoretical verification of the above experiments.

**Text Books:**

Experimental Methods in Structural Mechanics Kukreja C B and Sastry V V

**Note:**

1. Seven experiments are to be performed in the Semester.

**CE212C: OPEN CHANNEL FLOW LAB**  
**B. Tech. 2<sup>nd</sup>Year (Semester - IV)**

L	T	P	Credits			
--	--	2	1	<b>Class Work</b>	:	<b>25 Marks</b>
				<b>Examination</b>	:	<b>75 Marks</b>
				<b>Total</b>	:	<b>100 Marks</b>
				<b>Duration of Examination</b>	:	<b>3 Hours</b>

**Outcomes—**

Students will be able to-

1. Perform various applications of Froude no.
2. Determine the open channel flow pattern.
3. Know about calibration of venturimeter, current meter etc.
4. Effects of various types of roughness coefficients in a channel.

	PO1	PO2	PO7	PO11	PSO1	PSO2
CO1	-	2	1	1	-	2
CO2	3	3	1	1	1	3
CO3	3	3	-	1	1	2
CO4	2	2	-	-	1	3

1: Slight (Low)    2: Moderate (Medium)    3: Substantial (High)    “-”: no correlation

**List of Experiments:**

1. To determine Manning’s co-efficient of roughness for the rough bed of a given flume.
2. To measure the velocity distribution in a rectangular channel by Prandtl Pitot tube and to determine the energy correction factors
3. To study the flow through a horizontal contraction in a rectangular open channel.
4. To calibrate a current meter
5. To study the formation of hydraulic jump in a horizontal rectangular open channel (Measurement of Froude no. and energy loss)
6. To study the flow over a hump in a channel bed.
7. To study the pressure distribution along the spillway surface for different heads.
8. To calibrate a broad-crested weir and to study the pressure distribution along its surface.
9. To calibrate a venturi flume.
10. To study the flow under a sluice gate and formation of hydraulic jump at different Froude no.

**Note:** Ten experiments are to be performed in the Semester taking atleast 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.

**CE214C: GEOMATICS ENGINEERING LAB**  
**B. Tech. 2<sup>nd</sup> Year (Semester - IV)**

L	T	P	Credits
--	--	2	1

Class Work	:	25 Marks
Examination	:	75 Marks
Total	:	100 Marks
Duration of Examination	:	3 Hours

### COURSE OUTCOMES:

On completion of the course, the students will be able to:

1. Understand basics of advanced surveying techniques in different fields of civil engineering
2. Know the basics interaction of EMR
3. be familiar with the data processes and analysis of RS Data
4. Figure out the use of Photogrammetry in surveying

	PO1	PO2	PO4	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	1	2	1	3	2
CO2	3	3	2	1	-	1	3	-
CO3	1	1	1	2	1	-	1	2
CO4	2	2	3	1	1	1	3	1

### **List of Experiments**

1. Study of Aerial photographs.
2. Study and image interpretation of remote sensing data.
3. Introduction to CAD/GIS/Image Processing software
4. Study of digital image characteristics such as:
  - DN value,
  - Histogram,
  - Color image generation,
  - Simple Image enhancement,
  - On-screen digitization from images,
  - Area computation,
  - Geo-registration of images etc.

**Note:** The students will perform all above mentioned experiments. However, some more experiments may be performed as designed & set by the concerned Institution as per the scope of the syllabus.

### **CE216C : TRANSPORTATION ENGINEERING-I LAB**

#### **B. Tech. 3<sup>rd</sup> Year (Semester – IV)**

L	T	P	Credits
--	--	2	1

Class Work	:	25 Marks
Examination	:	75 Marks
Total	:	100 Marks
Duration of Examination	of :	3 Hours

### COURSE OUTCOME

After completion of this course students will be able to

1. Learn testing procedure for determination of mechanical properties of highway materials.
2. Perform various traffic studies.
3. Acquire basic ability of Accident Analysis.

### CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO4	PO9
CO1	-	-	3	-
CO2	1	2	3	2
CO3	1	2	3	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: no correlation

### List of Experiments:

- To test toughness of road Aggregates by Impact Test (CO-1 )
- To test hardness of aggregates by Los Angles Abrasion Test (CO-1 )
- To perform Crushing Strength Test on Aggregates (CO-1 )
- To identify grade of bitumen using Penetration Test. (CO-2 )
- To test the ductility of bitumen using Ductility test. (CO-2 )
- To test water absorption and specific gravity of road aggregates using density basket. (CO-1 )
- To find out Softening Point of Bitumen. (CO-2 )
- To find out Flash & fire point of bitumen. (CO-2 )
- To determine spot speed of traffic by radar speedometer and endoscope. (CO-3 )
- To conduct CBR test on samples of subgrade. (CO-3 )
- To perform classified traffic Volume count on a road section. (CO-3 )
- Study of Fir Performa and analysis of data extracted from FIR. (CO-4 )

### GFCE 202C GENERAL FITNESS FOR CIVIL ENGINEERING

#### B. Tech. Semester - IV (Civil Engineering)

L	T	P	Credits	Examination	:	75Marks
-	--	--	-	<b>Total</b>	:	<b>75 Marks</b>

The purpose of this course is to inculcate a sense of professionalism in a student along with personality development in terms of quality such as receiving, responding, temperament, attitude and outlook. The student efforts will be evaluated on the basis of his/ her performance / achievements in different walks of life.

A Faculty Counselor will be attached to a group of students which will remain associated with him /her during the entire period of the degree program in the University. Each faculty member will serve as a faculty counselor. They will act like a local guardian for the students associated with him / her and will help them in terms of career guidance, personal difficulties.

#### A. The student will present a written report before the committee with following in view:

The student will present before the committee his/her achievements during the current academicsession in the form of a written report highlighting followings:

- Academic Performance (10 Marks)
- Extra Curricular Activities / Community Service, Hostel Activities(10 Marks)
- Technical Activities / Industrial, Educational tour (10 Marks)

IV Sports/games

(10 Marks)

A student will support his/her achievement and verbal & communicative skill through presentation before the examiners. (15 Marks)

C. Faculty Counselor Assignment

(20 Marks)

It will be the duty of the student to get evaluated by respective faculty counselor and to submit the counselor assessment marks in a sealed envelope to the committee.

A counselor will assess the student which reflects his/her learning graph including followings:

Discipline throughout the year

Sincerity towards study

How quickly the student assimilates professional value system etc.

**University Departments:**

- |   |                               |          |
|---|-------------------------------|----------|
| 1 | Chairperson of the Department | Chairman |
| 2 | Senior Most Faculty Counselor | Member   |
| 3 | Vice- Chancellor's Nominee    | Member   |

**Affiliated Colleges:**

- |   |   |          |
|---|---|----------|
| 1 | Director/Principal                                  | Chairman |
| 2 | Head of the Department/Sr. Faculty                  | Member   |
| 3 | External Examiner to be appointed by the University | Member   |

**CE301C: DESIGN OF STEEL STRUCTURES I**

B. Tech. 3<sup>rd</sup> Year (Semester - V)

L	T	P	Credits	Class Work	: 25 Marks
3	1	--	4	Examination	: 75Marks
				Total	: 100 Marks
				Duration of Examination	: 3 Hours

USE OF RELEVANT INDIAN STANDARD IS ALLOWED IN THE EXAMINATIONS.

**Course Outcomes :**

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

CO1	Apply the IS codes of practice for the design of steel structural elements.
CO2	Analyze and design the behavior of various connections for both axial and eccentric forces.
CO3	Design of compression and flexural members using simple and built-up sections.
CO4	Analyze and design of column bases, tension members and gantry girder.

**Prepare CO-PO/PSO Articulation Matrix, e.g.:**

	PO1	PO2	PO3	PO4	PO6	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	2	1	1	2	2	1	3
CO2	3	2	2	1	1	1	1	1	-	2	2	2
CO3	3	2	1	2	-	2	2	2	2	2	3	3
CO4	2	1	2	1	1	1	1	1	1	2	2	2

## UNIT I

**Introduction:** Steel as Structural Material, Advantages and disadvantages of steel, Types of sections, Loads and combinations, design approaches – elastic and limit state methods, Indian standards codes.

**Connections:** Importance, various types of connections, Advantages and disadvantages of welded and bolted joints, design of bolted connections, efficiency and design of joints, design of welded connections.

## UNIT II

**Eccentric connections:** Types of eccentric connections, Bolted and welded connections, Load lying in plane of joint, Load lying perpendicular to the plane of joint, Design of bolted and welded connections.

**Tension Members:** Types of failures, gross and net sectional areas, rupture of critical section, strength calculation, block shear failure, slenderness ratio, design of tension members, lug angles and tension splices. Design of tension member subjected to axial and bending.

## UNIT III

**Compression Members:** Types of failures, strength calculation, effective length and slenderness ratio, design of compression member, design of built up compression member, laced and battened columns including the design of lacing and batten plate.

**Flexural Members:** Introduction to flexural members, Design criteria, permissible stresses, laterally supported beams and their design, laterally unsupported beams and their design, Built-up beams, design of purlins.

## UNIT IV

**Column Bases:** Introduction, types of column bases, design of slab base and gusseted base, design of gusseted base subjected to eccentric loading.

**Plate Girders:** Introduction, weight and economic depth, design of flanges, design of web, curtailment of flange plates, intermediate and bearing stiffeners.

### Text Books

1. Design of Steel Structures, Dr. Subramanian Narayanan, oxford publication.
2. Limit state design of Steel Structures, by S K Duggal, Tata McGraw Hill.

### Reference Books

1. Design of Steel Structures, P. Dayaratnam, Wheeler Publishing, New Delhi.
2. Design of Steel Structures, M. Raghupathi, Tata McGraw Hill, New Delhi.

**NOTE: 1.** For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.** The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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## CE303C: STRUCTURAL ANALYSIS - II

### B. Tech. 3<sup>rd</sup> Year (Semester - V)

L	T	P	Credits
3	1	--	4

Class Work	: 25 Marks
Examination	: 75Marks
Total	: 100 Marks
Duration of Examination	: 3 Hours

### Course Outcomes :

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

CO1	Apply the basic concepts of matrix methods in structural analysis.
CO2	Analyze the behavior of beams and frames during uneven support settlements.
CO3	Understand the concept of space frames and its equilibrium conditions
CO4	Identify the different load conditions for analyzing the multistory frames subjected to vertical and lateral loads.

**Prepare CO-PO/PSO Articulation Matrix, e.g.:**

	PO1	PO2	PO3	PO4	PO6	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	1	1	1	2	2	3	2
CO2	3	2	2	2	1	1	2	1	2	2	3	2
CO3	3	3	2	2	1	1	2	2	2	2	3	2
CO4	2	3	2	2	1	1	1	1	1	2	3	2

**UNIT - I**

**Introduction:** Introduction to matrix algebra, systems approach: force and displacement methods and their comparison. Relationship between force method and displacement method, Design examples

**UNIT - II**

**Slope and Deflection Method:** Introduction, slope-deflection equations, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loads and uneven support settlements.

**Moment Distribution Method:** Introduction, absolute and relative stiffness of members, stiffness and carry-over factors, distribution factors, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loads and uneven support settlements, symmetrical beams and frames with symmetrical, skew-symmetrical and general loading.

**UNIT - III**

**Kani's Method:** Introduction, basic concept, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loadings and yielding of supports, symmetrical beams and frames, general case-storey columns unequal in height and bases fixed or hinged.

**Approximate Analysis of Frame:** Vertical and lateral load analysis of multistory frames, portal, cantilever and substitute-frame methods and their comparison.

**UNIT - IV**

**Space Frames:** Introduction, simple space truss, types of supports, equilibrium and stability conditions, analysis of determinate and indeterminate space frames using tension coefficient method.

**PLASTIC ANALYSIS:** Basics of plastic analysis, static and kinematic theorems for plastic analysis of beams and frames.

**REFERENCE BOOKS**

1. Indeterminate Structural Analysis C K Wang Tata McGraw Hill

**TEXTBOOKS :**

1. Basic structural analysis - C.S. Reddy
2. Structural Analysis- Thandvamoorthy TS Oxford University Press
3. Structural Analysis - Devdas Menon Narosa Publishing House

**NOTE: 1.** For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.** The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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## CE 305C: REINFORCED CONCRETE DESIGN - I

### B. Tech. 3<sup>rd</sup> Year (Semester - V)

L	T	P	Credits
3	1	--	4

Class Work	:	25 Marks
Examination	:	75Marks
Total	:	100 Marks
Duration of Examination	:	3 Hours

USE OF RELEVANT INDIAN STANDRAD IS ALLOWED IN THE EXAMINATIONS

#### Course Outcomes :

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

CO1	Understand design philosophies used in the design of RCC.
CO2	Apply Indian Standards codal provisions correctly.
CO3	Design Different types of beams, slabs and footings.
CO4	Design columns subjected to axial loads and also subjected to moment.

#### Prepare CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1	2	1	2	2	2	2	3	2
CO2	2	2	2	2	3	1	-	-	2	1	2	2	3	2
CO3	2	2	3	3	3	1	1	1	2	2	2	1	3	2
CO4	2	2	3	3	3	1	1	2	2	1	2	2	3	2

#### UNIT I

**Working Stress Design Method** :Introduction, Assumptions, derivation of design constants, problems on computation of moment of resistance, determination of stresses, and design of rectangular beams reinforced in tension and compression, flanged beams and slabs.

Design for shear and bond and torsion, Permissible shear strength, maximum shear strength, shear reinforcement and design procedure for shear reinforcement, bond and development length, anchoring and curtailment of bars.

#### UNIT II

**Limit State Design Method** :Introduction, Limit States, Characteristic values, characteristic strength, characteristic loads, design values for materials and loads, factored loads. Limit State of Collapse (Flexure) Types of failures, assumptions for analysis and design of singly reinforced, doubly reinforced sections, and flanged sections. design of singly reinforced, doubly reinforced sections, and flanged sections.

Design of rectangular beam section for torsion, development length, continuation of reinforcement (beyond cut off points). Limit State of Collapse (Compression) Columns and their classification, reinforcement in columns, assumptions, short and long (both tied and helical) columns subjected to axial load, short columns subject to axial, uniaxial and biaxial bending.

#### UNIT III

**Slabs**: Introduction to one way and two-way slabs, Design examples. Advantages of flat slabs, general design considerations, approximate direct design method, design of flat slabs, design examples.

#### UNIT IV

**Foundations**: Isolated footings, Combined footings, rectangular, trapezoidal, strip, strap, raft footings

#### Text Books

1. Reinforced Concrete Design, M.L. Gambhir, Macmillan India Limited, New Delhi
2. Limit State Design of Reinforced Concrete, A.K. Jain, Nem Chand Brothers, Roorkee.
3. Limit State Design, Ram Chandra, Standard Book House, New Delhi

#### Reference Books

1. Reinforced Concrete Design, Pillai & Menon , Tata McGraw Hill Publishers, New Delhi

2. Reinforced Concrete Structures by Paulay and Thomas Park
3. Reinforced Concrete Design by Nilson and Winter
4. Reinforced Concrete Fundamentals Keith by Ferguson

**NOTE: 1.** For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.** The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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### CE307C : CONSTRUCTION ENGINEERING AND MANAGEMENT

#### B. Tech. 4<sup>th</sup> Year (Semester-VII)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>		<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>--</b>	<b>--</b>	<b>3</b>		<b>Examination</b>	<b>: 75 Marks</b>
					<b>Total</b>	<b>: 100 Marks</b>
					<b>Duration of Examination</b>	<b>: 3 hours</b>

#### Course Outcomes:

Students will be able to:

- 1: Do basic planning for a construction project.
- 2: Draw networks and solve using CPM and PERT.
- 3: Perform resource allocation for a project.
- 4: Do project monitoring and control.
- 5: Perform quality assurance and control.

	PO1	PO2	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	3	3	3	3	3	2	3	3	3	3
CO2	2	2	3	2	1	2	2	2	1	3	2	3	3
CO3	2	1	3	3	3	2	3	3	2	3	3	3	3
CO4	2	2	3	3	2	3	3	3	2	3	3	3	3
CO5	3	3	3	2	3	3	2	3	2	3	3	3	3

#### Unit-I

**Basics of Construction-** Unique features of construction, construction projects types and features, phases of a project, agencies involved and their methods of execution;

**Construction project planning-** Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts.

#### Unit-II

**Networks:** basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks.

**PERT-** Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion.

#### Unit-III

**Construction Equipment basics:**Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities

**Planning and organizing construction site and resources-** Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing;

**Funds:** cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothing and leveling. Common Good Practices in Construction

#### Unit-IV

**Project Monitoring & Control-**Supervision, record keeping, periodic progress reports, and periodical progress meetings.Updating of plans: purpose, frequency and methods of updating.Common causes of time and cost overruns and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modeling (BIM) in project management;

**Quality control:** concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.

#### Text/Reference Books:

1. Varghese, P.C., “*Building Construction*”, Prentice Hall India, 2007.
2. *National Building Code*, Bureau of Indian Standards, New Delhi, 2017.
3. Chudley, R., *Construction Technology*, ELBS Publishers, 2007.
4. Peurifoy, R.L. *Construction Planning, Methods and Equipment*, McGraw Hill, 2011
5. Nunnally, S.W. *Construction Methods and Management*, Prentice Hall, 2006
6. Jha, Kumar Neeraj., *Construction Project management, Theory & Practice*, PearsonEducationIndia, 2015
7. Punmia, B.C., Khandelwal, K.K., *Project Planning with PERT and CPM*, LaxmiPublications,2016.

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#### B. Tech. 3<sup>rd</sup> Year (Semester – V)

#### CE309C : GEO-MECHANICS

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>1</b>	<b>--</b>	<b>4</b>	<b>Examination</b>	<b>: 75Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Durationof</b>	<b>: 3 Hours</b>
				<b>Examination</b>	

**Course Outcomes** :After completion of this course the students would be able to:

CO1	Decide the location of various Civil Engineering projects from Geological considerations.
CO2	Understand Process of weathering of rocks and formation of soil, Properties of different types of soils, and their classifications.
CO3	Analyse the stresses at different points (subsurface), under different loading conditions and Determine the Compaction and Consolidation behavior of soil.
CO4	Understand permeability of the soil and its determination and Analyse the Shear Strength of the soil.

**CO-PO/PSO Articulation Matrix :**

	PO1	PO2	PO4	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	3	3	2	2	2	2	2	2	2
CO2	2	3	1	2	1	-	1	1	2	2	-	1
CO3	2	2	2	1	-	-	-	1	1	1	2	1
CO4	2	1	1	1	1	1	1	2	1	2	2	2

**UNIT I**

**Introduction to Engg. Geology:** Importance of Engineering Geology, Geological considerations in the Civil Engineering projects, such as Highways, foundations, dams and reservoirs. Weathering: Agents and effects, Geological works of rivers, wind, glaciers and oceans as agents of erosion, transportation and deposition, resulting features and engineering importance.

**Basic Soil Properties:** Importance of soil mechanics for Civil Engg., Index properties of soils, Phase relationships and their derivations; Sieve & Hydrometer analysis and Particle Size Distribution Curves, Atterberg's limits, Various soil types, Soil map of India, sensitivity, thixotropy. Indian standard and Unified classification systems of soils.

**UNIT II**

**Permeability of soil:** Relevance of permeability in Civil engineering, Darcy's law, Discharge Velocity and Seepage Velocity, Validity of Darcy's Law, Factors affecting permeability, Laboratory and field determination of permeability. Average permeability of layered soils.

**Seepage Analysis:** Types of head, seepage forces, quick sand condition and critical hydraulic gradient. Flow net and its properties, Laplace equation, methods of drawing flow net. Seepage through earth dams, exit gradient and seepage pressures, Determination of Phreatic Line of an earth dam with or without filter, Phenomenon of piping.

**UNIT III**

**Compaction:** Concept of Compaction, Water Content Density relationship, Zero Air Voids Line, Standard Proctor and Modified Proctor test, OMC, Placement Water Content, Field Compaction Control, Factors affecting compaction, Field Compaction Methods, Suitability of various compaction equipment.

**Consolidation:** One dimensional consolidation, Terzaghi's spring analogy of consolidation process, Difference between Primary and Secondary Consolidation, Pressure Void Ratio relationships for the consolidation of laterally confined soil, Normally Consolidated, Over Consolidated and Under consolidated soils, determination of pre-consolidation pressure, Coefficient of Compressibility, Coefficient of Volume Change, Coefficient of Consolidation and its relationship (derivation also) with coefficient of permeability.

**UNIT IV**

**Stresses in Soils:** Boussinesq Equations, its assumptions and Pressure distribution diagrams such as stress isobar or Pressure Bulb, Vertical Pressure distribution on a horizontal plane, Influence Diagram, Vertical pressure distribution on vertical line, Vertical Pressure under a uniformly loaded circular area, Vertical Pressure under Strip load, Vertical Pressure due to a Line Load, Equivalent Point Load Method, Newmark's

Influence Chart.

**Shear Strength:** Concept, Mohr's circle of Stress, Mohr Coulomb Failure Theory, Effective Stress principle, Measurement of Shear strength (Direct Shear Test, Triaxial Shear Test, Unconfined Compression Test, Vane Shear Test), Drainage conditions.

**Text Books:**

1. Basic and Applied Soil mechanics by Gopal Ranjan & A.S.R. Rao, New Age Publisher, New Delhi.
2. Soil Mechanics and Foundations by B. C. Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications, New Delhi.
3. A text book on Soil Mechanics and Foundation Engineering by V.N.S. Murthy, U.B.S. Publisher, New Delhi.
4. Geotechnical Engg. by Parshotham Raj, Tata McGraw Hill, New Delhi.

**Reference Books:**

1. Soil Mechanics by R. F. Craig, Chapman and Hall, U.K.
2. Principles of Soil Mechanics by B.M. Das, PWS and Kent Publisher USA.
3. Geotechnical Engg. by Venkatramaiah, New Age Publisher, New Delhi.
4. Modern Geotechnical Engineering Alam Singh

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**CE311C: TRANSPORTATION ENGINEERING – II**

**B. Tech. 3rd Year (Semester – V)**

**L      T      P      Credits**  
**3      -      --      3**

**Class Work :      25 Marks**

**Examination :      75 Marks**

**Total :      100 Marks**

**Duration of Examination: 3 Hours**

**COURSE OUTCOMES:**

After completion of this course the students will be able to:

1. Design structural and geometric components of permanent way.
2. Design of signaling and interlocking systems.
3. Understand methods of railway tunneling.

**CO-PO/PSO Articulation Matrix**

	PO1	PO2	PO4	PO6	PO7	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	2	-	-	1	1	1	3	-
CO2	2	2	1	2	-	2	1	1	1	3	-
CO3	-	-	1	1	1	-	1	1	1	-	2
CO4	-	-	1	1	-	-	1	1	1	-	2
CO5	3	3	1	2	-	-	1	1	1	3	-

1: Slight (Low)    2: Moderate (Medium)    3: Substantial (High)    “-”: no correlation

**UNIT – I**

Introduction: Role of railways in transportation, historical development of railways.

Permanent way and components: gauges in railway tracks, typical railway track cross-section, coning of wheels, Function of rails, requirement of rails, types of rail sections – comparison of rail types, length of rail, rail wear, rail failures, creep of rails, rail fixtures and fastenings – Fish plates, spikes, bolts, chairs, keys, bearing plates. Sleepers: Functions and requirements of sleepers, classification of sleepers, timber, metal and concrete sleeper, comparison of different types of sleepers, spacing of sleepers and sleeper density. Ballast: Function and requirements of ballast, types, comparison of ballast materials.

#### **UNIT – II**

Geometric design: Vertical and horizontal alignment, horizontal curves, super elevation, equilibrium, cant and cant deficiency, length of transition curve, gradients and grade compensation. Stations and yards, and their classification, Points and crossings: introduction, necessity of points and crossings, turnouts, points and crossings, design of a simple turnout.

#### **UNIT – III**

Track safety, Signaling and Interlocking: objects of signaling, engineering principle of signaling, classification control of train movements, absolute, automatic block system, centralized control system, ATS. Interlocking: definition, necessity and function, methods of interlocking, mechanical devices for interlocking. Traction and tractive resistance, stresses in track, Equipments, Mechanized Maintenance, modern methods of track maintenance, rehabilitation and renewal of track; Track Recording & track Tolerances, Mass Rapid Transport Systems, High Speed Trains, Present & Future, modernization of railway tracks, railway systems in modern era.

#### **UNIT – IV**

Railway tunneling: Necessity/advantage of a tunnel, Classification of Tunnels, Size and shape of a tunnel, Alignment of a Tunnel, Portals and Shafts, , Mucking, Lighting and Ventilation in tunnel, Dust control, Drainage of tunnels, Safety in tunnel construction. Methods of Tunneling in Hard Rock and Soft ground: Cut and cover method, Bored tunnel method, Clay kicking method, Shaft method, Pipe jacking method, Box jacking method, Underwater tunnels.

#### **Text Books**

- 1.Railway Engineering by Arora and Saxena, Dhanpat Rai & Sons, New Delhi
- 2.Railway Engineering by Rangawala, Charotar Publishing House, Anand
- 3.Railway Engineering by M.M. Aggarwal

#### **Notes:**

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**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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**Essence of Indian Traditional Knowledge**  
**HUM 301 C**  
**Mandatory Course**  
**B.Tech. V Semester**  
**(Common for All Branches)**

<b>L</b>	<b>T</b>	<b>P</b>
<b>3</b>	<b>0</b>	<b>0</b>

**External Assessment: 75 Marks**

**Internal Assessment: 25 Marks**

**Total : 100 Marks**

**Duration of Exam: 3 hrs**

**COURSE OBJECTIVE**

- To introduce students to the basics of Indian knowledge traditions and forms
- To impart basic principles of thought process, reasoning and inferencing

**UNIT I**

**Indian Knowledge Traditions and Processes: An Overview**

Vedic Tradition, Epical Tradition, Sutra Tradition, Scholastic Tradition

**UNIT II**

**Vedic and Upanishadic Traditions**

Vedic Mantras: Hymn of Creation, To Vāk

Upanishadic Narratives: The Story of Nachiketa

**UNIT III**

**Epical Insights**

Gyanmarg ( The Yoga of Wisdom)

**UNIT IV**

**Folk Wisdom**

(A) Folk Tales as knowledge: "The Blind Man and an Elephant" #

"The Goat who saved the Priest", "Buried Treasure", "Little Prince, No Father", "Demons in the Desert" ##

"The Story of Meddlesome Monkey", "The Story of the Lion and the Rabbit" "The Story of Three Fishes" "The Story of Dharmabudhi and Papabudhi" ###

(B) Haryanvi Ragini as Moral lesson: Raja Harishchandra

Approved through circulation by Board of UG Studies ( June 18, 2020)  
Approved through circulation by Faculty of Mgt Studies ( June 22, 2020)



Note: Different signs such as # etc. indicate source of the primary texts enlisted in the 'RECOMMENDED READING'

## COURSE LEARNING OUTCOMES

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

- Understand, appreciate and explain Indian traditional knowledge systems
- Relate life and learning with traditional knowledge in present times

## PEDAGOGY

Through lectures, self study, group discussion, Projects and seminar

## RECOMMENDED READING

1. Mitchell, Stephen. *The Bhagavad Gita*. Harmony Books, 2007 ( Ch.4 for UNIT III).
2. Radhakrishnan, S. & Charles A. Moore. eds. *A Source Book in Indian Philosophy*. Princeton UP, 1957 ( "General Introduction: History of Indian Thought" for UNIT I, Ch.1-2 for UNIT II)
3. ###Sharma, Vishnu. *Panchatantra*. Translated by Rohini Chowdhury. Puffin Books.
4. Sharma, Puran Chand. *Pundit Lakhmi Chand Granthavali*. Haryana Sahitya Akademi, 2010.
5. # <https://www.peacecorps.gov/educators/resources/story-blind-men-and-elephant/>
6. ## www. buddhanet.net

## SCHEME OF END SEMESTER THEORY EXAMINATION

1. The duration of the exam will be 3 hours.
2. The Question Paper shall have nine questions.
3. Each question will be of 15 marks.
4. The student is required to attempt five questions in all.
5. Questions no. 1 to 8 will be set in such manners that two questions are set from each unit of the syllabus. A student will have to attempt four questions selecting one question from each unit. Each question will have minimum 2 and maximum 4 parts.
6. Question no. 9 will be compulsory covering the entire syllabus and it will be in the form of short-answer type questions. Compulsory question will have minimum 5 and maximum 8 parts with minimum 1 part from each unit of the syllabus.
7. Marks and Bloom's Level (BL) of each part of the question will be there against each part/question, Following are Bloom's Level:- Bloom's Taxonomy Levels (1-Remembering, 2-Understanding, 3-Applying, 4- Analysing, 5-Evaluating, 6-Creating)



## CE313C: REINFORCED CONCRETE DESIGN-I LAB

### B. Tech. 3<sup>rd</sup> Year (Semester – V)

L	T	P	Credits
-	-	2	1

Class Work	:	25 Marks
Examination	:	75Marks
Total	:	100 Marks
Duration of Examination	:	3Hours

#### Course Outcomes :

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

CO1	Use the software tool Auto Cad.
CO2	Understand the structural drawings of various building components.
CO3	Understand the codal provisions of Indian Standards for detailing.
CO4	Test various types of aggregates and cement

#### Prepare CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO3	PO4	PO5	PO6	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	1	1	1	2	2	3	2
CO2	2	2	2	1	3	1	2	1	1	2	3	2
CO3	2	2	2	2	3	1	1	2	2	2	3	2

#### A. Structural Drawings through AUTOCAD of the followings

1. Reinforced concrete beams
2. Simply supported and cantilever slabs
3. Flat slabs
4. Columns.
5. Footings.

#### B. Testing of cement:

1. Setting time
2. Fineness
3. Specific gravity
4. Compressive strength

#### C. Testing of aggregates:

1. Specific gravity
2. Water absorption
3. Fineness modulus
4. Bulking of fine aggregates

#### D. Testing of Concrete for Strength

Students are required to draw full length sheets on AUTOCAD and perform minimum 10experiments during semester.

### B. Tech. 3<sup>rd</sup> Year (Semester – V) CE315C : GEO-MECHANICS LAB

L	T	P	Credits
		2	1

Class Work	:	25 Marks
Examination	:	75 Marks
Total	:	100 Marks
Durationof Examination	:	3 Hours

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

CO1	Understand variation of Geological features and variation of soil in India, from maps.
CO2	Have clear understanding of Folds and Faults and various other geological features.
CO3	Analyze and Determine various properties of soils and their classification.

CO4	Work with various laboratory equipment and test procedures.
-----	---

**CO-PO/PSO Articulation Matrix :**

	PO1	PO2	PO4	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	2	2	2	2	2	2	1
CO2	2	3	2	2	2	-	2	1	2	2	2	1
CO3	2	2	1	1	2	-	1	1	1	2	1	1
CO4	2	1	2	2	1	1	2	2	2	2	1	1

**List of Experiments:**

1. Study of Geological features, from the maps.
2. Study of Folds, from the models.
3. Study of Faults, from the models.
4. Study of Soil map of India.
5. Determination of water content of soil, by Oven Drying method.
6. Determination of water content of soil, by Pycnometer.
7. Determination of field density and dry unit weight by Core cutter method.
8. Determination of Specific Gravity of soil, by Pycnometer.
9. Determination of field density by Sand replacement method.
10. Grain size Analysis by Mechanical Method.
11. Grain size Analysis by Hydrometer Method.
12. Determination of Liquid Limit.
13. Determination of Plastic Limit.
14. Classification of a given soil sample based on the above determined properties.

**References Books:**

1. Soil Mechanics and Foundations by B. C. Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications, New Delhi.

**Note:** Ten experiments are to be performed in the Semester taking atleast 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.

**CE 317C: Survey Camp**

**B. Tech. 3<sup>rd</sup> Year (Semester - V)**

L	T	P	Credits	Class Work	: 25 Marks
--	--	2	1	Examination	: 75 Marks
				Total	: 100 Marks
				Duration of Examination	: 3 Hours

**Course Outcomes:** This training of survey camp will provide a student

- ii. Knowledge of different components of surveying such as triangulation, topography, mapping
- iii. Utilization of equipment used in surveying

	PO1	PO2	PO3	PO4	PO5	PO9	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	3	1	3	2
CO2	-	1	-	-	3	3	1	3	1

**Survey Camp:** Civil Engineering Surveying Practical Experience is a Two-Three week course between the spring and summer semesters. Each day is about eight hours long and full of hands-on experience with surveying and map preparation. Teams of 4-6 students will work with faculty, practicing surveyors and use their equipment out

in the field. The camp will provide a necessary foundation for any engineer. It will teach them how surveying is applied to engineering projects and what they need to know in order to review survey data. The students will prepare map of an area following various steps like establishment of control points, Triangulation, computations, error adjustment, plotting details on map and contouring .

The students for this course shall be evaluated in 5<sup>th</sup> semester by a Committee consisting of three teachers to be constituted by the Chairperson of the Department.

Teachers associated with evaluation work will be assigned 2 periods per week load.

## CE302C ESTIMATING AND COSTING

### B. Tech. 3<sup>rd</sup> Year (Semester-VI)

L T P Credits  
2 -- 2 3

Class Work : 25 Marks  
Examination : 75 Marks  
Total : 100 Marks  
Duration of Examination : 3 hours

#### Course Outcomes:

Students will be able to:

- 1: Calculate Cash flow using different methods.
- 2: Determine specifications of buildings.
- 3: Calculate quantities and cost of different components of civil engineering structure.
- 4: Understand about tendering.
- 5: Perform Rate analysis of different components of a structure.

#### 1. Prepare CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	3	2	2	3	2	3	2	3	3	3	3
CO2	2	2	-	-	2	3	3	3	2	2	1	3	2	3	3
CO3	3	3	-	-	3	1	1	3	2	3	2	3	3	3	3
CO4	1	1	-	-	3	3	2	3	3	3	2	3	2	3	3
CO5	2	3	-	-	2	2	1	3	2	1	2	3	3	3	3

#### Unit-I

**Cost & Cost Control**–Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cashflows). Business Forecasting – Elementary techniques. Statements – Cash flow, Financial Case Study Method.

**Specifications**-Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures.

#### Unit-II

**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-III

**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 buildup: Material, Labour, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management.

## Unit-IV

**Rate analysis-** Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity.

Introduction to Acts pertaining to- Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights.

### Text/Reference Books:

1. M Chakravarty, Estimating, Costing Specifications & Valuation
2. Joy P K, Handbook of Construction Management, Macmillan
3. B.S. Patil, Building & Engineering Contracts
4. Acts Related to Minimum Wages, Workmen's Compensation, Contract, and Arbitration
5. Typical PWD Rate Analysis documents.
6. UBS Publishers & Distributors, Estimating and Costing in Civil Engineering: Theory and Practice including Specification and Valuations, 2016.
7. Dutta, B.N., Estimating and Costing in Civil Engineering (Theory & Practice), UBS Publishers, 2016

### Practical work will include:

1. Deriving an approximate estimate for a multistoried building by approximate methods.
2. Detailed estimate for the following with the required material survey for the same.
  - a. Ground plus three storied RCC Framed structure building with block work walls
  - b. bridge with minimum 2 spans
  - c. factory building
  - d. road work
  - e. cross drainage work
  - f. Ground plus three storied building with load-bearing walls
  - g. Cost of finishes, MEP works for (f) above
3. Preparation of valuation report in standard Government form.
4. Assignments on rate analysis, specifications and simple estimates.
5. Detailed estimate of minor structure.
6. Preparation of Bar bending schedule.

**NOTE: 1.** For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.** The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE:** For examiner for paper setting:- In semester examinations, examiner is required to set up question paper covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

## CE 304C: DESIGN OF STEEL STRUCTURES II

B. Tech. 3rd Year (Semester - VI)

L      T      P      Credits  
3      1      --      4

Class Work : 25 Marks  
Examination : 75Marks  
Total : 100 Marks  
Duration of Examination :3 Hours

### Course Outcomes :

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

CO1	Design the members using plastic analysis
CO2	Analyze wind forces as per IS codes on various structures
CO3	Analyze and design the various tubular steel structures, roof trusses based on latest Indian standards
CO4	Develop Conceptual knowledge about cold form sections.

### Prepare CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO3	PO4	PO6	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	-	1	1	2	2	2	3
CO2	2	1	2	2	2	1	2	1	1	1	2	3
CO3	3	2	1	1	1	-	2	1	2	1	1	2
CO4	2	1	2	1	1	1	2	1	1	2	2	3

### UNIT I

Elementary Plastic Analysis and Design: Introduction, Scope of plastic analysis, shape factor, mechanisms, plastic collapse, plastic analysis of beams and portal frames, design of beams.

### UNIT II

Design of Steel Stacks: Introduction, various loads to be considered for the design of steel stacks, design of steel stacks including foundation.

Cold formed Sections: Introduction and brief description of various types of cold formed sections.

### UNIT III

Design of round tubular structures - Introduction, sectional properties, permissible stresses, grades of steel tubes, tubular tension members, tubular compression members, tubular flexural members, combined bending and axial stresses.

Tubular Light Poles: calculation for wind loads, design and analysis of tubular street light poles.

Towers: Basic introduction to transmission and telecommunication towers.

### UNIT IV

Roof trusses: Introduction, types, components, design considerations, design of roof trusses.

Water Tank: Analysis and design of rectangular water tank

### Text Books

- 1 Design of Steel Structures, A.S. Arya and J.L. Ajmani, Nem Chand Brothers, Roorkee
- 2 Design of Steel Structures, Ram Chandra, Vol. I & II, Standard Book House
- 3 Design of Steel Structures, P. Dayaratnam, Wheeler Publishing, New Delhi.

### Reference Books

- 1 BIS Codes IS 800:2007, IS 801:1975, IS 875
- 2 Design of Steel Structures, B.C. Punmia, Laxmi Publication, Delhi

**NOTE: 1.** For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.** The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE: For examiner for paper setting:-** In semester examinations, examiner is required to set up question paper covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

### CE 306C: REINFORCED CONCRETE DESIGN II

B. Tech. 3<sup>rd</sup> Year (Semester - VI)

L	T	P	Credits	Class Work	: 25 Marks
3	0	--	3	Examination	: 75Marks
				Total	: 100 Marks
				Duration of Examination	: 4 Hours

USE OF RELEVANT INDIAN STANDARD IS ALLOWED IN THE EXAMINATIONS. ONLY LIMIT STATE DESIGN METHOD IS TO BE USED IN THIS COURSE.

#### Course Outcomes :

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

CO1	Continuous flexural members such as beams and design of stair cases.
CO2	Domes and Curved beams.
CO3	Different types of water tanks.
CO4	Different types of retaining walls with different end conditions.

#### Prepare CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO3	PO4	PO5	PO6	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	3	3	2	1	2	2	2	2	3	2
CO2	2	2	3	3	3	1	1	2	2	1	2	3	2
CO3	2	3	3	2	3	1	1	1	2	2	2	3	2
CO4	2	2	3	2	3	1	1	1	1	1	1	3	2

#### UNIT I

**Continuous Beams:** Basic assumptions, Moment of inertia, settlements, Modification of moments, maximum moments and shear, redistribution of moments for single and multi-span beams, design examples.

**Stair- Cases:** Type of stair-cases, Effective span of stairs, Distribution of loads on different types of stair cases, Design examples.

#### UNIT II

**Water Tanks:** Estimation of Wind and earthquake forces, design requirements, rectangular and cylindrical underground, Intze tanks, design considerations, design examples.

#### UNIT III

**Design of curved beams in plan:** Analysis and Design of curved beams fixed at both ends, ring beams

**Design of Domes:** Meridional and hoop stress in spherical and conical domes.

#### UNIT IV

**Retaining walls:** Design of cantilever and counter fort type retaining walls.

**Introduction to Bridge Engineering:** Definition, components of a bridge, classifications, importance of bridges. Need for investigations, selection of bridge site, I.R.C. loadings.

**Text Books**

1. Reinforced Concrete Structures, P. C. Varghese, Tata McGraw Hill
2. Advanced Reinforced Concrete Structures, P. C. Varghese, Tata McGraw Hill
3. Reinforced Concrete Design, M.L. Gambhir, Macmillan India Ltd., New Delhi
4. Limit State Design of Reinforced Concrete, A.K. Jain, Nem Chand and Bros., Roorkee
5. Behaviour, Analysis and Design of R.C.C. Structural Elements, I.C. Syal and Ummat, A.H. Wheelers, New Delhi
6. Elements of Bridge Engineering, D. Johnson Victor, Oxford and IBH Publishers, New Delhi.

**Reference Books**

1. IS:456 2000
2. IS 3370 2009
3. Plain and Reinforced concrete, Vol. 2, O P Jain and J. Krishna, Nem Chand and Bros., Roorkee
4. Reinforced Concrete Design, S U Pillai and D Menon, Tata McGraw Hill

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE: For examiner for paper setting:-** In semester examinations, examiner is required to set up question paper covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

**CE308C: FOUNDATION ENGINEERING  
B. Tech. 3<sup>rd</sup> Year (Semester – VI)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>0</b>	<b>-</b>	<b>3</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Durationof</b>	<b>: 3 Hours</b>
				<b>Examination</b>	

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

CO1	Analyze and determine earth pressure behind a retaining structure.
CO2	Develop the conceptual knowledge in stability of slopes, Pile Foundations and Cassions and Wells.
CO3	Exercise soil exploration and Analyze and determine the Bearing Capacity of soil.
CO4	Understand Drainage and Dewatering of Soil, Soil Stabilisation Techniques and use of Geotextiles.

**CO-PO/PSO Articulation Matrix :**

	PO1	PO2	PO4	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	2	-	2	-	2	2	2	2	1
CO2	2	3	1	3	-	2	-	1	2	2	2	1
CO3	2	2	2	3	1	-	2	1	1	2	1	1
CO4	2	1	1	3	2	1	2	2	2	2	1	1

## UNIT I

**Introduction to soil exploration:** Scope, Methods of soil exploration, spacing, significant depth, boring and sampling techniques, types of samples, sample disturbances, penetration tests (Standard Cone Penetration Test and Standard Penetration Test), and Geophysical methods (Seismic Refraction Method & Electrical Resistivity Method).

**Earth Pressure:** Earth Pressures at rest condition, states of plastic equilibrium, Rankine's theory for active and passive conditions, Influence of surcharge, water table, wall friction, Numerical Problems for the determination of Active and Passive Earth Pressure diagrams, Critical height of an Unsupported Vertical Cut.

## UNIT II

**Stability of Slopes:** Infinite slopes, Critical Depth of a cohesive Infinite Slope, types of failure, Swedish Slip Circle Method, Taylor's stability Number and Stability Curves, Concept of factors of safety, Bishop's Method of slices, Effect of sudden draw down and submergence.

**Design of Shallow Foundation:** Bearing Capacity, Definitions, depth of foundation, Terzaghi's general bearing capacity equation, IS code equation, factors affecting bearing capacity. Bearing capacity by penetration tests, Plate load test.

Design Criteria for Shallow Foundations, Stability, Shear, and Settlement Failures.

## UNIT III

**Pile Foundations:** Types, function, selection of piles, pile driving formulae, point, bearing and friction piles. Load carrying capacity of single pile, group action, spacing of piles, Negative skin friction, Concept of under reamed piles.

**Caissons and Wells:** Introduction, components, shapes, stability of well foundation, sinking of well, tilts and shifts.

## UNIT IV

**Drainage and Dewatering of Soil:** Methods of Ditches and Sump, Well Point System, Shallow Well System, Deep Well Drainage, Vacuum Method, Electro Osmosis Method, Seepage Analysis for various conditions of Fully penetrating slot and partially penetrating slot, Protective Filters.

**Soil stabilization and Geotextiles:** Need and advantages of Ground Improvement techniques, Stabilisation (Mechanical, Lime, Cement, bitumen, Chemical) of Soils and its advantages, Geotextiles (Concept, Types, Functions, Use of Geotextiles in Earth Dam Construction, Road Works, Railway works, Erosion Control and in Bearing capacity Improvement.

### Text Books:

1. Basic and Applied Soil Mechanics, by Gopal Ranjan Rao, ASR Rao, New Age Int. (P) Ltd. Pub., New Delhi.
2. Soil Mechanics and Foundations by B. C. Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications, New Delhi.
3. Soils and Foundations, by Cheng Liu & Jack B Evett, Prentice-Hall Inc., USA.
4. A Text Book of Soil Mechanics Foundation Engg. by VNS Murthy – U.B.S, New Delhi.
5. Modern Geotechnical Engineering Alam Singh.

### References Books:

1. Foundation Analysis and Design, by J.E. Bowles McGraw Hill Book Company, New York.
2. Foundation Engineering by Peck, Wiley Eastern India Limited, New Delhi.
3. Soil Mechanics & Foundation Engineering, by K.R. Arora, Standard Publishers, New Delhi.
4. Soil Dynamics and Machine Foundations by Swami Saran, Galgotia Publishers, New Delhi.

**NOTE: 1.** For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.** The students will be allowed to use non-programmable scientific calculator. However, sharing / exchange of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE: For examiner for paper setting:-** In semester examinations, examiner is required to set up question paper covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

# CE 310C: ENVIRONMENTAL ENGINEERING – 1

## B. Tech. 3<sup>rd</sup> Year (Semester – VI)

**L T P Credits**  
**3 0 -- 3**

**Class Work : 25 Marks**  
**Examination : 75Marks**  
**Total : 100 Marks**  
**Duration of Exam. : 3 Hours**

### 1. Course outcomes:

Upon successful completion of the course students will be able to

CO1	Evaluate water sources, water quality and transportation of water.
CO2	Determine water quality parameters and design of water treatment units.
CO3	Calculate the water capacity reservoirs, water supply network design and treatment of water.
CO4	Understand the selection criteria of pumps and water fixtures in buildings.

### 3. Prepare CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO3	PO4	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	3	2	3	3	3	3	3	3
CO2	3	2	3	3	3	3	3	3	3	3	3	3	3
CO3	2	3	3	3	3	3	2	3	3	2	3	3	3
CO4	1	1	3	1	3	3	2	3	3	3	3	3	3

### Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put “-”

### 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;

**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 – III

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

**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.

### Text 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.

### References Books

1. Environmental Engineering Peavy, Rowe and Tchobanglous, McGraw Hill.
2. Water and Waste Water Engineering (Vol. 1&2), Fair, Geyer & Okun, John Wiley, New York.
3. Water Supply Engineering P.N. Modi, Standard Book House New-Delhi.
4. Standard Methods for the Examination of Water and Waste Water, American Public Health Association.

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE:** For examiner for paper setting:- In semester examinations, examiner is required to set up question paper covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

### CE 312C: FOUNDATION ENGINEERING LAB

#### B. Tech. 3<sup>rd</sup> Year (Semester – VI)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
-	-	2	1	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of</b>	<b>: 3 Hours</b>
				<b>Examination</b>	

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

CO1	Determine and analyze various index properties of soils, by different methods and their comparison.
CO2	Understand and determine the Permeability and shear strength characteristics of soil, and applicability of various tests.
CO3	Understand and determine the Compaction characteristics of soil, under various compactive efforts.
CO4	Understand and determine the Consolidation characteristics of soil.
CO5	Exercise soil exploration and determine the Bearing Capacity of soil.

### CO-PO/PSO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	1	1	2	-	2	-	2	2	2	2	1
CO2	3	2	2	1	2	3	-	2	-	1	2	2	2	2
CO3	1	2	1	2	-	3	1	-	2	1	1	2	1	2
CO4	1	2	2	1	-	3	2	1	2	2	2	2	1	1

CO5	1	1	2	1	1	2	1	3	3	3	3	2	2	2
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**List of Experiments:**

1. Determination of Permeability by constant head permeameter.
2. Determination of Permeability by variable head permeameter.
3. Determination of Specific Gravity of soil, by Density Bottle.
4. Determination of water content of soil, by Calcium Carbide Method.
5. Determination of water content of soil, by Proctor Needle Method.
6. Determination of Compaction properties by Standard Proctor Test.
7. Determination of Compaction properties by Modified Proctor Test.
8. Determination of MDD and OMC at different compactive effort by compaction test.
9. Determination of shear strength, by Direct shear test.
10. Determination of shear strength, by Tri-axial shear test.
11. Determination of shear strength, by Unconfined Compression Test.
12. Determination of Bearing capacity by Standard Penetration Test.
13. Determination of Bearing capacity by Plate Load Test.
14. Examine the Consolidation properties, by laboratory Consolidation Test.

**References Books:**

1. Soil Mechanics and Foundations by B. C. Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications, New Delhi.

**Note:** Ten experiments are to be performed in the Semester taking atleast 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.

**CE 314C, ENVIRONMENTAL ENGINEERING – I LAB**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>Practical</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Exam.</b>	<b>: 3 Hours</b>

**1. Course objectives:**

To analyze the physical and chemical characteristics of drinking water.

To study the test procedure and measurement of concentration of drinking water parameters.

**2. Course outcomes:**

**On completion of the course, the students will be able to:**

CO1	Recommend the degree of treatment required for the water.
CO2	Learn techniques for ensuring quality potable water.

**3. Prepare CO-PO/PSO Articulation Matrix, e.g.:**

	PO1	PO2	PO4	PO6	PO7
CO1	2	3	3	3	3
CO2	2	3	3	3	3

**Enter correlation levels 1, 2 or 3 as defined below:**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put “-”

**List of Experiments**

1. Physical Characterization of water: Turbidity, Electrical Conductivity, pH

2. Analysis of solids content of water: Dissolved, Suspended Solids
3. Alkalinity and acidity,
- 4 Hardness: total hardness, calcium and magnesium hardness
5. Analysis of ions: chloride
6. Analysis of ions: sulfate
7. Optimum coagulant dose
8. Dissolved Oxygen (D.O)
9. Break point Chlorination, residual chlorine and chlorine dose.
10. Visit to a Water Treatment Plant

**Note: Ten experiments are to be performed in the Semester taking atleast 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.**

#### **CE316C: MATERIAL TESTING LAB**

<b>L</b>	<b>P</b>	<b>Credits</b>		<b>Class Work</b>	<b>25 Marks</b>
	<b>4</b>	<b>2</b>		<b>Examinations</b>	<b>75 Marks</b>
				<b>Duration of Exam</b>	<b>3 Hrs</b>

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#### **List of experiments:**

1. Testing of bricks
2. Testing of paver blocks
3. Testing of HYSD bars
4. Testing of Concrete for workability
5. Concrete mix design using IS 10262
6. Concrete mix design using BS8110
7. Non destructive testing using rebound hammer
8. Non destructive testing using ultrasound
9. Study of testing of self compacting concrete

#### **Notes:**

1. Each Laboratory Class/Section shall not be of more than about 20 students.
2. To allow fair opportunity of practical hands-on experience to each student, each experiment may either be done by each student individually or in a group of not more than 3-4 students. Larger groups be strictly discouraged / disallowed.
3. Pre-experimental & post experimental quiz / questions may be offered for each Lab experiment to reinforce & aid comprehension of the experiment.

#### **COURSE OUTCOMES**

After completion of this students will be able to

1. Test various materials
2. Design bituminous mixes

#### **CE318C: HIGHWAY MATERIAL TESTING LAB**

<b>L</b>	<b>P</b>	<b>Credits</b>		<b>Class Work</b>	<b>25 Marks</b>
	<b>4</b>	<b>2</b>		<b>Examinations</b>	<b>75 Marks</b>
				<b>Duration of Exam</b>	<b>3 Hrs</b>

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**List of experiments:**

1. Testing of paver blocks
- 2 Concrete mix design using IS 10262
- 3 Testing aggregate: abrasion test
4. Testing aggregates: polishing test
- 4 Preparation of Job mix formula for road works
- 5 Durability test on aggregates
- 6 study of rheology of bitumen
- 7 To design bituminous mix using Marshal stability method
- 8 Pavement evaluation using Benkelman beam method

**Notes:**

4. Each Laboratory Class/Section shall not be of more than about 20 students.
5. To allow fair opportunity of practical hands-on experience to each student, each experiment may either be done by each student individually or in a group of not more than 3-4 students. Larger groups be strictly discouraged / disallowed.
6. Pre-experimental & post experimental quiz / questions may be offered for each Lab experiment to reinforce & aid comprehension of the experiment.

**COURSE OUTCOMES**

After completion of this students will be able to

3. Test various materials
4. Design bituminous mixes

## GFCE 302C GENERAL FITNESS FOR CIVIL ENGINEERING

### B. Tech. Semester - VI (Civil Engineering)

L	T	P	Credits	Examination	:	75Marks
-	--	--	-	Total	:	75 Marks

The purpose of this audit course is to inculcate a sense of professionalism in a student along with personality development in terms of quality such as receiving, responding, temperament, attitude and outlook. The student efforts will be evaluated on the basis of his/ her performance / achievements in different walks of life.

A Faculty Counselor will be attached to a group of students which will remain associated with him /her during the entire period of the degree program in the University. Each faculty member will serve as a faculty counselor. They will act like a local guardian for the students associated with him / her and will help them in terms of career guidance, personal difficulties.

The student will present a written report before the committee with following in view:

The student will present before the committee his/her achievements during the current academic session in the form of a written report highlighting followings:

- I. Academic Performance (10 Marks)
- II. Extra Curricular Activities / Community Service, Hostel Activities(10 Marks)
- III Technical Activities / Industrial, Educational tour (10 Marks)
- IV Sports/games (10 Marks)

A student will support his/her achievement and verbal & communicative skill through presentation before the examiners. (15 Marks)

- C. Faculty Counselor Assignment (20 Marks)

It will be the duty of the student to get evaluated by respective faculty counselor and to submit the counselor assessment marks in a sealed envelope to the committee.

A counselor will assess the student which reflects his/her learning graph including followings:

Discipline throughout the year

Sincerity towards study

How quickly the student assimilates professional value system etc.

University Departments:

- 1 Chairperson of the Department Chairman
- 2 Senior Most Faculty Counselor Member
- 3 Vice- Chancellor’s Nominee Member

Affiliated Colleges:

- Director/Principal Chairman
- Head of the Department/Sr. Faculty Member
- External Examiner to be appointed by the University Member

**CE 351C: CONCRETE TECHNOLOGY**

**B. Tech. 3<sup>rd</sup>Year (Semester - VI)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>4</b>	<b>-</b>	<b>--</b>	<b>4</b>	<b>Examination</b>	<b>: 75Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

**USE OF RELEVANT INDIAN STANDARDS IS ALLOWED IN THE EXAMINATION**

**Course Outcomes :**

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

CO1	Various properties of constituents of concrete on strength and durability of concrete
CO2	Properties of fresh and hardened concrete and various tests
CO3	Concrete Mix for the given data
CO4	Differences between various design methods
CO5	Requirements of special concrete and concrete in special environment

**Prepare CO-PO/PSO Articulation Matrix, e.g.:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	2	1	1	1	2	1	1	1	1	2	3
CO2	2	2	1	2	1	1	-	1	2	2	1	1	2	3
CO3	2	2	2	1	1	1	1	1	-	-	2	2	1	3
CO4	2	1	2	1	1	1	-	1	1	1	1	2	2	2
CO5	3	2	2	1	-	1	1	-	2	-	2	2	2	3

**UNIT - I**

**Constituents of Concrete:** Properties of Cement, Tests on cement, Various types of cement & their applications, Bulking of Sand, properties of good sand and functions of sand in mortar and cement concrete, substitutes of sand, Classification of Aggregates, Properties of aggregates - specific gravity, bulk density, porosity, adsorption & moisture content of aggregates, deleterious substance in aggregate, Soundness of aggregate, Grading of coarse and fine aggregates, physical requirements of aggregates, and their tests, Admixtures: their purpose, their types, properties, dosages, effects and usages.

**UNIT - II**

**Properties of Fresh and Hardened Concrete:** Properties & Tests of Cement Concrete, Workability, factors affecting workability, measurement of workability by different tests; Strength of concrete and factors affecting it, Water Cement Ratio - Abram's law, Degree of Compaction and Age of Concrete. Development of Strength of Concrete, Methods of Curing, Influence of Temperature, Steam curing, Durability, shrinkage & Creep of Concrete, Factors influencing Creep; Compression tests and Tension Tests, Flexural Tests & Splitting Tests, Freeze and Thaw in Concrete.

**UNIT - III**

**Concrete Mix Design:** Principles of Concrete Mix Design, Basic Considerations, Factors in the choice of mix design, outline of mix design procedure, Proportioning of Concrete mixes by various methods - BIS Method of Mix Design, American Concrete Institute, British Standard, Quality control and Acceptance Criterion. Grades of Concrete, stress strain curve, permissible stresses

**UNIT - IV**

**Durability of Concrete:** Sulphate attack of concrete, Corrosion of rebar wrt chloride and sulphate attack, Alkali Silica Reaction, Freezing and Thawing, Carbonation of Concrete, Corrosion Measurement Techniques, Prevention of Corrosion

Special Circumstances of Concreting: Hot weather concreting, Cold weather concreting, Underwater concreting, Heavy Concrete, Lightweight Concrete, Geopolymer concrete

**Text Books:**

1. Concrete Technology, by A. M. Neville & J.J. Brooks, Pearson.
2. Concrete Technology, by M.L. Gambhir, Tata McGraw Hill, New Delhi.
3. Concrete Technology, by M.S. Shetty, S. Chand & Co.

**Reference Books:**

1. Handbook of Mix Design, BIS, New Delhi.
2. Concrete Technology, by A.R. Santhakumar, Oxford University Press.
3. Concrete Microstructure and its Properties by P K Mehta and PJM Monterio
4. IS: 269 2015
5. IS:383 2016
6. IS:10262 2019

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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## CE 352C - WATER AND AIR QUALITY MODELING

### B. Tech. 4<sup>th</sup> Year (Semester – VII)

**L T P Credits**  
**3 -- 3**

**Class Work : 25 Marks**  
**Examination : 75Marks**  
**Total : 100 Marks**  
**Duration of Exam. : 3 Hours**

#### 1. Course outcomes:

Upon successful completion of the course students will be able to

CO1	Develop the water quality models.
CO2	Estimate and quantify of pollutants in water bodies.
CO3	Develop models for Estuary and lakes.
CO4	Prepare the Air quality model.

#### 2. Prepare CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO3	PO4	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	3	2	3	3	2	2	3	3
CO2	3	2	2	1	3	3	2	3	3	1	3	3	2
CO3	3	3	3	2	3	3	3	3	3	2	2	3	3
CO4	3	3	3	3	3	3	2	3	3	2	2	3	3

**Enter correlation levels 1, 2 or 3 as defined below:**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put “-”

#### UNIT – I

Water and air quality management, Introduction to Mathematical Models: kinds of mathematical models – model development, Model requirements and limitations, validation effluent and stream standards; ambient air quality standards.

#### UNIT – II

Water quality model development, D.O. Models for Streams: Dissolved oxygen model for streams sources and sinks of dissolved oxygen estimation of system parameters Streeter Phelps model , oxygen 'sag' curve-determination of deoxygenation and re-aeration coefficients- Benthic oxygen demand mass transport mechanisms

#### UNIT – III

Models for Estuary and Lakes: Assumptions, Benefits, Limitations, Physical, chemical and biological processes in estuaries and lakes;

Mass transport of solutes, degradation of organic compounds, application of concepts to predict groundwater contaminant movement, seawater intrusion – basic concepts and modelling

#### UNIT – VI

Air quality models: Micrometeorological processes, wind rose, dispersion, coefficients and stability classes, Gaussian and dispersion model, Stack height computation, Regional air quality models, Source inventories and significance. Air pollution modeling and prediction – Plume rise modeling techniques, modeling for non-reactive pollutants, single source – short term impact, multiple sources and area sources, model performance and utilisation, computer models.

**Text Books**

1. Environmental Engg.: by Howard s. Peavy& Others, MGH International.
2. Metacaf – EDDY – Waste-water engineering revised by George Teholonobus (TMH)
4. Manual on Water Supply and Treatment by Ministry of Urban Development, New Delhi.
5. Water Supply and Sewerage, McGhee, McGraw Hill.
6. Environmental Engineering, Vol. I, S.K. Garg, Khanna Publishers, New-Delhi.

**References Books**

5. Environmental Engineering Peavy, Rowe and Tchobanglous, McGraw Hill.
6. Water and Waste Water Engineering (Vol. 1&2), Fair, Geyer &Okun, John Wiley, New York.
7. Water Supply Engineering P.N. Modi, Standard Book House New-Delhi.
8. Standard Methods for the Examination of Water and Waste Water, American Public Health Association.

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE: For examiner for paper setting:-** In semester examinations, examiner is required to set up question paper covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

**CE 354C ROCK MECHANICS**

**B. Tech. 3<sup>RD</sup> Year (Semester -VI)**

L	T	P	Credits	Class Work	:	25 Marks
3	-	--	3	Examination	:	75Marks
				Total	:	100 Marks
				Duration of Examination	:	3Hours

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

CO1	Learn the engineering properties of rocks, in laboratory and site.
CO2	Apply the methods of improving the properties of rock masses.
CO3	Analyze the Stability of rock slopes.
CO4	Evaluate the rock stresses and deformation around tunnels.

### **CO-PO/PSO Articulation Matrix :**

	PO1	PO2	PO4	PO6	PO7	PO8	PO9	PO11	PSO1	PSO2	PSO3
CO1	1	-	1	2	-	2	-	2	3	2	1
CO2	2	2	1	3	-	2	-	2	3	2	1
CO3	2	2	2	3	1	-	2	1	3	1	1
CO4	1	1	1	3	2	1	2	2	2	1	1

#### **UNIT I**

Introduction, Importance and application of rock mechanics to engineering problems. Classification, Engineering classification of intact and fissured rocks, Classification of fissures, joints and faults.

#### **UNIT II**

Engineering properties of rocks, Laboratory and site measurements.

Definition of stress in rock, Simple methods of determining in-situ stresses, Borehole over covering technique, Bore hole deformation gauges, Evaluation of rock stresses and deformation around tunnels.

#### **UNIT III**

Simple methods of tunnel design.

Stability of rock slope, Modes of failure, Analysis by simple field Bishop's method and use of Hoek's chart

#### **UNIT IV**

Foundations on rocks, Plastic equilibrium of foundations, Elastic solutions for loading and excavation of foundations, Consideration of uplift pressures.

Methods of improving the properties of rock masses.

#### **Text Books:**

1. Goodman, R.E. (1989), 'Introduction to Rock Mechanics', John Wiley, Chichester.
2. Hudson, J.A. and Harrison, J.P. (2000), 'Engineering Rock Mechanics', Pergamon Press, Amsterdam.
3. Roberts, A. (1977)., 'Geotechnology', Pergamon Press, England.
4. Stagg, K.G. and Zienkiewicz (1968)., 'Rock Mechanics in Engineering Practice', John Wiley and Sons, London.

#### **Reference books**

1. Hoek, E. and Brown, E. T., "Underground Excavations", Span Press
2. Hoek, E. and Bray, J.W., "Rock Slope Engg.", Span Press

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE: For examiner for paper setting:-** In semester examinations, examiner is required to set up question paper covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

### **CE353C :TRAFFIC ENGINEERING AND MANAGEMENT**

#### **B. Tech. 3rd Year (Semester – VI)**

**L T P Credits**

**Class Work : 25 Marks**

**COURSE OUTCOMES**

After completion of this course the students will be able to

- 1 Understand traffic characteristics and Carry out traffic studies for various purposes.
- 2 Understand various Traffic flow parameters and flow theories.
- 3 Acquire understanding of traffic control devices and inculcate their design skills.
- 4 Practice traffic management strategies in their profession.

**CO-PO/PSO Articulation Matrix**

	PO1	PO2	PO4	PO6	PO7	PO9	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	-	-	-	-	-	-	1	-
CO2	3	3	3	-	-	-	1	-	1	3	-
CO3	2	1	1	-	-	-	-	-	-	3	-
CO4	1	2	1	2	1	2	1	3	1	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: no correlation

**UNIT – I**

Traffic Characteristics: Importance of traffic characteristics, Road user characteristics, Vehicular characteristics. Max dimensions and weights of vehicles allowed in India. Effects of traffic characteristics on various design elements of the road.

Traffic Studies: Traffic volume study, speed study and origin and destination study. Speed and delay study. Use of photographic techniques in traffic surveys. Parking surveys. Accident studies.

**UNIT – II**

Capacity and Level of Service: Fundamental diagram of traffic flow. Relationship between speed, volume and density. Traffic flow theories, Level of service. PCU. Design service volume. Capacity of non-urban roads. IRC recommendations. Brief review of capacity of urban roads.

**UNIT– III**

Traffic Control Devices: Signs, Signals, markings and islands. Types of signs, Types of signals, Design of Signal, Intersections at grade and grade separated intersections. Types of grade separated intersections.

**UNIT– IV**

Design of On street parking, off street parking.

Traffic Regulation: Need and scope of traffic regulations. Regulation of speed, vehicles and drivers. General traffic regulations. Motor vehicle act. Scope of traffic management.

**Recommended Books**

- 1 Principles of Transportation Engineering by Chakroborty & Das, Prentice Hall, India.
- 2 Highway Engg by S.K. Khanna & C.E.G. Justo, Nem Chand Bros., Roorkee.
- 3 Traffic Engg and Transport Planning by L.R. Kadiyali, Khanna Publishers, Delhi.
- 4 Principles of Transportation and Highway Engineering by G.V. Rao, Tata McGraw-Hill Publishing Co. Ltd. N. Delhi.

- 5 Traffic Engg. by Matson, T.M., Smith, W.S. and Hurd, F.W, McGraw- Hill Book Co., New York.  
 6 Traffic Flow Theory by Drew, D.R., McGraw- Hill Book Co., New York.

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE: For examiner for paper setting:-** In semester examinations, examiner is required to set up question paper covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

### CE 356C :GROUND WATER ENGINEERING

#### B. Tech. 3<sup>rd</sup> Year (Semester – VI)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>-</b>	<b>--</b>	<b>3</b>	<b>Examination</b>	<b>: 75Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

### COURSE OUTCOMES

On completion of the course the student will be able to

1. Understand ground water role in hydrological cycle, ground water fluctuations and environmental influence, movement of ground water, flow rates and various method/theories related to the ground water.
2. Analyze causes of ground water pollution and physical/chemical/biological property, quality of ground water, various method of surface/sub-surface ground water investigation.
3. Understand Concept & methods of artificial ground water recharge and saline water intrusion in aquifers.
4. Understand advanced well hydraulics, modeling and management of ground water.

	PO1	PO2	PO3	PO4	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	3	3	2	3	2	2	3	2	2	3	3
CO2	3	3	2	3	3	1	2	1	3	1	3	3	2
CO3	3	3	3	1	2	3	3	2	3	2	2	3	3
CO4	2	3	3	3	3	3	2	1	3	2	2	3	3

#### UNIT- I

**Introduction:** Ground water utilization & historical background, ground water in hydrologic cycle, ground water budget and ground water level fluctuations & environmental influence.

**Occurrence and movement of ground water:** Origin & age of ground water, rock properties affecting groundwater, groundwater column, zones of aeration & saturation, aquifers and their characteristics/classification, groundwater basins & springs, Darcy's Law, permeability & its determination, Dupuit assumptions, heterogeneity & anisotropy, Ground water flow rates & flow directions, Steady state flow, Unsteady state flow, Theis method, Jacob method, Slug test, Infiltration gallery, general flow equations through porous media.

#### UNIT- II

**Pollution and quality analysis of ground water:** Municipal/industrial /agricultural /miscellaneous sources & causes of pollution, attenuation/ underground distribution / potential evaluation of pollution, physical /chemical /biological analysis of ground water quality, criteria & measures of ground water quality, ground water salinity & samples, graphical representations of ground water quality.

**Surface/ sub-surface investigation of ground water:** Geological /geophysical exploration/ remote sensing / electric resistivity /seismic refraction based methods for surface investigation of ground water, test drilling & ground water level measurement, sub-surface ground water investigation through geophysical / resistivity /spontaneous potential /radiation / temperature / caliper / fluid conductivity / fluid velocity /miscellaneous logging.

#### UNIT-III

**Artificial ground water recharge:** Concept & methods of artificial ground water recharge mounds & induced recharge, wastewater recharge for reuse, water spreading.

**Saline water intrusion in aquifers:** Ghyben-Herzberg relation between fresh & saline waters, shape & structure of the fresh & saline water interface, upconing of saline water, fresh-saline water relations on oceanic islands, seawater intrusion in Karst terrains, saline water intrusion control.

#### UNIT-IV

**Advanced well hydraulics:** steady/ unsteady, uniform/ radial flow to a well in a confined/ unconfined /leaky aquifer, well flow near aquifer boundaries/ for special conditions, partially penetrating/horizontal wells & multiple well systems, well completion/ development/ protection/ rehabilitation/ testing for yield.

**Modeling and management of ground water:** Ground water modeling through porous media /analog / electric analog / digital computer models, ground water basin management concept, hydrologic equilibrium equation, ground water basin investigations, data collection & field work, dynamic equilibrium in natural aquifers, management potential & safe yield of aquifers, stream-aquifer interaction.

#### References/Books

1. D. K. Todd and L. F. Mays, "Groundwater Hydrology", John Wiley and sons.
2. K. R. Karanth, "Hydrogeology", TataMcGraw Hill Publishing Company.
3. S. Ramakrishnan, "Ground water", S. Ramakrishnan.

#### Additional readings

1. Literature of the Central Ground Water Board (CGWB); Relevant National/International Journal and/or Conference publications.

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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### CE358C : CONSTRUCTION COST ANALYSIS

#### B. Tech. 3<sup>rd</sup>Year (Semester-VI)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3-</b>	<b>--</b>	<b>3</b>		<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 hours</b>

#### COURSE OUTCOMES:

Students will know about:

- 1: Basics of Project cost control.
- 2: About value engineering and productivity in construction.
- 3: Budgeting and financial forecasting.
- 4: Capital budgeting.

	PO1	PO2	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	3	1	3	2	3	2	3	3	3	3
CO2	2	3	3	3	3	3	2	1	1	3	3	3	3
CO3	3	3	3	2	2	3	1	3	2	3	3	3	3

CO4	1	2	2	2	1	2	1	2	2	3	3	3	3
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### Unit-I

**Project Cost Controlling:** Development of Network, Development of Cost/Schedule Control System Criteria (C/SCSE), Monitoring of Project Cost, Cost Schedule Algorithms.

**Cost Time Trade – off Analysis:** Cost time trade – off curves, Non – convex discontinuous and discrete cost time trade – off curves, Crashing of projects, Heuristic methods, Siemen’s method of project cost curve, Trade-off problems.

### Unit-II

**Value Engineering:** Principles of value engineering in Project Management, Value engineering technique, Job Plans, Life cycle costing and its applications.

**Productivity in Construction:** Definition of Productivity. Productivity measurements. Productivity of production components, Labors, Equipment and Material capital productivity. Planning, Designing and execution processes.

### Unit-III

**Financial Statements:** Financial statement analysis. Funds flow analysis leverages – operating. Financial and total cost volume profit analysis.

**Budgeting and Financial Forecasting:** Responsibility budgeting preparation of operating budget. Performance – budget analysis growth with internal equity. Sales forecast.

### Unit-IV

**Working Capital Management:** Working capital leverage. Analysis of working capital Components. Inventory management. Financing current assets. Regulation of Bank finance.

**Capital Budgeting:** Tax considerations in investment appraisal, Payback period. Net present value method. Problems with internal rate of return method. Conflicts in ranking as per DCF criteria and their resolution. Capital budgeting under capital rationing and other constraints. Risk analysis of capital investments. Decision tree analysis. Applied utility theory. Cost of capital.

#### Reference Books:

- 1) Mueller, F.W. Integrated cost and schedule control for construction projects.
- 2) Gobourne: Cost control in the construction industry.
- 3) Schedule of rates, specification manual etc from PWD.
- 4) Chris hendrickson and Tung Au: project Management for construction.
- 5) Datta: material Management procedures, Text and Cases, 2e. Prentice Hall
- 6) Gopalakrishanan, P, Sundaresan, M Material Management- an Integrated Approach, Prentice Hall
- 7) Dobbler and Bart: Purchasing and supplies Management, Text and Cases, 6e.
- 8) Chitkara, K.K. Construction Project Mangement, Tata-McGraw Hill.

**NOTE: 1.** For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.** The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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## AR 318 C: BUILDING STANDARDS AND OFFICE MANAGEMENT – VI

B. Tech. Semester – VI

L T P Credits

Class Work

: 25 Marks

3 - -- 3

**Examination** : **75 Marks**  
**Total** : **100 Marks**  
**Duration of Examination** : **3 Hours**

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## **COURSE OUTCOMES:**

After successful completion of the course, student will be able to

1. understand principles of system approach and integrated building design
2. understand and interpret building standards, byelaws and regulations
3. understand basis office procedure and management techniques in building profession

### **UNIT I: Introduction to System approach and building standards**

System approach to building design and construction

Integrated building design - the participants and role of civil engineers in decision making process

Future of Real Estate profession in view of globalization, social, economic and environmental sustainability

Introduction to Building standards: codes, bye laws and regulations, their need and relevance.

Overview of basic terminologies, nature of building codes in special regions like heritage zones, air funnels, environmentally sensitive zones, disaster prone regions, coastal zones, hilly areas, etc.

### **UNIT II: Building codes and bye laws**

Study of structure of Building bye laws, National Building Code of India, Energy Conservation Building Code etc. General building requirements, building classifications and permissible uses.

Norms for exterior and interior open spaces, setbacks and margins, norms for building projections in open spaces, considerations in FAR, super area, guidelines for open green areas. Plinth, habitable rooms, kitchen, wet areas, mezzanine, store rooms, elevated parts like chimneys, parapets etc. Means of access, norms for access widths for various types of buildings, requirements of parking spaces, fire safety, Equivalent Car Space (ECS), standards for turning radius, access to service areas.

### **Unit III: Norms for Local bye laws**

Study of local planning bodies such as corporation, municipal board's and panchayats

Building bye laws framed by local bodies of Chandigarh, Delhi, Haryana

Procedural method for use of bye laws for submission drawings, obtaining building permits, architectural control and provision of building services, regulations for super structures, building height regulations, regulations for multi-storied buildings etc.

### **Unit IV: Office management**

Professional firm organization and legal/financial structures: proprietorship, partnership, associateship and private limited concerns, institutional consultancy practice

Taxonomy of building project delivery: Traditional, Design build, construction/project manager, turnkey

Office correspondence, filing and record keeping

Human resource management

Scale of remuneration for consultant services: Manhours basis for fees + extra, % basis for fees, stages and mode of payments, taxes and implications of service tax, GST on the profession in India

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under item No. 14\_18 of academic council.

CE360C: LOW VOLUME ROADS

<b>L</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>25 Marks</b>
<b>3</b>	<b>0</b>	<b>3</b>	<b>Examinations</b>	<b>75 Marks</b>
			<b>Duration of Exam 3 Hrs</b>	

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**COURSE OUTCOMES**

After completion of this students will be able to

1. Use of guidelines for alignment and geometric design of rural/low volume roads.
2. Acquire knowledge of methods of soil investigations and surveys.
3. Design pavements for rural roads as per NRRDA, IRC and MORD guidelines.
4. Design drainage systems for rural roads.
5. Acquire construction and maintenance skills related to low volume roads.

**UNIT I (CO-1)**

**Planning of rural road net work** – Concept of core and non-core roads, general principle, guidelines laid down in recent 20-year plans and in PMGSY

Guidelines for alignment and geometric design of rural/low volume roads and safety aspects.

**UNIT II (CO-2)**

Investigations and surveys, soil and material surveys, Promoting use of alternate marginal / low cost / waste / stabilized local materials in rural road works, fly ash in fill and other layers, use of other waste materials. Soil stabilization methods – mechanical, soil cement, soil lime, soil-lime-pozzolana, soil-lime-cement stabilization

**UNIT III (CO-3,4)**

Design of different types of pavements for rural roads, choice of pavement type / pavement materials. Guidelines and specifications by IRC, NRRDA and MORD

**Road drainage** – study of requirements of surface and subsurface drainage, and cross drains, standard design of culverts and small bridges

**UNIT IV (CO-5)**

Specifications and steps for the construction of different components of rural / low volume roads including pavement layers, quality control during construction

**Maintenance of rural roads** – shoulders, side and cross drains. Pavement distress, different types of failures and maintenance measures. Preventive maintenance works.

TEXT/REFERENCE BOOKS:

1. CRRRI “**Low Volume Roads’ Central Road Research Institute**”-New Delhi
2. IRC “**Rural Roads Manual**”-Special Publication 20 – 2002, Indian Roads Congress.
3. IRC SP- 26 “**Report Containing Recommendations of IRC Regional Workshops on Rural Road Development**”- 1984, Indian Roads Congress
4. IRC SP:42 –1994, “**Guidelines on Road Drainage**”- Indian Roads Congress
5. IRC SP: 58-2001, “**Guidelines for Use of Fly Ash in Road Embankments**”- Indian Roads Congress
6. MoRTH “**Specifications for Road and Bridge Works**”- 2001, fourth revision, Indian Roads Congress
7. MORD “**Specification for Rural roads**”
8. MORD “**Standard data book for analysis of rates for rural roads**”

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**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

## CE 361C : MASONRY STRUCTURES

### B. Tech. 4<sup>th</sup> Year (Semester - VII)

L	T	P	Credits
3	-	--	3

Class Work	: 25 Marks
Examination	: 75Marks
Total	: 100 Marks
Duration of Examination	: 3 Hours

#### Course Outcomes :

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

CO1	Understand the concept of brick construction.
CO2	Design the laterally loaded masonry structures.
CO3	Identify different lateral load cases for the design of masonry structure.
CO4	Understand the Seismic factors effecting the design of masonry structure.

#### Prepare CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO3	PO4	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1	1	1	1	2	2	2	3
CO2	2	1	1	-	-	1	-	2	-	1	1	2	2
CO3	2	2	2	1	1	2	1	1	1	2	1	2	3
CO4	2	1	2	1	1	-	1	1	1	2	2	2	2

#### Unit I

**Introduction:** Brick masonry units, Concrete masonry units, types, grades and properties of concrete masonry units, mortar, grout and plaster.

Masonry construction, types of bonds, bond at connections, types of joints, contraction and expansion joints

**Brick Masonry in Buildings:** Brickwork, brick walls, brick columns and piers. Allowable stresses, cross sectional area, shape factor of units, slenderness ratio. Type of loading, net permissible stresses, composite brick concrete piers. Bed stone and bed plates.

#### Unit II

**Laterally loaded Masonry Structure:** Structures and loads, stability of masonry, masonry dams, retaining walls.

**Foundations, Piers, Walls and Abutments:** Wall and column footings in buildings, bridge foundations, the substructure, loads on substructures. Determination of safe bearing capacity. Lateral load resistance of well foundations.

#### Unit III

**Structural Design:** General, Load Dispersion, arching action, design thickness/cross section. Design of foundations, piers, walls, dams and retaining walls, design of RBC slabs, lintels, Reinforced Brick columns.

**Masonry Arches and Domes:** Arches in buildings, stability of masonry arches. Design of masonry arches by elastic theory. Analysis of masonry domes – stability of masonry domes.

#### Unit IV

**Seismic Design** of brick masonry buildings. Introduction to SP20 (S&T):1991 "Handbook on Masonry Design and Construction".

#### **Text Book**

1. Structural Design in Steel, Masonry and Timber by A.S. Arya, Nem Chand & Bros.
2. Building Construction, Sushil Kumar, Standard Publishers and Distributors

#### **Reference Books**

1. SP20 (S&T): 1991 "Handbook on Masonry Design and Construction".

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt



load capacity for pipe piles, Estimating Axial Pile capacity by pile load test approach, Estimating axial pile capacity by driving resistance approach, Settlement Analysis, Reporting of Results and Recommendations for Geotechnical Design of pile foundation.

### UNIT III

**Sub-surface drainage for Roads:** Significance of Drainage, Requirements of Highway Drainage System, Collection of Surface Water through Covered Drainage trenches, Lowering of High Water Table in Permeable Soils, Subsurface Drainage System with Transverse Drains, Control of seepage flow, Control of capillary rise, Design of Sub-surface Drainage System, Road Construction in water logged areas.

**Analysis and Design of Sub-grade for highways and airfield pavements:** Significance and Desirable Properties of Subgrade soil, Group Index of soil, Characteristics of soil classification groups, Suitability of soil as subgrade material, Subgrade Soil strength, Modulus of Subgrade Reaction, Allowance of worst subgrade moisture, California Bearing ratio Test and CBR method of design of flexible pavement thickness and its subgrade.

### UNIT IV

**Earthen Embankments:** Types of Earthen Embankments, Protective Layers for erosion control, Toe Drainage, Effect of sudden draw down and submergence. Unstability of the Upstream and Downstream slopes due to seepage forces, Typical range of prescribed safety factors for stability of slopes of earth dams, Design Process, Performance and health Monitoring using instrumentation, Road, Rail and other embankments.

**Earth Retaining Structures:** Types of Earth Retaining Structures, Types of Retaining walls, Design of retaining walls, Design Criteria, Design Process, Backfill material, Drainage provisions in the backfill, Tentative dimensions, Earth Pressure diagram and Influence of Soil Displacement, Sliding Resistance, Overturning, Pressure distribution along base, Determination of final dimensions and the force and stress diagram for proceeding with the structural design.

#### Text Books:

1. Geotechnical Engineering, by Sashi K. Gulhati and Manoj Datta, Tata McGraw Hill Education Private Limited, New Delhi.
2. Soil Mechanics and Foundations by B. C. Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications, New Delhi.
3. Soil Mechanics & Foundation Engineering, by K.R. Arora, Standard Publishers, New Delhi.
4. Highway Engineering by S.K. Khanna and C.E.G. Justo, Nem Chand and Bros., Roorkee.
5. Modern Geotechnical Engineering by Alam Singh.

#### References Books:

1. Foundation Analysis and Design, by J.E. Bowles McGraw Hill Book Company, New York.
2. Soil Mechanics and Foundation Engineering, Hasmukh P Oza and Gautam H Oza, Charotar Publishing House, ANAND, Gujarat, India.
3. A Text Book of Soil Mechanics Foundation Engg. by VNS Murthy – U.B.S, New Delhi.
4. Basic and Applied Soil Mechanics, by Gopal Ranjan Rao, ASR Rao, New Age Int. (P) Ltd. Pub., New Delhi.
5. Foundation Engineering by Peck, Wiley Eastern India Limited, New Delhi.
6. Soils and Foundations, by Cheng Liu & Jack B Evett, Prentice-Hall Inc., USA.

**NOTE: 1.** For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

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# CE 363C: ENVIRONMENTAL IMPACT ASSESSMENT AND LIFE CYCLE ANALYSES

(Department elective course)

## B. Tech. 4<sup>th</sup> Year (Semester – VII) (Department elective)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>4</b>		<b>--</b>	<b>4</b>	<b>Examination</b>	<b>: 75Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Exam.</b>	<b>: 3 Hours</b>

### 1. Course outcomes:

Upon successful completion of the course students will be able to

CO1	Understand the basic concept of EIA.
CO2	Evaluate the EIA by different methodologies.
CO3	Understand the environmental audit of project.
CO4	Understand the laws of environment protection.

### 2. Prepare CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO3	PO4	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	2	3	3	3	3	3	3	3	3	3
CO2	2	3	3	3	3	3	2	3	3	3	3	3	2
CO3	1	1	3	1	3	3	3	3	3	3	3	3	3
CO4	-	-	1	-	3	3	3	3	2	3	3	3	3

### Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put “-”

### Content

#### 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 Prediction and Assessment of Impact on the physical environment, on the resources, and on the socio-economic, 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: Objectives, audit teams, planning audits, conducting audits, reporting audit findings

#### UNIT – VI

EIA related to the following sectors - Infrastructure –construction and housing Mining – Industrial - Thermal Power - River valley and Hydroelectric

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

### Text Books

- 1.R.E. Munn, Environmental Impact Assessment, John Wiley, New York, USA
- 2.Pollution Control Law Series; PCL/2/2001, Central Pollution Control Board, New Delhi.
3. Eds, Jain and Clark, Environmental Technology Assessment and Policy, John Wiley, New York, USA
4. National Conservation Strategy and Policy Statement on Environment and Development, Govt. of India, New Delhi
5. A guide to Manufacture, Storage and Import of Hazardous Chemicals Rules, Ministry of Environment and Forests, Govt. of India, New Delhi.
6. Canter, L.W., Environmental Impact Assessment, McGraw Hills, New York, USA
7. Woodside, Gayle and Patrick Aurrichio, ISO 14001 Auditing Manual, McGraw Hills, New York, USA
8. Pollution Control Acts, Rules and Notifications issued thereunder, Central Pollution Control Board, New Delhi.
9. Environmental Impact Assessment: A Manual, Ministry of Environment and Forests (Impact Assessment Division), Govt. of India, New Delhi

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

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### **CE364C : BUILDING CONSTRUCTION PRACTICES**

#### **B. Tech. 4<sup>th</sup> Year (Semester-VII)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>		<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>--</b>	<b>--</b>	<b>3</b>		<b>Examination</b>	<b>: 75 Marks</b>
					<b>Total</b>	<b>: 100 Marks</b>
					<b>Duration of Examination</b>	<b>: 3 hours</b>

#### **COURSE OUTCOMES:**

Students will know about:

- 1:** Basics of pre fabrication of buildings.
- 2:** Different prefabricated elements and their fabrication.
- 3:** Production and hoisting technology used for prefabrication.
- 4:** Basics of pre engineered buildings.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	2	2	3	1	2	1	2	2	2	2	2
CO2	2	2	-	-	2	3	2	2	1	1	1	2	2	2	2
CO3	1	1	-	-	2	2	1	1	2	2	2	2	2	2	2

CO4	3	3	-	-	1	2	2	1	2	1	1	2	2	3	3
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### Unit-I

**General Principles of Fabrication for High Rise buildings:** Comparison with monolithic construction – Types of prefabrication, site and plant prefabrication, Economy of prefabrication, Modular coordination, Standardization, Planning for Components of prefabricated structures, Disuniting of structures, Design of simple rectangular beams and I beams, Handling and erection stresses, Elimination of erection stresses – Beams, columns – Symmetrical frames.

### Unit-II

**Prefabricated Elements:** Roof and floor panels, ribbed floor panels – wall panels – footings – Joints for different structural Connections – Effective sealing of joints for water proofing – Provisions for non-structural fastenings – Expansion joints in pre-cast construction. Designing and detailing of precast unit for factory structures – Purlins, Principal rafters, roof trusses, lattice girders, gable frames – Single span single storeyed frames – Single storeyed buildings – slabs, beams and columns.

**Materials:** Use of advanced materials for speedy construction, Steel structures and their feasibility, Composite structures.

### Unit-III

**Production and Hoisting Technology** Choice of production setup – Manufacturing methods – Stationary and mobile production – Planning of production setup – Storage of precast elements – Dimensional tolerances – Acceleration of concrete hardening. Equipments for hoisting and erection – Techniques for erection of different types of members like Beams, Slabs, Wall panels and Columns – Vacuum lifting pads.

### Unit-IV

**Pre-Engineered Buildings:** Introduction – Advantages - Pre Engineered Buildings Vs Conventional Steel Buildings - Design of Pre Engineered Buildings (PEB) – Applications

**Equipments:** Use of advanced equipments like RMC, Tower Crane, Earthwork equipments for building construction.

#### References

1. L. Mokka, Prefabricated Concrete for Industrial and Public Structures, Publishing House of the Hungarian Academy of Sciences, Budapest, 2007.
2. T. Koncz, Manual of Precast Concrete Construction, Vol. I, II, III & IV, Berlin, 1971.
3. B. Lewicki, Building with Large Prefabricates, Elsevier Publishing Company, Amsterdam, London, New York, 1998.
4. Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precast Concrete, Netherland BetorVerlag, 2009.
5. Hass, A.M. Precast concrete design and Applications, Applied Science Publishers, 1983.

**NOTE: 1.** For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.** The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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under item No. 14\_18 of academic council.

## CE 365C: HIGHWAY CONSTRUCTION AND MANAGEMENT

B. Tech. Final Year (Semester – VII)

L T P Credits  
4 - -- 4

Class Work : 25 Marks

Examination : 75 Marks

Total : 100 Marks

Duration of Examination: 3 Hours

**COURSE OUTCOMES:** After completion of this course, students will be able to

1. Identify various types of soils and the methods to modify their properties as per requirement.
2. Understand properties of low cost, marginal and waste materials used in road construction.
3. Acquire proportioning and design skills of bituminous mixes.
4. Knowledge of operation of different equipments used in highway construction.
5. Acquire knowledge of construction of flexible and rigid pavement layers.
6. Maintain management of different highway pavements and hill roads.

### CO-PO/PSO Articulation Matrix

	PO1	PO2	PO4	PO5	PO7	PO9	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	-	-	1	-	1	3	2
CO2	1	-	2	-	3	-	1	-	1	3	1
CO3	1	1	-	2	-	-	-	-	-	2	1
CO4	1	-	-	-	-	-	1	-	1	2	1
CO5	2	-	-	2	2	-	1	-	1	3	2
CO6	2	-	-	2	-	1	1	3	1	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: no correlation

### UNIT-I

Soils: Characteristics of soil, Centrifuge moisture equivalent, Colour, Field moisture equivalent, Grain shape, Lineal shrinkage and volumetric change, Particle sizes and distribution, Plasticity, Presence of fines, Specific gravity, State of compaction. Grain or particle size classification, Textural classification, 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, Design of Bituminous Mix, Marshal Method of bituminous 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. 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. Machinery involved in construction, slip-form pavers, and joints in CC pavements. Introduction to various IRC and MORTH specifications.

Construction of other types of pavements: reinforced cement concrete pavements, prestressed concrete pavements, roller compacted concrete pavements and fibre reinforced concrete pavements.

#### UNIT IV

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, maintenance management.

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

#### TEXT/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. W. Ronald Hudson, Ralph Haas and Zeniswki “Modern Pavement Management”- McGraw Hill and Co.
8. MoRTH “Manual for Construction and Supervision of Bituminous Works”- 2001.
9. MoRTH “Manual for Maintenance of Roads”- 1989.
10. 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.

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**2.** The students will be allowed to use non-programmable scientific calculator. However, sharing / exchange of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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#### CE366C: TRANSPORTATION ECONOMICS

##### B. Tech. 4th Year (Semester – VI)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>-</b>	<b>--</b>	<b>3</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

**COURSE OUTCOMES:** At the end of this course the students will develop the ability to

1. Perform economical and financial analysis of a transport plan.
2. Learn various types of costs and benefits of a road project.

- Identify various financial resources available for a project and learn various method of economic evaluation.
- Understand basic concepts of public private partnership.

### **CO-PO/PSO Articulation Matrix**

	PO1	PO2	PO4	PO6	PO8	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	1	1	-	2	-	-	-
CO2	2	1	2	2	-	-	2	-	-	-
CO3	2	3	2	1	-	-	2	-	-	1
CO4	2	1	-	2	1	1	2	1	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: no correlation

### **UNIT – I**

Introductory Concepts in Transportation Decision Making: Overall transportation project development, budgeting, financial planning, the process of transportation project development, models associated with transportation impact evaluation;

### **UNIT – II**

Transportation costs - Classification of transportation costs, transportation agency costs, transportation user costs, general structure and behavior of cost functions and road pricing.

Vehicle operating costs: Fuel costs - Maintenance and spares, Depreciation – Crew costs - Value of travel time savings - Accident costs. Economics of traffic congestion - Pricing policy; Indirect costs and benefits of transport projects.

### **UNIT – III**

Estimating Transportation Demand and Supply - supply equilibration, dynamics of transportation demand and supply, elasticity of travel demand and supply, classification of elasticity; Economic analysis of projects - Methods of evaluation - Cost-benefit ratio, first year rate of return, net present value, and internal-rate of return methods;

### **UNIT – IV**

Financing of road projects - methods – Private Public Partnership (PPP) - Toll collection - Economic viability of Design-Build-Operate-Transfer Schemes – Risk Analysis – Value for Money analysis - Case Studies.

### **Text/reference Books:**

- Small, Kenneth, and Erik T. Verhoef. The Economics of Urban Transportation. New York, NY: Routledge, 2007. ISBN: 9780415285155.
- Transportation Economics: Theory and Practice: A Case Study Approach by Patrick S. McCarthy, Blackwell publishers, UK
- Gomez-Ibanez, Jose, William B. Tye, and Clifford Winston, eds. Essays in Transportation Economics and Policy: A Handbook in Honor of John R. Meyer. Washington, DC: Brookings Institution Press, 1999. ISBN: 9780815731818.
- Cascetta, Ennio. Transportation Systems Analysis: Models and Applications. 2nd ed. New York, NY: Springer, forthcoming in 2009. ISBN: 9780387758565.

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**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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**CE 368C : CONSTRUCTION ENGINEERING MATERIALS**

**B. Tech. 4<sup>th</sup>Year (Semester – VII)**

**L T P Credits**  
**3 -- - 3**

**Class Work : 25 Marks**  
**Examination : 75 Marks**  
**Total : 100 Marks**  
**Duration of Examination : 3 Hours**

**Course Outcomes :**

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

CO1	sound understanding about the properties of the various binding materials like cement, lime etc.
CO2	knowledge about various pozzolanic materials and their importance in construction industry.
CO3	knowledge about mix design methods of concrete.
CO4	knowledge about modern construction materials and their applications

**Prepare CO-PO/PSO Articulation Matrix, e.g.:**

	PO1	PO2	PO3	PO4	PO6	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	-	1	1	1	-	2	1	3	2
CO2	2	2	1	2	1	2	1	1	2	3	3	2
CO3	3	2	2	1	1	1	2	1	2	1	3	2
CO4	2	1	2	1	1	2	-	1	1	2	3	2

**Unit I.**

Lime – Preparation of lime mortar – Cement. Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration - Compressive strength – Tensile strength – Soundness and consistency – Setting time – Aggregates – Natural stone aggregates – Industrial byproducts – Crushing strength – Impact strength – Flakiness – Abrasion Resistance – Grading – Sand – Bulking – Code Practices

**Unit II.**

Pozzolanic materials, Importance of Pozzolanic materials, Types and Use of Pozzolanic materials in construction industries, Effects of pozzolanic materials on the properties of fresh and hardened concrete. Cement and Concrete hollow blocks – Light-weight concrete blocks – Code Practices

**Unit III.**

Concrete – Ingredients – Manufacture – Batching plants – RMC – Properties of fresh concrete – Slump – Flow and compaction – Principles of hardened concrete – Compressive, Tensile and shear strength – Modulus of rupture – Tests – Mix specification – Mix proportioning and Mix Design Methods – IS method

**Unit IV.**

Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic– Fibre textiles – Geosynthetics for Civil Engineering applications-Fibre Reinforced Concrete-High Strength Concrete-High Performance Concrete-Light Weight Concrete-Heavy Weight Concrete-their production, properties and applications.

**TEXT BOOKS**

- 1.R. K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.
- 2.M. S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003.
3. A. R. Santhakumar, Concrete Technology, Oxford press

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or

other electrical/ electronic items are allowed in the examination.

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**CE 372C: STRUCTURAL ANALYSIS BY MATRIX METHOD**

**B. Tech. 3<sup>rd</sup> Year (Semester -VI)**

L	T	P	Credits	Class Work	: 25 Marks
4		--	4	Examination	: 75Marks
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3Hours</b>

**Course Outcomes :**

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

CO1	Apply the basic concepts of matrix methods in structural analysis.
CO2	Develop stiffness and flexibility matrices for various structural members.
CO3	Analyze the structures using flexibility and stiffness method.
CO4	Understand the fundamental ideas of FEM.

**Prepare CO-PO/PSO Articulation Matrix, e.g.:**

	PO1	PO2	PO3	PO4	PO6	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	1	1	1	2	2	3	2
CO2	2	3	2	2	1	1	1	1	2	2	3	2
CO3	3	3	3	1	1	1	2	1	2	1	3	2
CO4	3	2	2	2	1	1	2	2	1	2	3	2

**UNIT I**

**Matrix Force Method:** Introduction to flexibility approach, Choice of redundant, static equilibrium matrix, deformation compatibility matrix, member flexibility matrix, static equilibrium and deformation compatibility checks. Application for trusses, continuous beams and rigid frames.

**UNIT II**

**The matrix displacement or Stiffness Method:** Conditions of stress-strain relationships, equilibrium and compatibility, Application for trusses, continuous beams and rigid frames.

**UNIT III**

**Direct Stiffness Method:** Derivation of global matrix from energy considerations, transformation matrices, member stiffness matrix with respect to member coordinate system, member stiffness matrix for global coordinates and global stiffness matrix. Displacement boundary conditions.

**UNIT IV**

**Finite Element Method:** Introduction and basic concepts. Energy approach and variation principles in Finite-Element Method, Various element shapes, 1-D bar element

**Text Books:**

2. Matrix Analysis of Framed Structures, Gere and Weaver, CBS Publishers & Distributors.
3. Basic Structural Analysis, C.S. Reddy, Tata McGraw Hill Publication.

**Reference Books:**

1. Matrix method of Analysis, Martin, McGraw Hill Book Company, New York.

Structural Analysis - A Unified Approach, D.S. Prakash Rao, Tata McGraw Hill Publishing Co., New Delhi.

**NOTE: 1.** For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.** The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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## CE 374C : DOCK AND HARBOUR ENGINEERING B. Tech. 3<sup>rd</sup> Year (Semester – VI)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>4</b>	<b>-</b>	<b>--</b>	<b>4</b>	<b>Examination</b>	<b>: 75Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration</b>	<b>of : 3 Hours</b>
				<b>Examination</b>	

**COURSE OUTCOMES:** at the end of this course the students will be able to

1. Understand historical development and general concepts of design of ports and harbors.
2. Learn fundamentals of dock and harbor planning.
3. Design of break waters and berthing structures.
4. Carry out maintenance of Dock structures.

	PO1	PO2	PO3	PO4	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	3	3	2	3	2	3	3	2	2	3	3
CO2	2	2	2	1	3	1	2	3	3	1	3	3	2
CO3	3	3	3	3	2	3	3	3	3	2	2	3	3
CO4	2	3	3	3	3	3	2	3	3	2	2	3	3

### UNIT – I

**Growth and regulation of Ports:** History of Port – Classification of Harbours - Factors affecting the growth of Port. - Requirement of a Harbour- General Planning Port capacity –traffic analysis - Berth occupancy – financial evaluation - EIA -Description of selected Indian ports.

### UNIT – II

**Harbour Planning (Technical):** Site investigation – harbour entrance - Navigational Channel – Depth of harbour – Turning basin – Anchor basin – berthing area – Storage area - Shipping terminal facilities – Essentials of passenger terminal, dry bulk cargo terminal, Liquid bulk cargo terminals and container terminals.

### UNIT – III

**Introduction to ocean waves** – Wave transformation – Wave and wind climate inside Harbour.

**Break waters:** Types – Factors determining their selection – Forces on break waters – Design of rubble mound and vertical break waters – Physical Model Studies.

**Berthing structures** – Types – Loads – Selection of berthing structures – Design principles of diaphragm walls, dolphins and piles.

### UNIT – IV

**Selection and Design principles** of Dock fenders and Mooring accessories.

**Design principles of dock structures** - Graving dry dock – Slip way – floating dry dock.

## Monitoring and repair of harbour structures - Dredging - Navigational aids – Light house.

### Text Books

1. Harbour and Coastal Engineering (Indian Scenario) Vol - I & Vol – II; S. Narasimhan & S. Kathioli, NIOT- Chennai
2. Design and construction of Port and marine Structures – Alonzo Def. Quinn – McGraw – Hill book Company

### References

1. IS: 7314 1974 - Glossary of terms relating to Port and harbour Engineering.
2. IS: 4651 - Code of practice for Planning and Design of Port and harbour (Part – I) Site Investigation, (Part – II) Earth Pressure, (Part – III) Loading, (Part – IV) General Design Consideration, (Part – V) Layout and functional Requirement.

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**2.** The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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### CE376C: AIRPORT PLANNING AND DESIGN OF AIRFIELD PAVEMENTS

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>4</b>	<b>-</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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### COURSE OUTCOMES:

After completion of this course the students will be able to:

1. Prepare layout for airport, runway, taxiway and apron.
2. Design geometrics of various airport components.
3. Design of airfield pavements.

#### UNIT I

**Airport Engineering:** Brief history of air transport: Aircraft characteristics. Airport site selection, various surveys for site selection. Classifications of obstructions, Imaginary surfaces, Approach zone and turning zone. Runway orientation, basic runway length, corrections for elevation, temperature & gradient, airport classifications.

#### UNIT II

**Airport Design:** runway geometric design, airport capacity, factors controlling taxiway layout, geometric design standards for taxiway holding aprons. Terminal area, building area, parking area, apron, hanger typical airport layouts. LCN/PCN method of rigid pavement design. Trend growth of Domestic Air Traffic in India, Air Cargo.

#### UNIT III

**Air traffic control aids:** visual aids, marking and lighting of runway and apron area, wind and landing direction indicator

#### 1. UNIT IV

**Design of flexible and rigid runways:** Factors affecting design and performance of airport pavements. Design procedure, Specifications for the different layers of runway and taxiway pavements, Pavement management systems for runway pavements.

## **2. Reference Books**

1. Airport Engineering by Harnjeff, McGraw Hill Inter. Publisher
2. Khanna, Arora & Jain, Airport Planning and Design, Nem Chand & brothers

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**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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## CE 401C :PROJECT

### B. Tech. Semester - VII (Civil Engineering)

L	T	P	Credits	Class Work	:	75 Marks
--	--	12	6	Examination	:	225 Marks
				Total		100Marks

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The primary objective of this course is to develop in students the professional quality of synthesis employing technical knowledge obtained in the field of Engineering & Technology through a project work involving design, analysis augmented with creativity, innovation and ingenuity.

Project involving design/ fabrication/ testing/ computer simulation/ case studies etc. will be evaluated through a panel of examiners consisting of the following:

Chairman of Department	:	Chairperson
Project coordinator	:	Member Secretary
Respective project supervisor	:	Member

The student will be required to submit two copies of his/her project report to the department for record (one copy each for the department and participating teacher).

Project coordinator will be assigned the project load of maximum of 2 hrs. per week including his own guiding load of one hr. However, the guiding teacher will be assigned maximum of one period of teaching load irrespective of number of students/groups under him/her.

The format of the cover page and the organization of the body of the report for all the B.Tech.will be finalized and circulated by the Dean, Faculty of Engineering and Technology.

## CE 403C : COLLOQUIUM

### B. Tech. 4<sup>th</sup> Year (Semester -VII)

L	T	P	Credits	Class Work	:	50Marks
-	-	2	1	Total	:	50 Marks

**Course Outcomes:** This course will enable a student to develop presentation skills in him/her

A student will select a topic in emerging areas of Engineering & Technology and will carry out the task under the observation of a teacher assigned by the department.

He/ She will give a seminar talk on the same before a committee constituted by the chairperson the department. The committee should comprise of three faculty members from different specializations. The teacher associated in the committee will be assigned 2 hours teaching load per week.

However, guiding students' colloquium will not be considered towards teaching load.

The format of the cover page and the organization of the body of the seminar report for all the undergraduate programs will be finalized and circulated by the Dean, Faculty of Engineering and Technology.

## CE405C PROFESSIONAL TRAINING

### B. Tech. Semester – VII (Civil Engineering)

L	T	P	Credits	Class Work	: 50 Marks
--	--	2	1	Total	: 50 Marks

At the end of 6<sup>th</sup> semester each student would undergo four weeks Professional Training in an Industry/ Institute/ Professional Organization/ Research Laboratory etc. with the prior approval of the Training and Placement Officer of the University and submit in the department a typed report along with a certificate from the organization.

The typed report should be in a prescribed format.

The report will be evaluated in the V Semester by a Committee consisting of three teachers from different specialization to be constituted by the Chairperson of the department. The basis of evaluation will primarily be the knowledge and exposure of the student towards different processes and the functioning of the organization.

The student will interact with the committee through presentation to demonstrate his/her learning.

Teachers associated with evaluation work will be assigned 2 periods per week load.

### CE 407C: INTERNSHIP

L	P	Credits	Class Work	: 300 Marks
-	-	14	Examination	: 300 Marks
			Total	: 600 Marks
			Duration of Examination	: 3 Hours

#### INTERNSHIP GUIDELINES:

1. A student may opt for one semester (minimum 16 weeks) industrial training-cum-Project of 7<sup>th</sup> semester in lieu of subjects of 7<sup>th</sup> Semester. A student can arrange the internship at his/her own and arranging internship for a student by the Department is never his/her right.
2. The candidate should submit a synopsis of the proposed work to be done during Internship programme/Industrial project. This synopsis should be submitted to the Department before the start of the internship semester. The synopsis received will be examined/evaluated by the Departmental committee. The student will be allowed for internship only after approval of synopsis by the Departmental committee.
3. Intimation of commencement of internship shall be submitted to the Chairperson concerned before the commencement of the ongoing semester.
4. Students will be allowed only for the internship sponsored by Govt/public sector organizations. They will have to further deposit the fee/due of the University during six semester internship. The internship will be allowed within India only. However, the students in reputed private companies will be given consent after due consideration in the Department.
5. If a student feels that the internship work is not of high quality/not-related to their field of interest, then he/ she should submit the application to the Department within two weeks and can re-join the institute.
6. The Industrial project work done during 6-month internship program is equivalent to one semester of their B.Tech. Two guides will supervise the internship project work, one from the Department and another one from industry.
7. Students will have to submit a detailed project report and daily diary after completing the internship which will be University property.
8. Industry/Educational Organization must submit the month-wise satisfactory attendance of the students to the Department.
9. Candidate should visit the institute in the specified dates of mid-term evaluation to present his/her project progress report to their respective guide(s)/Departmental committee.

10. Industry/ Institute should allow the student to produce results obtained during project/ internship period in the project report. The written certificate to this effect from the industry/ institute is mandatory before consideration of the proposed project/internship.
- 11 The final project presentation will be evaluated by institute guide/departmental committee on the basis of the recommendation given by outside supervisor.
12. If the internship project is not found to be of high quality, the student will have to reappear in the next session.

### **INTERNSHIP REPORT**

After completion of Internship, the student should prepare a comprehensive report to indicate what he/She has observed and learnt in the training period. The student may contact Industrial Supervisor/ Faculty Mentor for assigning special topics and problems and should prepare the final report on the assigned topics. Daily diary will also help to a great extent in writing the industrial report since much of the information has already been incorporated by the student into the daily diary. The training report should be signed by the Internship Supervisor and Faculty Mentor. The Internship report will be evaluated on the basis of following criteria: i. Originality. ii. Adequacy and purposeful write-up. iii. Organization, format, drawings, sketches, style, language etc. iv. Variety and relevance of learning experience. v. Practical applications, relationships with basic theory and concepts taught in the course.

The evaluation of Internship will be done by following departmental committee:

- |   |                    |
|---|--------------------|
| 1. Chairperson / Head of Department/Nominee | :Chairperson       |
| 2. Internship Coordinator/Senior Faculty    | : Member-Secretary |
| 3. Faculty mentor                           | :Member(s)         |
| 4. External expert/Industrial Expert        |                    |

### **MONITORING & EVALUATION OF INTERNSHIP**

The industrial training of the students will be evaluated in three stages:

1. Evaluation by Industry. 100
2. Evaluation by faculty supervisor on the basis of site visit(s): 150
3. Mid term evaluation: 150
4. Evaluation through seminar presentation/viva-voce at the Institute. 200

**1. EVALUATION BY INDUSTRY:** The industry will evaluate the students based on the Punctuality, eagerness to learn, Maintenance of Daily Diary and skill test in addition to any remarks.

**2. MONITORING/ SURPRISE VISIT BY FACULTY MENTOR:** Faculty Mentor of the institutes will make a surprise visit to the internship site, to check the student's presence physically, if the student is found absent without prior intimation, entire training will be cancelled. Students should inform the faculty mentor as well as the industry supervisor at least one day prior to availing leave by email. Students are eligible to avail 1-day leave/month.

**3. EVALUATION THROUGH SEMINAR PRESENTATION/VIVA-VOCE AT THE INSTITUTE:**

The student will give a seminar based on his training report, before a committee including external expert.

The evaluation will be based on the following criteria: • Quality of content presented. • Proper planning for presentation. • Effectiveness of presentation. • Depth of knowledge and skills. • Attendance record, daily diary.

Seminar presentation will enable sharing knowledge and experience amongst students and build communication skills and confidence in students.

Internship coordinator will be assigned the load of maximum of 2 hrs. per week. However, the guiding/supervising teacher will also be assigned one period of teaching load if the numbers of students are 4. If number of students exceeds 4, the load assigned will be 2.

## CE402C IRRIGATION ENGINEERING

B. Tech. 4<sup>th</sup> Year (Semester - VIII)

L    T    P    Credits  
3    -    --    3

Class Work                   : 25 Marks  
Examination                 : 75Marks  
Total                            : 100 Marks  
Duration of Examination   : 3 Hours

### Course Outcomes :

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

CO1	The students gain the knowledge needed on hydrologic cycle and precipitation, design of rain gauge station and estimating of various losses of precipitation.
CO2	The students will understand the basics of groundwater and hydraulics of subsurface flows.
CO3	Analyze the water requirement of crops, capacities of Distributaries and Canal.
CO4	Design a canal irrigation system, cross drainage works and their objectives, analyzes damstructures.

### Prepare CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO4	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	1	2	2	2	2	3	2
CO2	2	2	2	1	-	-	2	1	2	2	3	3
CO3	2	2	3	1	1	1	2	2	2	1	3	2
CO4	2	2	3	1	1	2	2	1	2	2	3	2

### Unit I

**HYDROLOGY:** Hydrologic cycle, Precipitation: introduction, forms of precipitation, types of precipitation, measurement of precipitation, selection of rain gauge station. Hyetograph and mass curve of rainfall, Evaporation: Definition, factors affecting, measurement, evaporation control. Evapo-transpiration, Infiltration.

Definition, components of hydrographs, unit hydrograph, base flow separation, Prepositions of unit hydrograph-problems.

Types of Aquifers - Darcy's Law - Dupuit's Assumptions - Confined Aquifer - Unconfined Aquifer - Recuperation Test - Transmissibility - Specific Capacity - Pumping Test - Steady Flow Analysis Only.

### Unit II

**Soil-water relationship and irrigation methods:** Soil-water relationship, root zone soil water, infiltration, consumptive use, field capacity, wilting point, available moisture in soil, Gross Command Area, Culturable Command Area, intensity of irrigation, delta, base period, Kor depth, core period, frequency of irrigation, duty of water, relation between delta, duty and base period, irrigation requirement, **Methods of Irrigation**-flooding methods, border strip method, check basin and furrow method, assessment of irrigation water, sprinkler irrigation system.

**Canal irrigation:** Component of canal distribution system, alignment of channels, losses in irrigation channels, design discharge, silt theories and design of alluvial channels, comparison of Kennedy's and Lacey's theories, canal section and design procedure, Garrets and Lacey's diagrams.

### Unit III

**Cross Drainage Works:** Classification and their selection, Hydraulic Design Aspects of Aqueducts, Syphon Aqueducts, Super Passage, Canal Syphon and Level Crossing, Design of Canal Transitions.

**Diversion Canal Headworks:** Various components and their functions, layout plan, selection of site for diversion headworks, Causes of failure of weir/barrages on permeable foundation, Bligh's creep theory, Khosla's method of independent variables, use of Khosla's curves, various corrections..

#### Unit IV

**Regulation works:** Canal falls-necessity and location, development of falls, design of cistern element, roughening devices. Design of Sarda type fall. Design of straight Glacis 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. **Dams:** Design principles for gravity and earthen dams

#### Text Books

1. Irrigation, Water Resources and Water Power Engg. by P.N. Modi.
2. Fundamentals on Irrigation Engg. by Bharat Singh

#### Reference Books

1. Irrigation Engg & Hydraulic Structures by S.K. Garg.
2. Irrigation Engg. by S.K. Sharma.

**NOTE: 1.** For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.** The students will be allowed to use non-programmable scientific calculator. However, sharing / exchange of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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### CE 404C : ENVIRONMENTAL ENGINEERING – II

#### B. Tech. 4<sup>th</sup> Year (Semester – VIII)

**L T P Credits**  
3 0 -- 3

**Class Work : 25 Marks**  
**Examination : 75 Marks**  
**Total : 100 Marks**  
**Duration of Exam. : 3 Hours**

#### 1. Course outcomes:

Upon successful completion of the course students will be able to

CO1	Determine the characteristics of sewage, its variation in flow due to weather and design of sewer.
CO2	Design sewage treatment units and understand their operation and maintenance.
CO3	Plan the most appropriate techniques' for the wastewater disposal on land and in to groundwater.
CO4	Design the low cost wastewater treatment units for sewage disposal.

#### 2. Prepare CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO3	PO4	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	1	3	3	1	3	2	3	3	3	3
CO2	3	3	3	2	3	3	2	3	1	3	2	3	3
CO3	3	3	3	3	3	3	3	2	3	3	3	2	1

CO4	3	2	3	3	3	3	3	3	3	3	3	3	3
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**Enter correlation levels 1, 2 or 3 as defined below:**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put “-”

**UNIT – I**

**Sewerage system:** Generation and Estimation of Community Sewage; Flow variations; Storm Water flow; Alternate systems for sewage collection and conveyance; Design of sewers; operation and maintenance of sewers,

**Characterization of sewage:** Parameters for characterization; Sampling, testing and analysis of sewage; Relative stability and population equivalent; BOD and BOD kinetics.

**UNIT – II**

**Treatment of sewage:** Effluents standards; Basic principles of sewage treatment; Introduction to unit operations and processes - primary treatment units such as screening, grit chamber, and Sedimentation tanks. Secondary treatment units such as different types of aerobic suspended and attached growth systems, and tertiary treatment Sludge Handling and disposal – thickening, stabilization, dewatering, drying and disposal

**UNIT – III**

**Sewage treatment units design:** ASP, TF, and Pollution due to improper disposal of sewage, Government authorities and their roles in sewerage disposal

**Treated effluent disposal:** Disposal into surface water bodies; Reuse for irrigation and aqua-culturing; Land disposal; Disposal through injection into groundwater, Indian standards for disposal of effluent.

**UNIT – VI**

**Low cost sanitation systems** – Imhoff tanks, septic tank, stabilization ponds; oxidation ponds; and constructed wetland systems.

**Pumping:** Sewage pumping and pumping stations, Sewer connections for houses and buildings, Sewer appurtenances; Construction, testing and Maintenance of sewers;

**Text 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.

**References Books**

1. Environmental Engineering Peavy, Rowe and Tchobanglous, McGraw Hill.
2. Water and Waste Water Engineering (Vol. 1&2), Fair, Geyer & Okun, John Wiley, New York.
3. Water Supply Engineering P.N. Modi, Standard Book House New-Delhi.
4. Standard Methods for the Examination of Water and Waste Water, American Public Health Association

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE: For examiner for paper setting:-** In semester examinations, examiner is required to set up question paper covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

**ECE 406C :INSTRUMENTATION AND SENSOR TECHNOLOGIES FOR CIVIL  
ENGINEERING APPLICATIONS  
B. Tech. 4<sup>th</sup> Year (Semester – VIII)**

**L    T    P    Credits**  
**3    0    --    3**

**Class Work                    :    25 Marks**  
**Examination                :    75Marks**  
**Total                            :    100**  
**Marks**  
**Duration                      of    :    3 Hours**  
**Examination**

**Course Outcomes:**

- Understand the principles of operation and characteristics of instrumentation and integrated sensor systems
- Understand right use of sensors and instruments for differing applications along with limitations
- Recognize and apply measurement best practice and identify ways to improve measurement and evaluation
- Troubleshoot and solve problems in instrumentation and measurement systems and to instill and encourage a questioning culture.

**Unit-I**

*Fundamentals of Measurement and Transducers:* Measurement and measuring system, Significance of measurements, methods of measurement, Direct and indirect methods: Classification of instrument, Application of measuring system. Transducers: Introduction, primary and secondary transducers, Active and passive transducer, analog and digital transducer.

**Unit-II**

*Transducers Technologies and Data acquisition:* Types of Transducers: Measurement of Strain :Strain Gauge, Stress-Strain relationship, Thermocouples, Measurement of vibration: LVDT, RVDT, Measurement of Thickness, capacitive & resistive transducers, piezo-electric transducers, Hall Effect Transducers, Opto-Electronic Transducers, transducers. *Data acquisition:* Data Acquisition Systems, Analog/Digital/Analog conversion Techniques, General consideration of A/D and D/A conversion, A/D and D/A convertors,.

**Unit-III**

*Sensing and Instrumentation:* Introduction, Basics of Sensors, Primary Sensing Elements, calibration of measuring sensors and instruments: principles of calibration, control of calibration environment, Smart sensors, communication & computation in smart sensors.

**Unit-IV**

*Application of Sensor Technologies:* Success stories related to: RFID use at Toll plaza, traffic signal regulation, beam defects detection, stress-strain measurements, automobile speed regulation.

**Text/Reference Books:**

1. A.K Sawhney(1997), Electrical & Electronics Measurement and Instrumentation ,Dhanpat Rai & Co. Ltd.
2. Alan S Morris (2001), Measurement and Instrumentation Principles, 3rd/e, Butterworth Hienemann
3. S K Singh, Industrial Instrumentation and Control, 3rd/e ,Tata McGraw Hill
4. S. Tumanski (2006), Principle of Electrical Measurement, Taylor & Francis
5. J.S. Saini, Text Book of Measurements and Instrumentation, New Age International Publishers

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE:** For examiner for paper setting:- In semester examinations, examiner is required to set up question paper covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

### CE406C : DISASTER MANAGEMENT

#### B. Tech. 4<sup>th</sup> Year (Semester - VIII)

L	T	P	Credits	Class Work	: 25 Marks
3	-	--	3	Examination	: 75Marks
				Total	: 100 Marks
				Duration of Examination	: 3 Hours

#### Course Outcomes :

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

CO1	Knowledge of the significance of disaster management,
CO2	Analyze the occurrences, reasons and mechanism of various types of disaster
CO3	Understand the preventive measures as Civil Engineer with latest codal provisions
CO4	Apply the latest technology in mitigation of disasters

#### Prepare CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO3	PO4	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	2	1	-	1	1	1	-	2	3	2
CO2	3	3	1	2	1	1	1	1	2	1	1	1	3	2
CO3	2	2	3	2	2	2	-	1	-	2	-	2	3	2
CO4	2	2	3	1	1	1	2	1	1	1	-	2	3	2

#### Unit-I

**Introduction to Disaster Management:** Disaster, Emergency, Hazard, Mitigation, Disaster Prevention, Preparedness and Rehabilitation, Risk and Vulnerability, Classification of Disaster, Natural and Man-made Disasters, International day and Decade of Disaster Reduction.

**Risk and Vulnerability to disaster mitigation and management options:** Warning and Forecasting.

#### Unit-II

**Hydro-meteorological based disasters I:** Disaster Management Act 2005, Role of NDMA, NDRF, NIDM, Tropical Cyclones, Floods, droughts, mechanism, causes, role of Indian Metrological Department, Central Water Commission, structure and their impacts, classifications, vulnerability, Early Warning System, Forecasting, Flood Warning System, Drought Indicators, recurrence and declaration, Structural and Non-structural Measures.

**Hydro-meteorological based disasters II:** Desertification Zones, causes and impacts of desertification, Characteristics, Vulnerability to India and Steps taken to combat desertification, Forest Fires; Causes of Forest Fires; Impact of Forest Fires, Prevention.

#### Unit-III

**Geological based disasters:** Earthquake, Reasons, Compression, Shear, Rayleigh and Love Waves; Magnitude and Intensity Scales, Direct and Indirect Impact of Earthquake; Seismic Zones in India, Factors, Indian Standards Guidelines for RCC and Masonry Structures, Prevention and Preparedness for

Earthquake, Tsunamis, Landslides and avalanches: Definition, causes and structure; past lesson learnt and measures taken; their Characteristic features, Impact and prevention, Atlas (BMTRPC); structural and non structural measures.

#### Unit-IV

**Manmade Disasters I:** Chemical Industrial hazards; causes and factors, pre- and post disaster measures; control ; Indian Standard Guidelines and Compliance;

Traffic accidents; classification and impact, Fire hazards; Classification as per Indian Standards; Fire risk assessment; Escape routes; fire fighting equipments; classification of buildings, fire zones, occupancy loads; .capacity and arrangements of exists,

**Use of remote sensing and GIS** in disaster mitigation and management.

#### Text Books

1. Thomas D. Schneid., Disaster Management and Preparedness, CRC Publication, USA, 2001
2. Patrick Leon Abbott, Natural Disasters, Amazon Publications, 2002
3. Ben Wisner., At Risk: Natural Hazards, People vulnerability and Disaster, Amazon Publications, 2001
4. Oosterom, Petervan, Zlatanova, Siyka, Fendel, Elfriede M., “Geo-information for Disaster Management”, Springer Publications, 2005
5. Savindra Singh and Jeetendra Singh, Disaster Management, Pravalika Publications, Allahabad
6. Nidhi GaubaDhawan and AmbrinaSardar Khan, Disaster Management and Preparedness, CBS Publishers & Distribution

#### Reference Books

1. Selected Resources Published by the National Disaster Management Institute of Home Affairs, Govt. of India, New Delhi.

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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#### CE 408C : ENVIRONMENTAL ENGINEERING – II LAB

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>:</b>	<b>25 Marks</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>Practical</b>	<b>:</b>	<b>75Marks</b>
				<b>Total</b>	<b>:</b>	<b>100 Marks</b>
				<b>Duration of Exam.</b>	<b>:</b>	<b>3 Hours</b>

#### Course objectives:

To study about the physical and chemical characteristics of wastewater.

To study the test procedures and measurement of concentration of waste water parameters.

#### Course outcomes:

**Upon successful completion of the course students will be able to**

CO1	Determine the characteristics of sewage and their concentration.
CO2	Measure the sewage parameters.

1. Prepare CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO4	PO6	PO7
CO1	2	3	3	3	3
CO2	2	3	3	3	3

**Enter correlation levels 1, 2 or 3 as defined below:**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put “-”

### **List of Experiments**

1. Physical Characterization of wastewater: Turbidity, Electrical Conductivity, pH
2. Analysis of solids content of water: Dissolved, Settleable, suspended, total, volatile, inorganic etc.
3. Alkalinity
4. Analysis of ions: chloride
5. Analysis of ions: sulfate
6. Chemical Oxygen Demand (COD)
7. Dissolved Oxygen (D.O) and
8. Biochemical Oxygen Demand (BOD)
9. Determination of SVI (including MLSS and MLVSS estimations).
10. Determination of Nitrite and Nitrate nitrogen.
11. Visit to waste water treatment plant.

### **CE410C: SOFTWARE APPLICATIONS IN STRUCTURE/EARTHQUAKE ENGINEERING LAB**

<b>L</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
	<b>04</b>	<b>2</b>	<b>Examination</b>	<b>: 75 Marks</b>

**Duration of Exam 3 Hrs**

**Course Objectives:** To study the design and detailing software tools.

**Course Outcomes:** At the end of the course, students will be able to use the software like Auto Cad and Staad Pro effectively.

### **Syllabus Content:**

1. Design of beams using excel work sheets
2. Design of columns using excel work sheets
3. Modeling of structures usinge-tab
4. Modeling of structures using Staad Pro
5. Loading over structures using Staad Pro
6. Loding over structures usinge-tab
7. Assigning Load-combinations over structures using Staad Pro
8. Assigning Load-combinations over structures usinge-tab
9. Designing structures using Staad Pro

10. Designing structures using tab
11. Design and detailing of G+5 storey building considering all the loads as per IS Codes.

**Note 1: The students will be required to carry out the design of the G+5 storey's individually with different layout of the building in the software. All the structural drawings (prepared using Auto Cad) and design report (prepared in MS Excel and word) should be submitted at the end of the semester. Students should develop the design sheets for various structural components in MS Excel.**

**CE412C: SOFTWARE APPLICATIONS IN HIGHWAY ENGINEERING LAB**

<b>L</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>25 Marks</b>
	<b>4</b>	<b>2</b>	<b>Examinations</b>	<b>75 Marks</b>
			<b>Duration of Exam</b>	<b>3 Hrs</b>

**COURSE OBJECTIVES**

1. To study various drafting and road design software.
2. To perform road design using software.

**List of experiments:**

1. Basics of AutoCAD
2. Alignment Design using MXRoad
3. Horizontal Alignment using MXRoad
4. Vertical Alignment using MXRoad
5. L-Section, cross section and earth work calculations using MXRoad
6. Design of pavement using IIT Pave
7. Introduction to GIS software
8. Introduction to Traffic simulation software: VISSIM/VISSUM and other software in Highway Engineering
9. Analysis of accident data using excel worksheets
10. Statistical modeling using SPSS

**Notes:**

1. Each Laboratory Class/Section shall not be of more than about 20 students.
2. To allow fair opportunity of practical hands-on experience to each student, each experiment may either be done by each student individually or in a group of not more than 3-4 students. Larger groups be strictly discouraged / disallowed.
3. Pre-experimental & post experimental quiz / questions may be offered for each Lab experiment to reinforce & aid comprehension of the experiment.

**COURSE OUTCOMES**

After completion of this students will be able to

1. Acquire understanding of various drafting and designing capacities of software.
2. Design horizontal and vertical alignment
3. Understand the importance of GIS in highway designs

**ECE486C Instrumentation & Sensor Technologies for Civil Engineering Applications lab**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>	<b>Examination</b>	<b>: 75</b>
				<b>Total</b>	<b>: 100</b>
				<b>Duration of Exam</b>	<b>: 3 Hours</b>

## LIST OF EXPERIMENTS:

1. Measurement of Displacement using LVDT.
2. Measurement of Distance using LDR.
3. Measurement of Temperature using R.T.D.
4. Measurement of Temperature using thermocouple.
5. Measurement of weight using Strain Gauge.
6. Measurement of Pressure using piezo-electric pick up.
7. Measurement of Distance using Inductive and Capacitive pick up.
8. To measure pressure using Pressure transducer.
9. Measurement of Speed of DC motor using Magnetic pick up.
10. To measure frequency and time period of given waveform using frequency meter.

### Text/Reference Books:

1. A Course in Electrical and Electronics Measurements and Instrumentation by A.K.Sawhney, Dhanpat Rai & Sons
2. Electronics Measurements and Instrumentation Techniques by Helfrick & Cooper, Pearson Education, 2015.
3. J.S. Saini, Text Book of Measurements and Instrumentation, New Age International Publishers

**Course Outcomes:** At the end of the course, students will be able to:

1. Students get hands on training on various transducers used in various industrial applications.
2. They will understand apt use of all the principles of a transducer for proper design and improvement in various transducers applications.
3. They learn to explore the various aspects of measurement and applications of CRO.
4. The students will become creative and will channelize and mobilise their skills for underdeveloped instrumentation sectors like rural areas.

### Note:-

1. Atleast seven experiments should be performed from above list and remaining experiments can be performed using available infrastructure in concerned subject.
2. Each laboratory class/section shall not be more than about 20 students.
3. To allow fair opportunity of practical hands on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups be strictly discouraged/disallowed.

## GFCE 402C: GENERAL FITNESS FOR THE PROFESSION

### B. Tech. Semester – VIII (Civil Engineering)

L	T	P	Credits	Examination	: 75 Marks
--	--	--	-	Total	: 75 Marks

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The purpose of this course is to inculcate a sense of professionalism in a student along with personality development in terms of quality such as receiving, responding, temperament, attitude and outlook. The student efforts will be evaluated on the basis of his/ her performance / achievements in different walks of life.

The evaluation will be made by the committee of examiners constituted as under:

1. Chairperson
2. External Expert
3. Student Coordinator

**A. The student will present a written report before the committee with following in view:**

The student will present before the committee his/her achievements during the current academic session in the form of a written report highlighting followings:

- I. Academic Performance (10Marks)
- II. Extra Curricular Activities / Community Service, Hostel Activities (10 Marks)
- III Technical Activities / Industrial, Educational tour (10 Marks)
- IV Sports/games (10Marks)

**Note:** Report submitted by the students should be typed on both sides of the paper.

**B. A student will support his/her achievement and verbal & communicative skill through presentation before the examiners. (15 Marks)**

**C. Faculty Counselor Assignment (20 Marks)**

It will be the duty of the student to get evaluated by respective faculty counselor and to submit the counselor assessment marks in a sealed envelope to the committee.

A counselor will assess the student which reflects his/her learning graph including followings:

1. Discipline throughout the year
2. Sincerity towards study
3. How quickly the student assimilates professional value system etc.

**CE450C :BASICS OF COMPUTATIONAL HYDRAULICS**

**B. Tech. Final Year (Semester – VIII)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>-</b>	<b>--</b>	<b>3</b>	<b>Examination</b>	<b>: 75Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

**Course Outcomes**

On completion of the course the student will be able to

1. Understand basics of Computational Hydraulics and various numerical methods.
2. Understand various type of flows, flow through pipe and channels.
3. Understand Ground water flow, surface water flow.
4. Understand concept of pressurized Conduits and various types of losses in pipe flow.

**UNIT - I**

**Introduction:** Computational hydraulics in the context of civil engineering problems. e.g., groundwater flow, open channel flow and flow in closed conduits.

**Numerical Methods:** Overview and Mesh Generation, Finite Difference Method, Finite Volume Method, Mesh Reduction Methods, Traditional method, reservoir routing, Richardson extrapolation, higher order method

**UNIT II**

Conservation Laws, Critical Flows, Uniform Flows, Gradually Varied Flows, Rapidly Varied, Unsteady Flows, Flow through pipe and channels.

**UNIT- III**

Groundwater Flow, Surface Water Flow: Open Channel Flow, Surface Flooding, Over Hydraulic Structures

**UNIT- IV**

Flow in pressurized conduits, interaction of different types of flow, various types of losses in pipe flow.

**References**

1. Abbott M.B., Minns A.W., (1979) Computational Hydraulics, London: Pitman
2. Chaudhry M H, Applied Hydraulic Transients (2014), Springer, New York.
3. Chaudhry M H, Open-Channel Flow (2008), 2nd edition, Springer, New york.

4. Christopher G Koutitas, (1983) Elements of Computational Hydraulics, Pentech Press, London.
5. Chung T. J., (2002) Computational Fluid Dynamics, Cambridge University Press, Cambridge.
6. Cunge J.A., Holly F. M., Verway A., (1980) Practical Aspects of Computational River Hydraulics, Pitman Publishing Ltd. Melbourne.
7. Ferziger J. H., Peric M. (2008) Computational Methods for Fluid Dynamics, 3rd Edition, Springer, New Delhi.
8. Jeppson R. (2011) Open Channel flow- Numerical Methods and Computer Applications, CRC Press, NW.

**BOOKS –**

1. Computational Hydraulics-**John Fenton**
2. Computational Hydraulics - **Vreugdenhil, Cornelis B**

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**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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**CE 452C : DESIGN OF PRESTRESSED CONCRETE STRUCTURES**

**B. Tech. 4<sup>th</sup> Year (Semester -VIII)**

L	T	P	Credits	Class Work	: 25 Marks
3	-	--	3	Examination	: 75Marks
				Total	: 100 Marks
				Duration of Examination	: 3Hours

**Course Outcomes :**

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

CO1	Use the concepts of pre-stressed concrete systems, dealing with load analysis.
CO2	Analyse prestress losses due to creep, shrinkage etc.
CO3	Analyze and design pre-stressed concrete members such as slabs and beams.
CO4	Design the compression and tension members using prestress methodology.

**Prepare CO-PO/PSO Articulation Matrix, e.g.:**

	PO1	PO2	PO3	PO4	PO6	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	1	1	1	2	2	2	2
CO2	2	2	1	2	1	-	2	2	1	1	2	2
CO3	3	2	2	1	1	1	-	2	2	1	2	2
CO4	2	2	2	1	1	1	2	1	2	2	2	2

**UNIT I**

**Introduction:** Basic concepts of prestressing, terminology, advantages and applications of prestressed concrete. Materials for Prestressed Concrete: High strength Concrete, permissible stresses in concrete, high strength steel, permissible stresses in steel. **Prestressing Systems:** Prestensioning and post tensioning systems, various types of tensioning devices, Lec-Macall systems, MagnelBlaton post tensioning, Freyssinet systems, Gifford Udal system.

**UNIT II**

**Losses of Prestress :** Types of losses of prestress, loss due to elastic deformation of concrete, loss due to shrinkage of concrete, loss due to creep of concrete, loss due to relaxation of stress in steel, loss due to friction, loss due to anchorage slip, total loss in pretensioned and post tensioned members. **Analysis of Prestress and Bending stresses:** Basic assumptions, resultant stresses at a section, concept of load balancing, cracking moment.

**UNIT III**

**Deflections:** Factors influencing deflections, short term deflections of un-cracked members, deflections of cracked members, prediction of long term deflections.**Shear and Torsional Resistance:** Ultimate shear resistance of prestressed concrete members, prestressed concrete members in torsion, design of reinforcements for torsion, shear and bending.

#### UNIT IV

**Design of Flexural Members:** Dimensioning of flexural members, design of pre-tensioned and post tensioned beams, design of partially prestressed members, design of one way and two way slabs, continuous beams.Design for axial tension, compression and bending, bond and bearing.

#### Text Books

1. Prestressed Concrete by N. Krishna Raju, TMH Publishing Company, New Delhi,
2. Prestressed Concrete by P. Dayartnam, Oxford and IBH Publication, New Delhi.

#### Reference books

- 1.Design of PrestressedConcreet Structures by T Y Lin& Ned H. Burns

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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### CE 454C :CONTRACT MANAGEMENT

#### B. Tech. 4<sup>th</sup> Year (Semester-VIII)

L T P Credits  
3 -- -- 3

Class Work : 25 Marks  
Examination : 75 Marks  
Total : 100 Marks  
Duration of Examination : 3 hours

#### Course Outcomes:

Students will know about

- 1: Quantity surveying before contract management.
- 2:Various disputes that could arise in construction and dispute resolution technique like arbitration.
- 3:Labour management.
- 4:Different components of contract.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	3	2	2	3	2	1	1	3	2	2	2
CO2	1	1	-	-	2	3	2	3	2	3	1	3	3	3	3
CO3	1	1	-	-	3	3	2	1	2	3	2	3	3	3	3
CO4	1	1	-	-	1	2	2	2	1	1	2	3	2	3	3

#### Unit-I

**Quantity Surveying:** Basic principles of estimating. Construction costs. Different methods and stages of estimating.Specification of construction items and method of statement.Principles of rate analysis and valuation.

#### Unit-II

**Claims and Arbitration:** Indian contract act and arbitration act. Variations in work and conditions. Claims and disputes. Liquidated damages. Rights. Responsibilities and duties of client (Owner). Architect. Engineer. Contractor etc. Purchase order as contracts insurance contract and claims.

### Unit-III

**Legal Frame Work of Construction:** Contract laborers act 1970 and other acts and laws relating to labor management. Wages. Bonus and Industrial disputes.

**Construction Contracts:** International contract rules and regulation.

### Unit-IV

**Contract Conditions:** Important contract clauses. Terms of payments. Retention. Acceptance and final payment. Time of completion. Extension of time. Maintenance period etc.

**Special Contracts:** BOT projects, Variation in BOT projects. Infra structural projects.

### Reference Books

1. Estimating and Costing by B.N. Dutta
2. Estimating and Costing by G.S. Birdie
3. Estimating and Costing by Chakaraborty

**NOTE: 1.** For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.** The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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## CE456C :ASSET MANAGEMENT

### B. Tech. 4<sup>th</sup> Year (Semester-VIII)

**L T P Credits**  
3 -- -- 3

**Class Work : 25 Marks**  
**Examination : 75 Marks**  
**Total : 100 Marks**  
**Duration of Examination : 3 hours**

### Course Outcomes:

Students will know about:

- 1: Basics of Asset Management.
- 2: Strategies of financing public works.
- 3: Performance modeling.
- 4: Role of concrete and steel in infrastructure

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	3	3	2	3	2	1	2	2	3	3	3
CO2	1	1	-	-	2	2	2	1	2	2	1	3	2	3	3
CO3	3	3	-	-	3	3	3	2	1	2	3	3	2	3	3

CO4	1	2	-	-	3	2	2	1	2	1	2	2	2	2	2
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### Unit-I

Basic discussion of concepts of infrastructure assets and their management, Performance of infrastructure assets, stakeholders involved, along with factors affecting the demand and supply of public works services; relating infrastructure and economic development;

### Unit-II

Strategies for financing public works; performance indicators and measures; Framework for Infrastructure Management: Design for reliability, maintainability, supportability, and service life; Inventory and database management; Condition assessment

Impact of failure, risk analysis, monitoring, performance, resilience, service life, repair, condition assessment, non-destructive testing and evaluation

### Unit-III

Performance modeling and failure analysis; Maintenance strategies, Life-cycle cost and benefits analysis; Introduction to the basic policies and initiatives of the Government in the area of infrastructure asset creation and management (JNNURM, Smart cities, etc.).

Case studies including Bridge Management Systems, Pavement Management System, Pipeline management, Hydro-system Asset Management

### Unit-IV

Concrete and Steel in Infrastructure – Concrete and Steel engineering practices , Quality control, Codal provisions, Durability of concrete and steel under special conditions, elevated temperature, nuclear emissions, extreme exposure conditions such as sea water attacks, freeze-thaw condition, ground water exposure, etc. Infrastructure Corrosion – Repair and Rehabilitation of Concrete and steel Structures, Non-destructive testing of concrete

### Reference Books:

1. Public Infrastructure Asset Management, Second Edition (P/L Custom Scoring Survey) by Waheed Uddin and W Ronald Hudson
2. Infrastructure Reporting and Asset Management: Best Practices and Opportunities by AdjoAmekudzi, Ph.D.; and Sue McNeil, Ph.D., P.E.
3. Asset Management for Infrastructure Systems- Energy and Water by Balzer, Gerd, Schorn, Christian
4. Public Infrastructure Asset Management by Waheed Uddin.
5. Infrastructure Management: Integrating Design, Construction, Maintenance, Rehabilitation, and Renovation by W. Ronald Hudson.

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

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### CE458C : GROUND IMPROVEMENT

#### B. Tech. 4<sup>th</sup> Year (Semester – VIII)

L	T	P	Credits	Class Work	: 25 Marks
3	-	--	3	Examination	: 75Marks
				Total	: 100 Marks
				Duration of Examination	: 3 Hours

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

CO1	Understand the need, mechanism and importance of ground improvement.
CO2	Apply appropriate method of ground improvement as per requirement of the soil properties.
CO3	Apply appropriate method of Soil Reinforcement, Anchored Earth or Soil Nailing, Grouting etc.
CO4	Design the reinforced earth retaining walls, abutments, earth slopes etc.

**CO-PO/PSO Articulation Matrix :**

	PO1	PO2	PO4	PO6	PO7	PO8	PO9	PO10	PO11	PSO2	PSO3
CO1	3	3	1	2	1	2	2	2	2	2	1
CO2	2	3	1	3	1	2	1	1	2	2	1
CO3	2	2	2	3	1	1	2	1	1	1	1
CO4	2	1	1	3	2	1	2	2	2	1	1

**UNIT I**

Introduction to different methods of ground improvement and its importance. Mechanical method of ground improvement, Ruthfuch method; methods based on PI.

Ground Freezing, methods, Hydrogeology of frozen soils, strength and behaviour of frozen soils. Ground heating, effect on soil properties, methods.

**UNIT II**

Drainage Techniques, filter drains, sand drains, sandwicks & band drains, lime columns. Electro-osmosis and Electrochemical stabilization.

Compaction & consolidation techniques viz. pre-compression, compaction piles, vibro-compaction (Vibro-floatation, Terra-probe, vibro-replacement, concrete columns & vibro-displacement), Dynamic compaction, explosive compaction.

**UNIT III**

Soil Reinforcement, load transfer mechanism, strength development, anchored earth. In-situ reinforcement techniques viz soil nailing, reticuled micropiles, soil dowels and anchors.

Grouts, properties, penetration, clay, cement clay, cement, clay-chemical, chemical and Bituminous grouts, grouting methods viz penetration, claquage, compaction & jet.

**UNIT IV**

Reinforced earth; Introduction, Mechanism of reinforced types of reinforcement strength characteristics. Design of reinforced earth retaining walls, abutments, earth slopes.

Exclusion techniques viz. sheet piles, contiguous bored piles, secant piles, slurry trenches. Diaphragm walls. Design of stone columns.

**Text Books**

1. Ground Improvement Techniques by P. Purushotham Raj, Tata McGraw Hill, ND.
2. Engineering Treatment of Soils by F.G. Bell, E & FN Spon Publishers, UK.

**Reference Books**

1. Engineering Principles of Ground Modification by M.R. Hausmann, McGraw Hill Publishers, New York.
2. Ground Improvement Techniques & their Evolution by W.F. Van Impe., A.A. Balkema Publishers, Netherlands.
3. Koerner, R.M., Construction & Geotechnical methods in foundation engineering, MGH, New York, 1985
4. Bowle's J.E., Foundation Analysis and design, 4th edition, MGL, 1998.
5. Jones. C.J.F.P., Earth reinforcement and soil structures, Butter worth & co., London, 1985
6. Arora. K.R., Soil mechanics and foundation Engineering, SPD, 2001

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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## CE 460C : RURAL WATER SUPPLY AND ONSITE SANITATION SYSTEMS

### B. Tech. 4<sup>th</sup> Year (Semester – VIII)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>		<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>-</b>	<b>--</b>	<b>3</b>		<b>Examination</b>	<b>: 75Marks</b>
					<b>Total</b>	<b>: 100 Marks</b>
					<b>Duration</b>	<b>of : 3 Hours</b>
					<b>Examination</b>	

#### Course outcomes:

**Upon successful completion of the course students will be able to**

CO1	Design schemes for rural water supply.
CO2	Design schemes for distribution of water in rural areas.
CO3	Identify the simple methods for waste water treatment.
CO4	Plan schemes for final disposal of solid waste generated from sludge.

#### Prepare CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO3	PO4	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	3	2	3	3	3	3	3	3
CO2	3	3	3	2	3	3	2	3	3	3	3	3	3
CO3	1	2	1	3	3	3	1	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3

#### Unit-I

Concept of environment and scope of sanitation in rural areas. Magnitude of problems of rural water supply and sanitation. Population to be covered, difficulties. National policy.

Water supply: Design population and demand loads. Various approaches of planning of water supply schemes in rural areas. collection of raw water from surface source. Specific practices and problems encountered in rural water supply. Relationships between diseases and water quality, hygiene and sanitation.

#### Unit-II

Improved methods and compact systems of treatment of surface and ground waters for rural water supply. Brief Details of multi-bottom settlers (MBS), diatomaceous earth filter, cloth filter, slow sand filter, chlorine diffusion cartridges. disinfection systems for rural areas, chlorination, Pumps, pipe materials, appurtenances and improved devices for use in rural water supply. Planning of distribution system in rural areas.

#### UNIT-III

Community and sanitary latrines. Various methods of collection and disposal of night soil.

Planning of waste water collection system in rural areas. Treatment and Disposal of waste water. Compact and simple waste water treatment units and systems in rural areas such as stabilization ponds, septic tanks, Imhoff tank, soak pit etc. Disposal of waste water soakage pits and trenches.

#### Unit-IV

Disposal of Solid Wastes. Composting, land filling, incineration, Biogas plants, sludge /seepage management systems. Rural health. Other specific issues and problems encountered in rural sanitation

#### Text Books

1. Excreta Disposal for Rural Areas and Small Communities. Wagner, Lanoix, WHO Publication.
2. Small Community water supplies - Holket (ed.) John Wiley & Sons.

#### Reference Books

1. Manual on Water Supply and Treatment - CPHEEO Govt. of India.
2. Water Treatment and Sanitation – Simple Method for Rural Area’ by Mann H.T. and Williamson D.
3. ‘Water Supply and Sewerage’, by E.W.Steel&T.J.Mcgee, McGraw Hill.
4. ‘Manual on Water Supply and Treatment’, CPHEEO, Mini. Of Urban Development, Govt. of India.
5. ‘Manual on Sewerage and Sewage Treatment’, CPHEEO, Mini. Of Urban Development, Govt. of India

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### CE462C :INFRASTRUCTURE PLANNING AND DESIGN

#### B. Tech. 4<sup>th</sup> Year (Semester-VIII)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>--</b>	<b>--</b>	<b>3</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 hours</b>

#### Course Outcomes:

Students will know about:

- 1: basics of Infrastructure development.
- 2: various level of infrastructure development.
- 3: human resettlement and rehabilitation.
- 4: non private organization in Infrastructure development.
- 5: environmental impact of infrastructure projects.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	2	3	3	1	3	1	2	3	3	3	3
CO2	1	1	-	-	2	2	3	1	2	2	2	3	2	3	3
CO3	1	1	-	-	1	3	3	2	2	2	2	3	2	2	2
CO4	1	1	-	-	3	2	3	2	2	1	2	3	3	3	3
CO5	1	2	-	-	2	3	3	2	2	2	3	3	2	2	2

## Unit-I

Meaning and scope of Infrastructure Development Management; Functions, components, stages and principles of Management in relation to Infrastructure Development, Infrastructure Development Issues at National, Regional and Human Settlement (Urban & Rural) levels. Process of decision making for Infrastructure development at National level, Infrastructure Development in India; policies, programmes and provisions in the National Five Year Plans, Recommendations of various committees, task forces and commissions from time to time.

## Unit-II

Various National level organizations related to Infrastructure Development in terms of their background, functions, powers, setup and resources (with some case studies). Process of decision making for Infrastructure Development at State level, State policies; programmes and provisions in the various Five Year Plans, various State level organizations related to Infrastructure development in terms of their background, functions, powers, set-up and resources (with some case studies).

## Unit-III

Process of decision making for Infrastructure Development at Human Settlements/local Level, Various local level organizations related to Infrastructure Development in terms of their background, functions, powers, set-up and resources (with some case studies).

Role of NonGovernment and Private Organizations in Planning and Development of Infrastructure and their relationships with Local and State Governments. Importance and methods of Public-Private Partnership (PPP); Public/Citizen participation in Infrastructure Planning and Development, its scope, methods and limitations.

## Unit-IV

Infrastructure planning process, and considerations for environmentally conscious plan. Environmental considerations in Infrastructure Planning. Environmental Impact Assessment: meaning, significance, parameters for EIA, framework; Environmental impact statement and related concepts, Techniques for Environmental Impact Assessment.

Strategies of preparation of Environment Plan of a city, Special surveyed and studies, Environment measures to be adopted in different areas.

### Text/Reference Books:

1. Kulwant Singh ed. "Integrated Urban Infrastructure Development in India".
2. Ganesan S. ed. (2001), "Infrastructure Development and Financing".
3. Centre for Science and Environment (CSE), Citizens Fifth Report, (1999)
4. Report of Task Force on Planning and Development of Small and Medium Town and Cities (1997), Government of India.
5. Ministry of Urban Affairs & Employment (G.O.I.), (1996), 'Urban Development Plans Formulation and Implementation Guidelines', ITPI, New Delhi.

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**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or

other electrical/ electronic items are allowed in the examination.

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**CE 464C : SOLID AND HAZARDOUS WASTE MANAGEMENT**

**B. Tech. 4<sup>th</sup> Year (Semester – VIII)**

**L T P Credits**  
**3 - -- 3**

**Class Work : 25 Marks**  
**Examination : 75Marks**  
**Total : 100 Marks**  
**Duration of : 3 Hours**  
**Examination**

**Course outcomes:**

**Upon successful completion of the course students will be able to**

CO1	Manage various types of solid waste.
CO2	Assess the risk of hazardous waste.
CO3	Minimise the production of waste.
CO4	Quantify the risk and provide methods to reduce it.

**Prepare CO-PO/PSO Articulation Matrix, e.g.:**

	PO1	PO2	PO3	PO4	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	3	1	3	3	2	3	3	2	3	2	3
CO2	2	3	3	2	3	3	2	3	3	3	3	3	3
CO3	1	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	1	3	3	3	3	3	3

**Enter correlation levels 1, 2 or 3 as defined below:**

**1:** Slight (Low)    **2:** Moderate (Medium)    **3:** Substantial (High)    If there is no correlation

**UNIT – I**

Solid Wastes: Origin, Analysis, Composition and Characteristics. Integrated Solid Waste Management System: Collection, Storage, Segregation, Reuse and Recycling possibilities, Transportation, Treatment / Processing and Transformation Techniques, Final Disposal. Management of: Municipal, Biomedical, Nuclear, Electronic and Industrial Solid Wastes and the rules and regulations.

**UNIT – II**

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

**UNIT – III**

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 – IV**

Environmental audit, Pollution Prevention, Facility Development and operation, Site Remediation: Quantitative risk assessment, site and subsurface characterization, Containment, remedial alternatives.

**Text/Reference Books:**

1. Solid and hazardous waste management by M N Rao and RaziaSultana , published by B S Publication.
2. Solid and hazardous waste management by S C Bhatia
3. Solid and hazardous waste management by Abdul – Salam AKhalaf published by Lambert.
4. Solid and hazardous waste management by P M Cherry, published by CBS

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**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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## CE466C :CONSTRUCTION EQUIPMENT AND AUTOMATION

### B. Tech. 4<sup>th</sup> Year (Semester-VIII)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>		<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>--</b>	<b>--</b>	<b>3</b>		<b>Examination</b>	<b>: 75 Marks</b>
					<b>Total</b>	<b>: 100 Marks</b>
					<b>Duration of Examination</b>	<b>: 3 hours</b>

#### Course Outcomes:

Students will know about:

- 1:** Different types of equipments used for foundations and their applications.
- 2:** Formwork used in construction.
- 3:** Prefabrication and its application in construction.
- 4:** Different methods of prestressing.
- 5:** Advanced techniques used for construction of pavement

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	3	2	1	1	2	1	1	3	2	3	2
CO2	2	1	-	-	3	3	1	1	2	2	1	3	2	3	2
CO3	1	1	-	-	3	2	1	1	2	1	1	3	2	3	2
CO4	1	1	-	-	3	2	1	1	2	1	1	2	2	3	2
CO5	1	1	-	-	3	2	1	1	2	1	1	3	2	3	2

#### Unit-I

**Foundations:** Techniques of construction of piles, Cessions, Wells, Cofferdams and diaphragms, Drilling blasting, Underpinning, Shoring and shuttering of foundation.

#### Unit-II

**Formwork:** Design and construction of different types of formworks and temporary structures, Stationary and slip formwork techniques, Formwork of special structures eg. Shells, Bridges, Towers etc.

**Steel Construction:** Shop and insitu construction techniques, Different connections, Clearances and tolerances, Erection of steel structures like bridges. Chimneys and trusses.

#### Unit-III

**Prefabrication:** Modular construction and standardization, Special equipments and plants for industrial production of prefabricated components.

**Prestressing:** Special equipments and plants for industrial production of prestressed components, Prestressing of bridge girders, Water tanks and special structures.

## Unit-IV

**Advanced pavement construction Techniques:** Pavement construction using bitumen hot mix plant, Concrete road construction, Fibre reinforced pavement construction, Low cost road construction techniques.

### Reference Books:

1. Soil Mechanics by Gopal Ranjan , New Age Publishers.
2. Mahesh Verma, Construction Equipment, its planning & Application, Metropolitan Book Co.(P) Ltd.,
3. Foundation Design Manual by Narayan V. Nayak
4. Prestressed concrete by Rajagopalan
5. Highway Engg by Justo and Khanna

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**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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### CE468C : WATER POWER ENGINEERING

#### B. Tech. Final Year (Semester – VIII)

L	T	P	Credits	Class Work	: 25 Marks
3	-	--	3	Examination	: 75Marks
				Total	: 100 Marks
				Duration of Examination	: 3 Hours

### COURSE OUTCOMES:

On completion of the course student will be able to

1. Understand concept of water power, relation of water power and hydrology, energy losses in hydraulics system, concepts of pump and motors.
2. Understand water power estimate, effect of storage, estimates of available water power and concept of water ways.
3. Understand concept of hydraulic turbines and efficiency of turbines.
4. Understand model of power house and working concept of power house.

#### UNIT - I

**Introduction**Water Power, its development and use, relation of water power and hydrology. Distribution of fluid power, ISO symbols, energy losses in hydraulic systems.

Applications, basic types and constructions of Hydraulic pumps and motors, pump and motor analysis, Performance curves and parameters.

#### UNIT – II

**Water Power Estimate:** Collection and analysis of stream flow data, mass curve, flow duration curves, construction and utility of these curves, effect of storage and pondage, estimates of available water power.

**Water way:** Intake, gates, valves, surges and its effects, penstocks, classification, design criteria, economical diameter, water hammer, surge tank.

#### UNIT – III

**Hydraulic Turbines :** Classification of turbines, Francis, Kaplan and Pelton Turbines, Component parts and their function, Draft tubes and their theory, Similarity laws and specific speed unit, Quantities, performance curves, Governing of turbines, selection of turbines, cavitation in turbines, efficiency of turbines.

## UNIT-IV

**Power House and Equipment:** Location of power house, general arrangement of hydroelectric unit, Number and size of units, Power house substructure, and Pumped storage plant, Concept of tidal power plant.

### Books/References

Irrigation and Water Power Engineering – B.C. Punmia (Laxmi Publication)

Hydro Electric Engineering – Creager and Justin (Willay Institutional)

Hydro Electric Engineering Practice – Brown, J.G. (Blackie and Sons Ltd., London)

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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### CE 470C : ENERGY EFFICIENT BUILDINGS

#### B. Tech. 4<sup>th</sup> Year (Semester – VIII)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>		<b>Class Work</b>	<b>: 25 Marks</b>
<b>3</b>	<b>-</b>	<b>--</b>	<b>3</b>		<b>Examination</b>	<b>: 75Marks</b>
					<b>Total</b>	<b>: 100 Marks</b>
					<b>Durationof</b>	<b>: 3 Hours</b>
					<b>Examination</b>	

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

CO1	Understand the factors determining the different types of Climates and the characteristics of various Climatic Zones.
CO2	Analyze and design the climatically conscious and energy efficient buildings in various climatic conditions and other restraints.
CO3	Apply Solar Energy, in their design of buildings.
CO4	Apply the concept of Green Building to their building design and apply the Green Building Rating Systems, for their evaluation.

### CO-PO/PSO Articulation Matrix :

	PO1	PO2	PO4	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	2	-	2	-	2	2	2	2	1
CO2	2	3	1	3	-	2	-	1	2	2	2	1
CO3	2	2	2	3	1	-	2	1	1	2	1	1
CO4	2	1	1	3	2	1	2	2	2	2	1	1

## UNIT I

**Vernacular architecture:** Basic functional requirements of a building, Use of local materials and needs of the local people. Contemporary Trends, Concept of Energy Efficient Buildings, Case Studies of heritage buildings and modern buildings. Domestic energy consumption and saving strategies. Energy use in commercial buildings and saving strategies. Scope of Energy Efficiency in buildings, by Solar Energy and Energy conservation.

**Thermal Comfort Factors :** Body's Heat Production, Body's Heat Loss, Thermal Balance of the Body, Heat Loss in various thermal environments, Bioclimatic Chart.

**Heat Exchange of Buildings:** Heat Loss and Heat Gain Calculations, Cooling and Heating by Air, Transmittance of Composite Walls, Thermal Gradients

## UNIT II

**Principles of Thermal Design:** Thermal Quantities (Temperature, Heat, Specific Heat, Latent Heat, Thermal Capacity and Calorific Value), Heat Flow Rate, Conductivity, Relevance of Density, Conductance, Multilayer Body, Surface Conductance, Transmittance, Sol-air Temperature, Solar gain Factor.

**Global Climatic Factors :** Tropical Climate, Solar Radiation (Quality and Quantity), Tilt of Earth's Axis, Radiation of Earth's surface, Measurement of Temperature, Humidity and Solar Radiation and Wind Velocity.

**Climate and Climatic Zones:** Weather and factors affecting weather, Climate, Climatic Zones (of India) and their characteristics, Comfort Conditions and Climate wise requirements.

### UNIT III

**Principles of Solar Passive Architecture and Planning:** Site Conditions, Building Orientation, Plan Form, Building Envelope and its elements (Roof, Walls, Fenestrations, External Colour and Texture, Shading), Use of Insulation, Microclimate and the factors affecting the Microclimate,

**Advanced Solar Passive Techniques : (Concept, Working Principle and variations and Controls of):** Direct Gain, Thermal Storage Wall, Trombe Wall, Water Wall, Solar Chimney assisted passive heating device, Thermal Storage Roof and Roof Pond, Roof radiation Trap, Solarium (Attached Green House / Sunspace, Isolated Gain.

**Passive Cooling Techniques: (Concept, Working Principle and variations and Controls of):** Evaporative cooling, Nocturnal Radiation Cooling, Passive desiccant Cooling, Induced Ventilation, Earth Sheltering/ Berming, Wind Tower, Earth Air Tunnels, Curved Roofs and Air Vents

### UNIT IV

**Design Guidelines:** Natural building design consideration for Energy efficient design for different climatic zones i.e. Hot and Dry, Warm and Humid, Moderate Climate, Cold and Cloudy and Cold and Sunny Climate and Composite Climate.

**Design Approach:** Comfort Requirements and Physical Manifestation for different Climatic Zones, Advanced Techniques in different Climatic zones, Integrated Design Process.

**Green Buildings:** Energy and Resource conservation –Concept of green buildings and various Green Building Rating Systems and the detail study of LEED and GRIHA rating systems.

#### Text Books:

1. Manual of Tropical Housing and Building (Climatic Design), by Koenigsberger, Ingersoll, Mayhew, Szokolay, Orient BlackSawn, Hyderabad.
2. Moore F., Environmental Control System McGraw Hill, Inc., 1994.
3. Brown, G Z, Sun, Wind and Light: Architectural design strategies, John Wiley, 1985.

#### Reference Books

1. Cook, J, Award - Winning passive Solar Design, McGraw Hill, 1984.

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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### CE472C: TRANSPORT PLANNING

#### B. Tech. Final Year (Semester – VIII)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>4</b>	<b>-</b>	<b>--</b>	<b>4</b>	<b>Examination</b>	<b>: 75Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>

## Duration of Examination :3 Hours

**COURSE OUTCOMES:** The students will be able to attain the following outcomes at the end of this course

1. Carry out various surveys required for transportation planning.
2. Estimate trips generated from an area and their distribution.
3. Estimate traffic on a particular route by various modes.
4. Know fundamentals of relationship between land use and transportation.
5. Learn various fundamentals of evaluation of different transport plans.

### CO-PO/PSO Articulation Matrix

	PO1	PO2	PO4	PO5	PO6	PO7	PO9	PSO1
CO1	1	1	3	-	2	-	1	1
CO2	3	3	1	2	2	-	-	2
CO3	3	3	1	2	2	-	-	2
CO4	2	3	1	2	2	-	-	1
CO5	3	3	1	-	2	2	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: no correlation

### UNIT I

Transportation Planning Process: Urban morphology - Urbanization and travel demand – Urban activity systems and travel patterns – Systems approach – Trip based and Activity based approach - Urban Transportation Planning – Goals, Objectives and Constraints - Inventory, Model building, Forecasting and Evaluation - Study area delineation – Zoning - UTP survey;

### UNIT II

Trip Generation: Classification of trips, Factors governing trip generation and attraction; Zonal models; Trip generation estimation by multiple linear regression analysis, brief review of category analysis, advantages and limitations of these methods.

Trip Distribution: Methods of trip distribution. Growth factor models, Gravity model and Opportunity modes;

### UNIT III

Modal split models – Mode choice behavior – Trip end and trip interchange models - Probabilistic models – Utility functions - Logit models - Two stage model.

Traffic assignment – Transportation networks – Minimum Path Algorithms - Assignment methods – All or Nothing assignment, Capacity restrained assignment and Multi path assignment - Route-choice behavior;

### UNIT IV

Land use transportation models – Urban forms and structures - Location models - Accessibility – Land use models - Lowry derivative models - Quick response techniques - Non-Transport solutions for transport problems;

Preparation of alternative plans - Evaluation techniques – Plan implementation - Monitoring - Financing of Project – urban development planning policy –

### **Text/Reference Books:**

1. Hutchinson, B.G., “Principles of Urban Transport System Planning”– McGraw Hill Book Co.
2. Kadiyali, L.R., “Traffic Engineering and Transportation Planning”– Khanna Publication.
3. Institute of Traffic Engineers – “An Introduction to highway Transportation Engineering”.
4. Introduction to Transport Planning by Bruton, M.J., Hutchinson Technical Education, London.

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt

five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

2.The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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## CE 474C : EARTHQUAKE RESISTANT STRUCTURES

### B. Tech. 4<sup>th</sup> Year (Semester - VIII)

L	T	P	Credits		Class Work	: 25 Marks
4	-	--	4		Examination	: 75Marks
					Total	: 100 Marks
					Duration of Examination	: 3Hours

#### Course Outcomes :

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

CO1	Fundamentals of earthquake resistant structures
CO2	Design masonry and framed structures for earthquake loading
CO3	Deliver safety measures and can use different techniques to strengthen the building
CO4	Apply codal provisions on masonry and framed structures including special structures

#### Prepare CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO3	PO4	PO6	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO2
CO1	3	2	1	1	1	1	1	1	2	2	2	2
CO2	2	3	1	1	1	2	1	2	1	1	2	3
CO3	3	2	2	-	-	1	-	2	1	1	2	3
CO4	2	2	-	1	-	1	1	1	1	2	2	3

#### UNIT I

**Introduction:** Engineering seismology, Seismic zones of India, Earthquake and its causes, Types of waves, location of earthquakes, seismograph, Impact of Earthquake, base isolation.

**Theory of Vibrations:** Free Body Diagrams, Undamped single degree of freedom systems, Damped single degree of freedom system, Response to single degree of freedom system to harmonic loads.

#### UNIT II

**Introduction:** Provisions of IS:4326

**Seismic performance, repair and strengthening:** Identification of seismic damage in RCC Buildings, Effect of Structural Irregularities on Performance, Criteria for Repair and Strengthening

#### UNIT III

**Introduction to Structural Failures due to Earthquake**

**Introduction to IS: 1893 - 2002:** Seismic analysis and design of Framed structures by equivalent lateral load procedure.

#### UNIT IV

**Introduction to Ductile Detailing** of Structures, Design of Beams and Columns as per IS 13920

**Concept of Soft storey,** shear walls, seismoresistant building architecture

**Text Book**

1. Dynamics of Structures, Clough and Penzian, McGraw Hill Publishing Co., New York
2. Structural Dynamics (Theory and Computation) Mario Paz, CBS Publishers and Distributors.
3. Earthquake Resistant Design of Structures, Pankaj Agarwal, PHI learning Private Limited

#### Reference Books

1. Structural Dynamics (An Introduction to computer methods), Roy R. Carig, Jr., John Wiley & Sons
2. Structural Dynamics Anil Kr. Chopra

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**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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### CE 476C :DESIGN OF BRIDGES

#### B. Tech. 4<sup>th</sup> Year (Semester - VIII)

L	T	P	Credits	Class Work	: 25 Marks
3	-	--	3	Examination	: 75Marks
				Total	: 100 Marks
				Duration of Examination	: 3 Hours

#### Course Outcomes :

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

CO1	Understand the bridge identify the loading over the bridges and make selection of bridge and bridge site
CO2	Will be able to design T beam, deck slab and culverts using latest IS
CO3	Understand the importance of sub structural components of the bridge.
CO4	Understand the importance of bearings their analysis and design.

#### Prepare CO-PO/PSO Articulation Matrix, e.g.:

	PO1	PO2	PO3	PO4	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1	-	1	1	2	1	3	2
CO2	2	2	3	3	1	-	1	1	2	1	1	3	2
CO3	3	3	3	3	1	1	2	1	1	1	2	3	2
CO4	1	2	2	1	1	-	-	1	-	-	2	3	2

#### Unit I

**Introduction to Bridges:** Definition, components of a bridge, classifications, importance of bridges. Need for investigations, selection of bridge site, preliminary data to be collected, design discharge and its determination, linear waterway, economical span, vertical clearance above HFL, scour depth, choice of bridge type.

**Standard Specifications:** Road bridges, I.R.C. loadings, code provisions on width of carriageway, clearances, loads considered etc. Standard specifications for railway bridges, Railway bridge code.

#### Unit II

**Analysis and Design Bridges:**Analysis and design of Deck slab, T-beam bridge using Pigeauds method, Hendry-Jaegar method, Courbon's theory and Guyon-Massonet method and RCC culvert.

#### Unit III

**Sub Structure:** Types of piers and abutments, design forces, design of piers and abutments.

#### Unit IV

**Bearing and Joints:** Various types of expansion bearing and fixed bearings, elastomeric bearings, joints and their types, design of bearings.

**Construction Method:** Inspection, maintenance and construction of bridges, case studies of recently constructed major bridges.

**Text Books**

1. Elements of Bridge Engineering, D. Johnson Victor, Oxford and IBH Publishers, New Delhi.
2. Design of Steel Structures, A.S. Arya and J.L. Ajmani ,Nem Chand Brothers, Roorkee.
3. Design of Concrete Bridges, Khanna Publishers, New Delhi, Vazirani&Ratwani

**Reference Books**

1. Analysis, Design and Construction of Bridges by V.K. Raina, Tata McGraw Hill

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**CE478C: PUBLIC TRANSPORTATION SYSTEMS**

**B. Tech. 4<sup>th</sup> Year (Semester – VIII)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>:</b>	<b>25 Marks</b>
<b>3</b>	<b>-</b>	<b>--</b>	<b>3</b>	<b>Examination</b>	<b>:</b>	<b>75Marks</b>
				<b>Total</b>	<b>:</b>	<b>100 Marks</b>
				<b>Duration</b>	<b>of</b>	<b>3 Hours</b>
				<b>Examination</b>		

**COURSE OUTCOMES:** At the completion of this course the students will develop the ability to

1. Understand basic characteristics of public transport.
2. Learn concepts of transit network planning and scheduling.
3. Carry out transit performance evaluation.
4. Design bus stops, terminals or other facilities.

**CO-PO/PSO Articulation Matrix**

	PO1	PO2	PO4	PO6	PO11	PSO1	PSO2	PSO3
CO1	3	1	-	-	-	-	-	-
CO2	3	3	2	1	1	1	2	1
CO3	2	3	1	-	1	1	-	-
CO4	2	3	2	1	1	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) “-”: no correlation

**UNIT – I**

Public Transport: Definitions, modes of public transport and comparison, public transport travel characteristics, trip chaining, technology of bus, rail, rapid transit systems, basic operating elements;

## UNIT – II

Transit Network Planning: Planning Objectives, principles, considerations, transit lines – types, geometry and characteristics, transit routes and their characteristics, timed transfer networks, prediction of transit usage, evaluation of network, accessibility considerations; Transit Scheduling: Components of scheduling process, determination of service requirements, scheduling procedure, marginal ridership, crew scheduling;

## UNIT – III

Transit Agency and Economics: Organizational structure of transit agency, management and personnel, transit system statistics, performance and economic measures, operations, fare structure;

## UNIT – IV

Design of Facilities: Design of bus stops, design of terminals – principles of good layout, types of layout, depot location, twin depot concept, crew facilities and amenities.

### Text/reference Books:

- 1 Public Transport: Its Planning, Management and Operation, By Peter R. White, Routledge, Taylor and Francis group.
- 2 Public Transport Planning and Management in Developing Countries, 1st Edition, by Ashish Verma, T.V. Ramanayya, CRC press.
- 3 Ceder, Avishai. Public Transit Planning and Operation: Theory, Modeling and Practice. Burlington, MA: Elsevier, 2007. ISBN: 9780750661669.
- 4 Transit Capacity and Quality of Service Manual, 2nd ed. TCRP Report 100. Transportation Research Board, 2003.
- 5 Vuchic, Vukan. Urban Transit: Operations, Planning and Economics. New York, NY: Wiley, 2005. ISBN: 9780471632658.
- 6 Bruun, Eric. Better Public Transit Systems: Analyzing Investments and Performance. Washington, DC: American Planning Organization, 2007. ISBN: 9781932364484.
- 7 Fielding, Gordon. Managing Public Transit Strategically: A Comprehensive Approach to Strengthening Sales and Monitoring Performance. New York, NY: Jossey-Bass, 1987. ISBN: 9781555420680.

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**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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### CE 480C :DYNAMICS OF STRUCTURES

#### B. Tech. Final Year (Semester – VIII)

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>4</b>	<b>-</b>	<b>-</b>	<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
				<b>Total</b>	<b>: 100 Marks</b>
				<b>Duration of Examination</b>	<b>: 3 Hours</b>

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## **Course Outcomes :**

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

CO1	Apply the basics of dynamics into structural engineering
CO2	understand the different single and multi-degree of freedom system.
CO3	Deliver safety measures and use different techniques to strengthen the structure.
CO4	Apply codal provisions on framed structures.

## **Prepare CO-PO/PSO Articulation Matrix, e.g.:**

	PO1	PO2	PO3	PO4	PO6	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	-	1	1	1	-	1	1	2	2	3
CO2	3	1	2	2	2	1	1	2	2	1	2	2
CO3	3	2	1	-	1	-	-	1	-	1	2	2
CO4	2	1	1	1	1	2	1	1	1	2	2	2

### **Unit I**

**Seismology:** Introduction, plate tectonics, earthquake distribution and mechanism, seismicity, seismic waves, earthquake magnitude and intensity, seismic zoning and seismometry.

**Single Degree of Freedom Systems:** Various types of dynamic loads, vibration of single degree of freedom system, Free and forced vibrations, types of damping, critical damping. Transmissibility, vibration measuring instruments, response spectrum.

### **Unit II**

#### **Multi-degrees of Freedom(MDOF)Systems:**

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

### **Unit III**

#### **Seismic Analysis and Design:**

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

#### **Seismic Performance, Repair and Strengthening:**

Methods for assessing seismic performance, influence of design ductility and masonry infills, criterion for repair and strengthening, repair and strengthening techniques and their applications, additions of new structural elements.

### **Unit IV**

#### **Vibrational Control:**

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

## **TEXT / REFERENCE BOOKS:**

1. Mario Paz, and William Leigh, Structural Dynamics, CBS, Publishers, 1987.
2. Roy Craig, Jr. Structural Dynamics, John Wiley & Sons, 1981.
3. A.K. Chopra "Dynamics of Structures Theory and Application to Earthquake Engineering" Pearson Education,2001.

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set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

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## CE482C: ROAD SAFETY AND ENVIRONMENT

### B. Tech. 4th Year (Semester – VIII)

**L      T      P      Credits**  
**4      -      --      4**

**Class Work :      25 Marks**

**Examination :      75Marks**

**Total :      100 Marks**

**Duration of Examination:3 Hours**

### **COURSE OUTCOMES:**

After completion of this course students will be able to

1. Know about road safety scenario in India and the need of planning and design for safety.
2. Perform crash investigation and diagnose the issues involved.
3. Understand the concepts of various stages of road safety audit and methods of prioritization of audit recommendations.
4. Audit highways for safety and suggest improvements.

### **CO-PO/PSO Articulation Matrix**

	PO1	PO2	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO2
CO1	-	1	1	-	-	1	-	-	-	-
CO2	1	2	3	-	2	-	-	2	-	1
CO3	2	3	2	2	-	-	-	-	-	-
CO4	1	3	3	-	3	2	2	3	3	2

1: Slight (Low)    2: Moderate (Medium)    3: Substantial (High)    “-”: no correlation

### **UNIT – I**

Planning for Network, Land Use and Road Environment for Safety, Designing for Safety: Road Link Design, Junctions.

Introduction to Road Safety Engineering and Crash Investigation, Human and other Factors Relating to Crashes/Accidents, Crash/Accident Investigation & Crash Problem Diagnosing, determination of pre-crash speed using skid marks, Crash Problems into Solutions & Crash Investigation Reporting, Black spot identification, safety performance functions and accident modification factors, Crash/Accident Costing, Economic Appraisal.

### **UNIT – II**

Road Safety Auditing- An Introduction, How to Conduct Road Safety Audit, Design Stage Road Safety Audit, Road Safety Audits of Land Use Developments, Traffic Control Devices & Safety, Needs of Different Road Users, Road Safety Audit in Road Works & Pre Opening Safety Audit.

Street Lighting & Traffic Signals, Provisions for NMT Vehicles in India, Safety Provisions for Pedestrians & Cyclists, Road Signs and Pavement Markings.

### UNIT – III

Safe System Approach- A Global Perspective, Speed Management & safety, Safe System and Speed & Assessing speed limit, Type of speed limit & Speed zone signing Infrastructure to support safe speed feedback and enforcement.

Hazard Management Organizational commitment & encouraging RSA, Road Safety Audit Checklist.

### UNIT – IV

Site Visits and Preparation of the Audit Reports.

Risk Assessment & Prioritization of audit recommendations, Solutions and effectiveness & Corrective, Action Report.

#### Text Books

1. Highway Engineering by Khanna and Justo, Nem Chand & Brothers, Roorkee
2. Highway Engineering by L.R. Kadyali, Nem Chand & Brothers, Roorkee

#### Reference Books

1. Highway Engineering by Oglesby and Hews
2. Transportation Engineering by G.V. Rao, Tata McGraw Hill Publisher, New Delhi
3. Traffic Engineering by Matson, Smith & Hurd
4. Road safety audit Manual

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

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### CE-484C:ADVANCED STRUCTURAL DESIGN & DETAILING

<b>L</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>4</b>		<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
			<b>Total</b>	<b>: 100 Marks</b>
			<b>Duration of Examination</b>	<b>: 3 Hours</b>

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#### COURSE OUTCOMES:

1. Students will be able to use limit state method of design
2. Students will be able to design buildings as per earthquake zone
3. Apply the basics of design standards on earthen and masonry structures
4. Apply codal provisions on masonry and framed structures including special structures

## USE OF INDIAN STANDARDS IS ALLOWED IN EXAMINATION

### UNIT-I

Introduction to limit state method of design, provisions in the Indian standard codes for loading wind loads and seismic loads, design and detailing of concrete structures.

BIS Handbook for design, Examples of design using handbook SP-16.

### UNIT-II

Design of Structures as per I.S. 1893 for Earthquake Resistant Design Construction.

Design and Detailing Requirements as per 4326-1993.

### UNIT-III

Design and detailing of Earthen Buildings as per 13827-1993

Design and detailing of Masonry Structures as per I.S. 13828-1993

### UNIT-IV

Design and Ductile Detailing of R.C.C. Structures of R.C.C. Structures as per I.S. 13920-1993

Repair and Seismic Strengthening of Building as per I.S. 13935-1993

#### References:

1. Pillai and Menon, Reinforced Concrete Design
2. Jain, A.K. Reinforced Concrete, Limit State Method of Design.
3. Punmia, B.C. reinforced Concrete Structures, Vol-II.
4. B.I.S. Codes 1893, 4326, 13827, 13828, 13920, 13935

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

**2.**The students will be allowed to use non-programmable scientific calculator. However, sharing / ex-change of calculator or any other items are prohibited in the examinations. No programmable calculators, mobile phones or other electrical/ electronic items are allowed in the examination.

**NOTE: For examiner for paper setting:-** In semester examinations, examiner is required to set up question paper covering the entire syllabus in accordance with the examination reforms circulated by the AICTE & approved under item No. 14\_18 of academic council.

#### CE486C: APPLIED STATISTICS TO TRANSPORTATION ENGINEERING

<b>L</b>	<b>P</b>	<b>Credits</b>	<b>Class Work</b>	<b>: 25 Marks</b>
<b>4</b>		<b>4</b>	<b>Examination</b>	<b>: 75 Marks</b>
			<b>Total</b>	<b>: 100 Marks</b>
			<b>Duration of Examination</b>	<b>: 3 Hours</b>

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**COURSE OUTCOMES:** at the end of this course students will be able

1. To understand applications of various probability distributions in transportation engineering.
2. To understand theory of sampling, design of experiments and hypothesis testing concepts.
3. To perform regression modeling and testing of model fit.

Introduction to statistical methods, scope aim and limitations, sample, attribute and types of data, sources and collection of data. Accuracy of data. Representation and summarizing data. Frequency distribution, histogram and frequency curves. Ogive curve, Measure of central tendency – arithmetic mean, median and mode dispersion-range, standard deviation, variance and co-efficient of variation, skewness and kurtosis.

#### UNIT II

Introduction to probability & statistics for Traffic Engineering Design – Introduction, Random variables and statistical measures: arithmetic mean, measures of dispersion, basic laws of probability, probability laws for discrete random variables: binomial and Poisson distribution, probability laws for continuous random variables: normal distribution, Poisson distribution.

#### UNIT III

Sampling Techniques – objective, basics of sampling, advantages of sampling, sampling techniques, sampling distributions – sampling distribution of the sample mean, central limit theorem, chi square, t and F – distributions. Sampling error, sample size and design. 10 Hours Module -4 Statistical decisions – point estimation, properties of parameters, Testing of Hypothesis – Type I and II errors. Tests of significance – tests for mean and variance. Tests for proportions.

#### UNIT VI

Chi-square test of goodness of fit, student's t test, Confidence interval. Curve fitting by the method of least squares, Linear correlation & regression, multiple linear regression. Analysis of variance Use of soft-wares in statistical analysis – SPSS

#### **Reference books:**

- 1 Gupta S. P. and Kapoor V. K., Fundamentals of Statistics, Sultan Chand and Sons, Delhi - 02(2005)
- 2 Hines, W. W. and Montgomery, D. C., et. al.; "Probability and Statistics in Engineering and Management Science", John Wiley and Sons, New York, (1990).
- 3 Freund, J. E.; "Mathematical Statistics", PHI, New Delhi, (1990)
- 4 Montgomery, D. C.; "Design and Analysis of Experiments", 5th edition, John Wiley and Sons, INC., New York. (2001).
- 5 Johnston, J. and Dinardo, J.; "Econometric Methods", 4th edition, McGraw-Hill International Editions, (1997).
- 6 Benjamin, J. R. and Cornell, C. A.; "Probability Statistics and Decision for Civil Engineers", McGraw-Hill, (1970).

**NOTE: 1.**For the semester examination, nine questions are to be set by the examiner. Question no. 9, containing 5-7 short answer type questions, will be compulsory & based on the entire syllabus. Rest of the eight questions are to be set by setting two questions from each of the four units of the syllabus. The candidates will be required to attempt five questions in all, selecting one from each unit AND Question no. 9. All questions will carry equal marks.

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