

Third Year B. Tech. (Civil Engineering) - Semester V										
Course Code	Course Title	L	T	P	C	Evaluation Scheme				
						Component	Exam	WT (%)	Min. Pass %	
CET301R1 (ES SS) Version:1.0	Design of RCC Structures	3	-	-	3	Theory (100)	FET	20	40	40
							CT I	15		
							CT II	15	40	
							ESE	50		
CET302 R1 (PC ST) Version:1.0	Infrastruct ure Engineerin g	3	-	-	3	Theory (100)	FET	20	40	40
							CT I	15		
							CT II	15	40	
							ESE	50		
CET303 R1 (PC ST) Version:1.0	Foundation Engineering	3	-	-	3	Theory (100)	FET	20	40	40
							CT I	15		
							CT II	15	40	
							ESE	50		
CET304 R1 (PC ST) Version:1.0	RCC Structure Design Lab	-	-	4	2	Drawing	ISE	50	40	40
							ESE	50		
CET305 R1 (PC ST) Version:1.0	Highway Engineering Lab	-	-	2	1	Practical	ISE	50	30	40
							ESE	25		
CET306 R1 (PC ST) Version:1.0	Software Proficiency Program I	-	-	4	2	Practical	ISE	100	40	40
CET307 R1 (PC ST) Version:1.0	Foreign Language /Scholastic Aptitude	3	-	-	-	Theory	-	-	-	-
CPE3-- (PE ST) Version:1.0	Program Elective – I	3	-	-	3	Theory (100)	FET	20	40	40
							CT I	15		
							CT II	15	40	
							ESE	50		
CET3-- (PC ST) Version:1.0	Program Elective - I Lab	-	-	2	1	Practical	ISE	50	30	40
							ESE	25		
		15	0	12	18	Total Hours: 27, Total Credits: 18, Audit: - 03				

**FET** – Faculty Evaluation Test; **CT** – Class Test; **ESE** – End Semester Examination; **ISE** – In semester Evaluation; **POE** - Practical Oral Examination;

Third Year B. Tech. (Civil Engineering) - Semester VI										
Course Code	Course Title	L	T	P	C	Evaluation Scheme				
						Component	Exam	WT (%)	Min. Pass %	
CET308 R1 (ES SS) Version:1.0	Design of Steel Structures	3	-	-	3	Theor y (100)	FET	20	40	40
							CT I	15		
							CT II	15		
							ESE	50	40	
CET309 R1 (PC ST) Version:1.0	Analysis of Indeterminate Structure	3	-	-	3	Theor y (100)	FET	20	40	40
							CT I	15		
							CT II	15		
							ESE	50	40	
CET310 R1 (PC ST) Version:1.0	Water Supply Engineer ing	3	-	-	3	Theory (100)	FET	20	40	40
							CT I	15		
							CT II	15		
							ESE	50	40	
CET311 R1 (PC ST) Version:1.0	Steel Structure Design Lab	-	-	4	2	Drawing	ISE	50	40	40
							ESE	50		
CET312 R1 (PC ST) Version:1.0	Water Testing Lab	-	-	2	1	Practical	ISE	50	30	40
							ESE	25		
CET313 R1 (PC ST) Version:1.0	Software Proficiency Program II	-	-	4	2	Practical	ISE	100	40	40
CET314 R1 (PC ST) Version:1.0	Foreign Language /Scholastic Aptitude	3	-	-	-	Theory	-	-	-	-
CET315 R1 (PW/ST) Version:1.0	Mini Project - I	-	-	2	1	Project	ISE	25	50	50
CET316 R1 (PW/ST) Version:1.0	Industry Internship * (20 days)	-	-	-	1	Project	ISE	25	50	50
CPE3-- (PE ST) Version:1.0	Program Elective – II	3	-	-	3	Theor y (100)	FET	20	40	40
							CT I	15		
							CT II	15		
							ESE	50	40	
CET3-- (PC ST) Version:1.0	Program Elective - II Lab	-	-	2	1	Practical	ISE	50	30	40
							ESE	25		
		15	0	10	20	Total Hours: 25, Total Credits: 20, Audit: - 03				

**FET** – Faculty Evaluation Test; **CT** – Class Test; **ESE** – End Semester Examination; **ISE** – In semester Evaluation; **POE** - Practical Oral Examination;

\* Vacation Field Training of at least 3 weeks should be completed during V & VI semester before the commencement of VI semester & to be evaluated in the VI semester

**T. Y. Program Elective I (Semester V)**

<b>Code</b>	<b>Geotechnical and Structural Engineering</b>	<b>Code</b>	<b>Infra-structure and Construction Management</b>	<b>Code</b>	<b>Environmental and Water Resources Engineering</b>
CET317 R1	Site Investigation Methods and Practices	CET319 R1	Advanced Traffic Engineering	CET321 R1	Advance Fluid Mechanics
CET318 R1	Fiber Reinforced Concrete	CET320 R1	Quality Control and Safety Management	CET322 R1	Disaster Management and Mitigation
CET341 R1	Advanced Concrete Technology				

**T. Y. Program Elective II (Semester VI)**

<b>Code</b>	<b>Geotechnical and Structural Engineering</b>	<b>Code</b>	<b>Infra-structure and Construction Management</b>	<b>Code</b>	<b>Environmental and Water Resources Engineering</b>
CET323 R1	Earth Retaining Structure	CET325 R1	Engineering Economics and Finance	CET327 R1	Water Power Engineering
CET324 R1	Advanced Design of R.C.C. Structures	CET326 R1	Road Safety Management	CET328 R1	Solid and Hazardous Waste Management

**T. Y. Program Elective I Lab (Semester V)**

<b>Code</b>	<b>Geotechnical and Structural Engineering</b>	<b>Code</b>	<b>Infra-structure and Construction Management</b>	<b>Code</b>	<b>Environmental and Water Resources Engineering</b>
CET329 R1	Site Investigation Methods and Practices Lab	CET331 R1	Advanced Traffic Engineering Lab	CET333 R1	Advance Fluid Mechanics Lab
CET330 R1	Fiber Reinforced Concrete Lab	CET332 R1	Quality Control and Safety Management Lab	CET334 R1	Disaster Management and Mitigation Lab

CET342 R1	Advanced Concrete Technology Lab
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**T. Y. Program Elective II Lab (Semester VI)**

<b>Code</b>	<b>Geotechnical and Structural Engineering</b>	<b>Code</b>	<b>Infra-structure and Construction Management</b>	<b>Code</b>	<b>Environmental and Water Resources Engineering</b>
CET335 R1	Earth Retaining Structure Lab	CET337 R1	Engineering Economics and Finance Lab	CET339 R1	Water Power Engineering Lab
CET336 R1	Advanced Design of R.C.C. Structures Lab	CET338 R1	Road Safety Management Lab	CET340 R1	Solid and Hazardous Waste Management Lab



**T. Y. B. Tech. Civil Engineering**

**Program Core Semester V**

S.N.	Course Code	Course Description	Page No.
1	CET301R1	Design of RCC Structures	3
2	CET302 R1	Infrastructure Engineering	5
3	CET303 R1	Foundation Engineering	8
4	CET304 R1	RCC Structure Design Lab	10
5	CET305 R1	Highway Engineering Lab	12
6	CET306 R1	Software Proficiency Program I	13
7	CET307 R1	Foreign Language /Scholastic Aptitude	14

**Program Elective I Semester V**

S.N.	Course Code	Course Description	Page No.
1	CET317 R1	Site Investigation Methods and Practices	29
2	CET318 R1	Fiber Reinforced Concrete	31
3	CET319 R1	Advanced Traffic Engineering	33
4	CET320 R1	Quality Control and Safety Management	36
5	CET321 R1	Advance Fluid Mechanics	38
6	CET322 R1	Disaster Management and Mitigation	40
7	CET341 R1	Advanced Concrete Technology	70

**Program Elective I Laboratory Semester V**

S.N.	Course Code	Course Description	Page No.
1	CET329 R1	Site Investigation Methods and Practices Lab	56
2	CET330 R1	Fiber Reinforced Concrete Lab	57
3	CET331 R1	Advanced Traffic Engineering Lab	58
4	CET332 R1	Quality Control and Safety Management Lab	60
5	CET333 R1	Advance Fluid Mechanics Lab	61
6	CET334 R1	Disaster Management and Mitigation Lab	62
7	CET342 R1	Advanced Concrete Technology Lab.	70

**T. Y. B. Tech. Civil Engineering**

**Program Core Semester VI**

S.N.	Course Code	Course Description	Page No.
1	CET308 R1	Design of Steel Structures	15
2	CET309 R1	Analysis of Indeterminate Structure	17
3	CET310 R1	Water Supply Engineering	19
4	CET311 R1	Steel Structure Design Lab	21
5	CET312 R1	Water Testing Lab	23
6	CET313 R1	Software Proficiency Program II	25
7	CET314 R1	Foreign Language /Scholastic Aptitude	26
8	CET315 R1	Mini Project - I	27
9	CET 316 R1	Industry internship	28

**Program Elective II (Semester VI)**

S.N.	Course Code	Course Description	Page No.
1	CET323 R1	Earth Retaining Structure	43
2	CET324 R1	Advanced Design of R.C.C. Structures	45
3	CET325 R1	Engineering Economics and Finance	47
4	CET326 R1	Road Safety Management	49
5	CET327 R1	Water Power Engineering	51
6	CET328 R1	Solid and Hazardous Waste Management	53

**Program Elective II Laboratory (Semester VI)**

S.N.	Course Code	Course Description	Page No.
1	CET335 R1	Earth Retaining Structure Lab	63
2	CET336 R1	Advanced Design of R.C.C. Structures Lab	64
3	CET337 R1	Engineering Economics and Finance Lab	66
4	CET338 R1	Road Safety Management Lab	67
5	CET339 R1	Water Power Engineering Lab	68
6	CET340 R1	Solid and Hazardous Waste Management Lab	69

CET301 R1		Design of RCC Structures					
(Ver 1.0, Program Core, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

**Course Description:** This course provides knowledge about different types of RC element design. The course shall be taught using a combination of lectures, interactive tutorials. This course focuses on the principles of design of Beam, column, slab, footing, staircase etc. It also focuses on the analysis, design and construction aspects of RC building elements.

**Prerequisites -** This course requires the student to know about the basic concepts in structural mechanics like shear force, bending moment, stress in rcc, strain etc.; properties of concrete and reinforcing steel.

**Course Outcomes:** after the end of this course students will able to

**CET301.1** Extend<sup>3</sup> the concept shear, bond, development length and design the shear reinforcement

**CET301.2** Analyze<sup>4</sup> and design<sup>5</sup> of the reinforced concrete beam sections.

**CET301.3** Design<sup>5</sup> of RCC slab, column, footing.

**CET301.4** Analyze<sup>4</sup> and design<sup>5</sup> of the prestressed concrete beam sections.

#### Course content

Units	Description	Hours
I	Introduction- Stress strain behavior of concrete and steel, Behavior of RCC, Permissible stresses in steel and concrete, Design philosophies, Various limits states, Characteristics strength and Characteristic load, Load factor, Partial safety factors. Concept -Limit state of collapse (shear and bond): Shear failure, Types of Shear reinforcement, Design of Shear reinforcement, Bond-types, Factors affecting bond Resistance, Check for development length.	07
II	Limit state of collapse (flexure): Analysis and Design of Singly and Doubly Reinforced rectangular sections, concept -Singly reinforced T and L beams.	07

<b>III</b>	Design of slabs: One way, Two way with different support conditions as per IS:456, Cantilever slab.	07
<b>IV</b>	Analysis and Design of axially loaded column introduction of eccentrically (uni-axial & biaxial) loaded circular and rectangular columns, Introduction of Interaction diagram, Circular column with helical reinforcement	07
<b>V</b>	Design of isolated rectangular column footing with constant depth subjected to axial load and moment, Introduction to Design of combined rectangular footing	07
<b>VI</b>	Introduction of prestress concrete, Advantage and disadvantages of prestress. Methods of prestressing, Analysis of simple pre-stressed rectangular section.	07

#### **Text Book**

- 1 Fundamentals of Reinforced Concrete. Sinha and Roy, S. Chand and company Ltd. Ram Nagar, New Delhi.
- 2 Limit state theory and Design of concrete structure -Karve and Shah Structures publications, Pune
- 3 Reinforced Concrete Design Limit state - brothers Roorkee - A.K. Jain Nemchand brothers Roorkee
- 4 Prestressed concrete-T.Y.Lin john willey & sons Newyark

#### **References**

- 1 Limit State Design of reinforced concrete, P.C.Varghese Prentice Hall, New Delhi
- 2 Reinforced Concrete Design by B.C. Punmia Mcmillan India Ltd. New Delhi
- 3 Special publications -16 Bureau of Indian standards
- 4 IS 456-2000 Bureau of Indian standards
- 5 Prestressed concrete- N.Krishnaraju,Tata McGraw-Hill Publications
- 6 Prestressed concrete-Sinha & Roy S.Chand & Co. New Delhi



CET302 R1		Infrastructure Engineering					
(Ver 1.0, Program Core, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

**Course Description:** This course is about various sub branches of transportation engineering and its application. Pre-requisites for this course are courses from transportation engineering and basic civil engineering.

**Course Outcomes:** after the end of this course students will able to

- CET302.1** Understand<sup>2</sup> components, construction and maintenance of railway  
**CET302.2** Understand<sup>2</sup> basic concepts of bridge engineering  
**CET302.3** Know<sup>2</sup> basic concepts of airport engineering, docks and harbor  
**CET302.4** Describe<sup>1</sup> methods and safety in tunneling

### Course Content

Units	Description	Hours
<b>I</b>	<b>Railway Engineering</b>  Introduction, Permanent Way: Components, coning of wheels; Geometric design: Alignment, gradient, horizontal curves, super elevation, design problems on above.  Points & Crossing: Terms used, standard points and crossings, design of simple turnout various types of track junctions.  Stations and yards: purpose, location, site selection, types and general layouts of terminus, Junction.	07
<b>II</b>	<b>Construction and Maintenance of Railway.</b>  Introduction, Construction and maintenance of railway track: methods, material required per KM of track, tools and plant used for plate laying, maintenance of Track, Modern trends in railways.	07
<b>III</b>	<b>Bridge Engineering</b>	07

	Classification of bridges, selection of site, Bridge Hydrology, IRC loads, Types of bridge foundations, Bridge piers, Abutments, Wing walls, bearings. Construction and maintenance of bridges—Introduction; Recent trends in bridges	
<b>IV</b>	<b>Airport Engineering</b>	<b>07</b>
	a) Introduction: Terminology, Airport Classification ICAO, components of an aircraft, aircraft characteristics. b) Airport Planning: Airport surveys, Site selection, Airport Obstructions, layouts, zoning laws, Environmental considerations. c) Air Traffic Control: VFR, IFR, Visual aids, airport lighting and marking. d) Runways: Orientation, wind rose, Basic runway length, Geometric design, Airport capacity, Runway patterns. e) Taxiways: Layout, geometrical standards, exit taxiways. Terminal Buildings: Site selection, facilities, aprons, parking systems	
<b>V</b>	<b>Tunnel Engineering</b>	<b>07</b>
	a) Introduction, consideration in tunneling, geological investigation, tunnel alignment, tunnel shafts, pilot tunnels. b) Tunneling in hard rock, (TBM). Tunneling in soft materials: shield methods. Tunnel lining (rock bolting and guniting), Safety measures, ventilation, lighting and drainage of tunnels.	
<b>VI</b>	<b>Dock And Harbour Engineering</b>	<b>07</b>
	a) Introduction Inland water transport in India, tides , waves, erosion, beach drift, littoral drift sand bars, coast protection, classification of ports and harbours, sites selection, break waters, jetties, wharves piers, facilities required. Types of dock, navigational aids, lighthouses, terminal buildings, special equipment, containerization.	

#### **Text Book**

- 1 A Course in Railway Engineering - Saxena and Arora, Dhanpat rai & Sons, New Delhi.
- 2 Railway Engineering – K. F. Antia
- 3 Bridge Engineering – S.P. Bindra
- 4 Bridge Engineering – Ponnuswamy S, , Tata Mcgraw Hill Publications
- 5 Bridge Construction Practice – Raina
- 6 Bridge Engineering – John Victor

#### **Reference Books**

- 1 Dock and Harbor Engineering – Oza ,Chartor pub. House
- 2 Dock, Harbor and Tunnel Engineering – Shrinivasan Chartor pub. House
- 3 Dock and Harbor Engineering – Cormick H. F. Horonjeff Robert

- 4      Khanna S.K., Arora M.G. and Jain S.S. (1997): Airport Planning and Design, Nem Chand and Bros., Roorkee
- 5      Planning and Design of Airports, McGraw Hill Co., New York.

CET303 R1		Foundation Engineering					
(Ver 1.0, Program Core, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	1	-	4	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

**Course Description:** This course deals with knowledge of foundation engineering, types of foundation and their selection.

**Pre-requisite:** Engineering mechanics, engineering mathematics I, II and III.

**Course Outcomes:** after the end of this course students will able to

**CET303.1** Identify<sup>1</sup> the investigation plan to explore the subsurface and determine necessary soil parameters for judging its suitability for the proposed engineering works

**CET303.2** Define<sup>1</sup> and calculate<sup>3</sup> load bearing capacity by using different classical theories.

**CET303.3** Discuss<sup>2</sup> different types of shallow foundations and design those. Predict the possible settlement of foundations, Classify<sup>3</sup> different types of piles and determine load carrying capacity of piles acting individually and in group.

**CET303.4** Explain<sup>2</sup> well foundation, caissons, sheet piles and coffer dams.

#### Course contents

Units	Description	Hours
<b>I</b>	Necessity, Planning, No & depth of bore holes, Exploration Methods( auger boring (hand and continuous flight augers), and wash boring, rotary drilling. Soil sampling (disturbed and undisturbed	7
<b>II</b>	Definitions, Modes of failure, Terzaghi's bearing capacity theory, I.S. Code method of bearing capacity evaluation & computation (IS 6403), Effect of various factors on bearing capacity(Size & Shape, Depth, WT, Eccentricity), Bearing capacity evaluation from Plate load test, S.P.T. (By I.S. Code method) and pressure meter tests with detailed procedure	7
<b>III</b>	Types and their selection, minimum depth of footing, Assumptions & limitations of rigid design analysis. Design of Isolated, combined, strap	7

footing (Rigid analysis), Raft foundation (elastic analysis), floating foundations (R.C.C. Design is not expected)

Foundation Settlement:

Immediate settlement (computations from I.S. 8009 (1976 (Part I) approach, consolidation, Settlement computations, Concept of total settlement, differential settlement and angular distortion.

- |           |  |   |
|-----------|--|---|
| <b>IV</b> | Classification and their uses, single pile capacity evaluation by static and dynamic methods, pile load test. Negative skin friction, Group action piles, spacing of piles in a group, Group efficiency. Under reamed piles – equipment, construction and precautions                  | 7 |
| <b>V</b>  | Element of wells, types, methods of construction, tilt and shift, remedial measures.<br>Pneumatic caissons: sinking method (Sand island method, Caisson disease. Types and material used for sheet piling<br>Common types of cofferdams, Soil pressure distribution, Braced cofferdam. | 7 |
| <b>VI</b> | Slope classification, slope failure, modes of failure. Infinite slope in cohesive and cohesion less soil, Taylor's stability number, Swedish slip method and concept of Friction circle method, Landslides   | 7 |

#### **Text Book**

- 1 Irrigation Engineering - S. K. Garg, Khanna Publishers
- 2 Elementary Engineering Hydrology- M. J. Deodhar - Pearson Education

#### **References**

- 1 Irrigation Engineering - S. K. Garg, Khanna Publishers
- 2 Irrigation, Water Resources and water power engineering- P. N. Modi, Standard Book House.
- 3 Irrigation and water power Engineering- Dr. Punmia and Dr. Pande, Standard Publisher
- 4 Elementary Engineering Hydrology- M. J. Deodhar - Pearson Education
- 5 Engineering hydrology – K. Subramanyam Tata McGraw Hill
- 6 Hydrology- Principles, Analysis and Design, Raghunath, New Age International

CET304 R1		RCC Structure Design Lab					
(Ver 1.0, Program Core, School of Technology)							
Lecture	Tutorial I	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	4	2	Practical	ISE	50	40
					POE	25	

**Course Outcomes:** after the end of this course students will able to

**CET304.1** Able<sup>5</sup> to Translate the ideas into workable plans

**CET304.2** Analyze<sup>4</sup> and Design<sup>5</sup> the structural elements like beam, column, slab footing, & hence the structure as a whole

**CET304.3** Draft<sup>4</sup> the details for execution.

**CET304.4** Apply<sup>5</sup> drafted details for execution on site.

### Laboratory Work

Term work shall consist of detailed design & drawing of the following R.C. structures by Limit State Method.

1. Any ONE from the following:
  - a) Retaining wall (cantilever or counter fort type)
  - b) Design of footing (Raft foundation /pile foundation)
2. Design of staircase.
3. Design of Residential two storied building. (Minimum 120 sq mt.) for gravity loading. Drawings prepared shall indicate ductility details as per the provision in IS: 13920.

### Text Book

1. Fundamentals of Reinforced Concrete. Sinha and Roy, S. Chand and company Ltd. Ram Nagar, New Delhi.
2. Limit state theory and Design of concrete structure -Karve and Shah Structures publications, Pune
3. Reinforced Concrete Design Limit state - brothers Roorkee - A.K. Jain Nemchand brothers Roorkee
4. Design of G+3 RCC Building -Karve and Shah Structures publications, Pune

### References

- 1      Limit State Design of reinforced concrete, P.C.Varghese Prentice  
Hall, New Delhi
- 2      Reinforced Concrete Design by B.C. Punmia Mcmillan India Ltd.  
New Delhi
- 3      Special publications -16 Bureau of Indian standards
- 4      IS 456-2000 Bureau of Indian standards
- 5      IS 800-2007 Bureau of Indian standards
- 6      IS 875-1987 Bureau of Indian standards
- 7      IS 13920-2016 Bureau of Indian standards

CET305 R1		Highway Engineering Lab					
(Ver 1.0, Program Core, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	40
					POE	25	

**Course Outcomes:** after the end of this course students will able to

- CET305.1 Understand<sup>2</sup>** the basic properties of aggregates used for road construction.  
**CET305.2 Understand<sup>2</sup>** the basic properties of bitumen.  
**CET305.3 Recommend<sup>6</sup>** the suitability of road materials in constructions.  
**CET305.4 Analyze<sup>4</sup>** the quality of highway materials

### Laboratory Work

The students are expected to perform experiments out of list given below and submit report of same;

#### Tests on Aggregates

- Aggregate impact test
- Aggregate crushing value
- Aggregate abrasion value test
- Determination of flakiness index and elongation index of coarse aggregate

#### Test on Bituminous Materials

- Penetration Test
- Softening point test
- Flash and fire point test
- Ductility test
- Striping Value
- Viscosity of Bitumen

#### Text Book

1. Khanna, S.K., Justo, C.E.G. and A. Veeraragavan *Highway Materials and Pavement Testing*, 5th Edition, Nem Chand and Bros, Roorkee, India, 2009.
- Huang, Y.H. *Pavement Analysis and Design*, Pearson Prentice Hall, New Jersey, USA, 2004.
- Relevant IS, IRC, ASTM Codes.



CET 306 R1		Software Proficiency Program I					
(Ver 1.0, Program Core, School of Technology)							
Lecture	Tutoria l	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	4	2	Practical	ISE	100	40

**Course Outcomes:** after the end of this course students will able to

**CET 306.1 Know<sup>2</sup>** and defining details input in software by using software language.

**CET 306.2 Know<sup>2</sup>** in details of software to for estimating structure, Understand the preparation of Quotation.

**CET 306.3 Understand<sup>3</sup>** change of specification in Quotation, Know and define the entries of quantities and generating estimated reports.

**CET 306.4 create<sup>4</sup>** subcontractor database and detailed estimation for building and Reports.

Laboratory Work		Hours
1	HIT Office Function Toolbar	04
2	HIT Office Basic Three libraries of estimation module – Resource library - Introduction How to add new Resource, Work item specification library – Introduction, Rate Analysis library – Introduction, How to create new work item with its rate analysis?	06
3	Estimate Module: Settings, How to prepare the Quotation How to import the work item from Specification library?, How to import the work item from another Quotation?, Meaning of tabs in Edit Quotation window.	06
4	How to change detail specification of work item in Quotation?	05
5	How To enter the Quantities?, How to change rate analysis for Quotation? How to change price of resource for particular Quotation , How to give additional charges in % or amount, Reports	04
6	How to create subcontractor database. How to import the work item from Quotation?, How to import subcontractors from Supplier database? Price request letter, Enter prices of subcontractors in data, Price simulation, Reports.	05

#### MINI PROJECT

7	Detailed estimation on Residential Building or Commercial Building	20
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#### Text Book

1	T S Sharma, Estimating and Costing R C C Buildings using HIT Office with Indian Examples, Educreation Publishing New Delhi 2017.
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#### References

1	<a href="https://www.hit-office.com">Refer the website https://www.hit-office.com</a>
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CET 307 R1		Foreign Language/ Scholastic Aptitude					
(Ver 1.0, Program Core, School of Technology)							
Lecture	Tutoria l	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	-	-	-	-	-

CET 308 R1		Design of Steel Structures					
(Ver 1.0, Program Core, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

**Course Description:** This includes structural behavior of steel member subjected to different nature of force (Axial tension, axial compression, flexural and moving loads etc.). Analysis and design of end connections may be bolted or welded for each structural steel element. Also in this course study of structural behavior of steel member beyond the elastic limit.

**Course Outcomes:** after the end of this course students will able to

- CET308.1** Explain<sup>2</sup> behavior of structural steel elements and the design philosophies and Analyze<sup>4</sup> and design<sup>5</sup> bolted and welded connections in steel structures.
- CET308.2** Analyze<sup>4</sup> and design<sup>5</sup> of structural steel tension, compression members.
- CET308.3** Analyze<sup>4</sup> and design<sup>5</sup> column and column bases.
- CET308.4** Analyze<sup>4</sup> and design<sup>5</sup> beams and gantry girder and plastic analysis of steel member

### Course Content

Units	Description	Hours
<b>I</b>	<b>Introduction to Design of steel structures:</b> a) Design Philosophy, comparison of LSM & WSM, advantages and disadvantages of steel structures, types of steel structures, grades of structural steel, various rolled steel sections, loads and load combinations partial safety factors for load and materials, load calculation for roof trusses. b) Types of bolts & welds, analysis and Design of axially and eccentrically loaded bolted and welded connections (subjected to bending and torsion).	07
<b>II</b>	<b>Tension Members:</b> Common sections, Net area, modes of failure, load carrying capacity, Design of axially loaded tension members, Design of end connections (Bolted and welded).	07
<b>III</b>	<b>Compression Members as Struts</b>	07

Common sections, economical sections, effective length, slenderness ratio, modes of failure, classification of cross section, behavior of compression member, load carrying capacity, Design of compression members.

- |           |   |    |
|-----------|---|----|
| <b>IV</b> | <p><b>a) Columns :</b> Design of column subjected to axial and eccentric loading, design of lacing, battening system, column splices.</p> <p><b>b) Column Bases</b> Design of slab bases &amp; gusseted base subjected to axial and eccentric load and design of concrete pedestal</p>  | 07 |
| <b>V</b>  | <p><b>Beams:</b> Types of sections, behavior of beam in flexure, design of laterally supported, unsupported beams and built up beam using flange plates, curtailment of flange plates, check for deflection, shear, web buckling &amp; web crippling. Secondary and main beam arrangement, beam to beam connections.</p> <p><b>Gantry girder:</b> Forces acting on gantry girder, commonly used sections, design of gantry girder as laterally unsupported beam, connection details</p> | 07 |
| <b>VI</b> | <p><b>Plastic Analysis:</b> Plastic analysis of steel structures, shape factor, plastic hinge, collapse mechanism, upper bound theorem and lower bound theorems, application to continuous beam, single bay single storied rectangular frame.</p>   | 07 |

#### Text Book

- |   |   |
|---|---|
| 1 | Dr. M. R. Shiyekar, Limit state design in structural steel, PHI publications.   |
| 2 | S.S. Bhavikatti, Design of steel structure by Limit State Method as per IS: 800- 2007, I K International Publishing House, New Delhi. |

#### References

- |   |   |
|---|---|
| 1 | K.S. Sairam, Design of Steel Structures, Pearson  |
| 2 | S.K. Duggal, Limit State Design of Steel Structures, Tata Mc-Graw Hill India Publishing House |
| 3 | N.Subramanian, Design of steel structures, Oxford University Press                            |
| 4 | S. Ramamrutham, Design of Steel structures, Dhanapat Rai, Publication                         |

CET 309 R1		Analysis of indeterminate structures					
(Ver 1.0, Program Core, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

**Course Description:** This includes analysis of indeterminate structures Continuous beams, portal frames and plane frame. This course is divided into six units having different methods for analysis for indeterminate structures and interprets the output of different methods. Apply appropriate solution techniques to the problem and aware of limitations of the methods.

**Course Outcomes:** after the end of this course students will able to

- CET309.1 Understand<sup>2</sup>** concept of indeterminacy and **Analyze<sup>4</sup>** propped and fixed beam  
**CET309.2 Analyze<sup>4</sup>** indeterminate beam by slope deflection and moment distribution method  
**CET309.3 Analyze<sup>4</sup>** indeterminate beams by stiffness & flexibility method  
**CET309.4 Analyze<sup>4</sup>** indeterminate beams/frames by Clapeyron's theorem of three moment and approximate method.

### Course Content

Units	Description	Hours
<b>I</b>	<b>Introduction to Indeterminacy:</b> a) Concept of indeterminate structures, degree of freedom, static and kinematic indeterminacy (no numerical), methods of analysis. b) Analysis of propped cantilever beam and fixed beam using consistent deformation method	07
<b>II</b>	<b>Displacement method :</b> Slope deflection equation method, modified slope deflection equation, analysis of beam with sinking of support, variation of EI, Analysis of nonsway frame.	07
<b>III</b>	<b>Displacement method:</b> Moment distribution method, Distribution factor, analysis of beam with sinking of support, variation of EI, Analysis of nonsway and sway frame	07

<b>IV</b>	<b>Matrix Method:</b> a) <b>Displacement method:</b> Stiffness Method: Analysis concept of stiffness coefficient, stiffness matrix, analysis of continuous beam, frame. b) <b>Force Method:</b> Flexibility Method: Analysis concept of flexibility coefficient, flexibility matrix, analysis of continuous beam	07
<b>V</b>	<b>Force Method:</b> Clapeyron's theorem of three moments, analysis of continuous beam with sinking of support and variation of EI.	07
<b>VI</b>	<b>Approximate methods:</b> a) Approximate methods of analysis of multistoried, multibay 2D rigid jointed frames by portal and cantilever method. b) Introduction to substitute method of frame of analysis.	07

#### Text Book

- 1 Reddy C. S., Basic Structural Analysis, Tata Mc Graw Hill Publications.
- 2 B. N. Thadani, J. P. Desai, Structural Analysis – A Matrix Approach, Asia Publishing house, Mumbai.

#### References

- 1 S. Ramamrutham, R.Narayan, Theory of structures, Danapat Rai publishing company Pvt.Ltd
- 2 Vazirami&Ratwani, Analysis of Structure, Vol. II, Khanna Publications, New Delhi.
- 3 Pandit& Gupta, Structural Analysis a Matrix Approach, TataMcGraw Hill Publising Ltd.
- 4 A. S. Meghare, S. K. Deshmukh, Matrix Methods of Structural Analysis, Charotor Publishing House.
- 5 Negi&Jangid, Structural Analysis, TataMcGraw Hill.

CET310 R1		Water Supply Engineering					
(Ver 1.0, Program Core, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	00	-	3	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

**Course Description:** This course is about all the aspects related to water supply system of the society. It will be dealt with quality, characteristics of water and also describes in detail various water treatment processes. This course is divided into six units in two sections. section – I contains quality and characteristics of water, collection and conveyance of water section –II includes water treatment processes, distribution system of water and water supply appurtenances

**Pre-requisite:** Environmental science, Engineering mathematics I, II and III.

**Course Outcomes:** after the end of this course students will be able to

**CET310.1 Explain<sup>3</sup>** the sources with respect to characteristics and quantity of water

**CET310.2 Describe<sup>4</sup>** and design the various water treatment units.

**CET310.3 Illustrate<sup>4</sup>** the special water treatments and sequencing of treatment for various qualities of surface & ground water.

**CET310.4 Design<sup>4</sup>** the various components related to transmission and distribution of water.

### Course content

Units	Description	Hours
<b>I</b>	<b>Introduction</b> - Importance and Necessity of Protected Water supply Scheme - Flow chart of public water supply system <b>Quality and Quantity of Water</b> - Domestic, commercial and public requirements - Various methods of estimating population - Variations in rate of demand and its effects on design - Indian standards for drinking water	07
<b>II</b>	<b>Collection and Conveyance of Water</b> - Intakes, types of intakes - Hydraulics of conduits - Different types of pipes used and their suitability - pumping & gravity mains	07

<b>III</b>	<b>Water treatment Process –</b> Aeration: Principle and Concept – Necessity – Methods - Types. Plain sedimentation - sedimentation tank & its design sedimentation with coagulation - types of coagulants - optimum dose of coagulants -mixing devices - design of flocculator	07
<b>IV</b>	<b>Filtration-</b> Mechanism, head loss development - negative head loss. Types of filters- Slow sand, Rapid sand, Multimedia & Pressure filters. <b>Disinfection-</b> Mechanism - factors affecting disinfection - methods of disinfection - chemistry of chlorination - Forms of chlorination and practices. <b>Water softening processes-</b> lime-soda process - ion exchange <b>Demineralization</b> - Reverse osmosis, electro dialysis - Layout of water treatment units as per source.	07
<b>V</b>	<b>Distribution System</b> - methods of water distribution - storage capacity of ESR, and underground service reservoir- Layouts of distribution networks, Components of distribution – system - Equivalent Pipe - Newton’s and Hardy cross methods for network analysis	07
<b>VI</b>	<b>Water supply appurtenances:</b> sluice valve - air relief valve - gate valve - non-return valve- scour valve - fire hydrants, water meter - service connections, maintenance & leak detection of water distribution system. Concept of Green building	07

#### Text Book

- 1 Peavy and Rowe, Environmental Engg., McGraw Hill Publications
- 2 S. K. Garg ,Water Supply Engg., Khanna Publishers -NewDelhi.

#### References

- 1 B.C.Punamia, Water Supply Engg , Laxmi publication
- 2 Water Supply and Treatment Manual: Govt. Of India Publication.
- 3 Dr.P.M.Modi, Water Supply Engg, Standard Book House, New Delhi.
- 4 A.P. Sincero and G.A. Sincero, Environmental Engineering: A design approach, Prentice Hall of India
- 5 Mark J. Hammer, John Wiely and Sons, Water and Waste Water Technology, John Wiely and Sons.



CET 311 R1		Steel Structure Design Lab					
(Ver 1.0, Program Core, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	4	2	Practical	ISE	50	40
					POE	50	

**Course Outcomes:** after the end of this course students will able to

- CET311.1** Analyse<sup>4</sup> and design<sup>5</sup> of truss, gantry girder and Bracket.  
**CET311.2** Analyse<sup>4</sup> and design<sup>5</sup> of column and column bases  
**CET311.3** Draw<sup>1</sup> detail drawing of design structure using Auto cad.  
**CET311.4** Analyse<sup>4</sup> and design<sup>5</sup> plate girder or steel building frame.

#### Laboratory Work

**Project** The students are expected to Analyze and design the following steel structures and submit report of same in printed form.

**Project 1 is compulsory and students have to select any one from project 2 and 3**

**1 Design of Industrial shed for different location of the India**

**It includes,**

- Analysis and Design of truss.
- Analysis and Design of gantry girder.
- Analysis and Design of bracket.
- Analysis and Design of column.
- Analysis and Design of Column bases.
- Analysis and Design of bracings.
- One full imperial drawing sheet on above design using Auto cad Software.

**2 Design of welded plate girder and its end connections.**

- One full imperial drawing sheet on above design using Auto cad Software.

**OR**

**3 Design of G+1 Steel Building frame**

- One full imperial drawing sheets on above design using Auto cad Software.
- Students must analyze and design any one project using relevant software like Stadd Pro, ETABS, SAP 2000 and ANSYS etc.

#### Text Book

- 1 Dr. M. R. Shiyekar, Limit state design in structural steel, PHI publications.
- 2 S.S. Bhavikatti, Design of steel structure by Limit State Method as per IS: 800- 2007, I K International Publishing House, New Delhi.

**References**

- 1 K.S. Sairam, Design of Steel Structures, Pearson
- 2 S.K. Duggal, Limit State Design of Steel Structures, Tata Mc-Graw Hill India Publishing House
- 3 N.Subramanian, Design of steel structures, Oxford University Press
- 4 S. Ramamrutham, Design of Steel structures, Dhanapat Rai, Publication

CET312 R1		Water Testing Lab					
(Ver 1.0, Program Core, School of Technology)							
Lecture	Tutoria l	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	40
					POE	25	

**Course Outcomes:** after the end of this course students will able to

**CET312.1 Identify<sup>1</sup>** the tests to assess water quality parameters

**CET312.2 Assess<sup>2</sup>** the quality of the given source of water for drinking purpose as per codal provision

**CET312.3 Identify<sup>1</sup>** the treatment for purification of water based on laboratory test results

**CET312.4 Correlate<sup>4</sup>** the water treatment facility in the practice with theoretical knowledge

### Laboratory Work

**A]** The students are expected to perform experiments given below and submit report of same;

- 1 pH
- 2 Alkalinity and Acidity
- 3 Hardness
- 4 Chlorides
- 5 Chlorine demand and residual chlorine.
- 6 Turbidity and optimum dose of alum
- 7 Dissolved oxygen
- 8 Conductivity, total solids, suspended solids
- 9 Sulphates
- 10 Fluorides
- 11 Iron
- 12 Most Probable Number (MPN)

**B]** Site visit to water treatment plant: A report based on the visit to water treatment plant would be submitted and would form a part of the term work.

**C]** Design of various components of water treatment plant :  
 Design of various components of water treatment plant would be carried out based on the theory covered in Environmental Engineering-I.

**OR**

**C]** Study of Software or programming for analysis of water distribution

System :Programmes available for the design of various water treatment plants would be used or Computer Programmes to Design various units.

**Text Book**

- 1 A. K. Chopra, Dynamics of Structures: Theory & Application to Earthquake Engineering, Prentice Hall Publications.
- 2 Mario Paz, Structural Dynamics, CBS Publication.

**References**

- 1 Water Supply and Treatment, Manual, Ministry of Works and Housing, New Delhi.
- 2 S.K.Garg ,Water Supply Engineering, Khanna Publisher
- 3 B.C. Punmia, Environmental Engg. Vol. – I, Laxmi Publications.
- 4 G.S. Birdie and J.S. Birdie, Water Supply and Sanitary Engineering, Dhanpat Rai Publishing Co. New Delhi

CET313 R1		Software Proficiency Program II					
(Ver 1.0, Program Core, School of Technology)							
Lecture	Tutoria l	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	4	2	Practical	ISE	100	40

**Course Outcomes:** after the end of this course students will able to

**CET 313.1 Know<sup>2</sup>** and defining structural properties in software by using software language, **Analyze<sup>4</sup>** and design of beams in software.

**CET 313.2 Analyze<sup>4</sup>** and design of Frames for vertical loads , Analyze and design of Frames for Lateral loads (Wind Loads, Earthquake loads).

**CET 313.3 Analyze<sup>4</sup>** and design of Truss structure.

**CET 313.4 Analyze<sup>4</sup>** of plates.

Laboratory Work		Hours
1	Introduction of ETABS software. (File Operations, Edit, Define, Draw, Select, Assign, Analyze) Basic Modes, Drawing Tools, Mouse Pointers, Begin a Model	04
2	Create the Structural Model: Add Structural Objects Using Templates, Define Properties, Add Structural Objects Manually,( Draw Columns, Beams etc.)	06
3	Select Structural Objects: Graphical Selection Options, Selecting by Coordinates, Selecting by Feature, Deselect Command, Invert Selection Command, Get Previous Selection Command, Clear Selection Command	06
4	Assign/Change Properties : Assign the AUTOLATBM Auto Select Section List, Make an Assignment as the Object is Drawn, Make an Assignment using the Model Explorer, Check the Sections in an Auto Select Section List, Load the Structural Model: Structural Loads, Define Load Cases	05
5	Edit the Model Geometry: Editing Options	04
6	Analyze the Model: Set the Mesh Options, Model Analysis, Locking and Unlocking the Model, Design, Detailing, Display Results, Generate Results.	05

#### MINI PROJECT

Analysis and Design of RCC Multistoried building	20
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#### Text Book

1	Gaurav Verma, ETABS 2016 Black Book, Cadcam cae Works; 1 edition (27 February 2018).
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#### References

1	Gaurav Verma, Etabs 2016 Black Book, Cadcam cae Works; 1 edition (27 February 2018).
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CET 314 R1		Foreign Language/ Scholastic Aptitude					
(Ver 1.0, Program Core, School of Technology)							
Lecture	Tutoria l	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	-	-	-	-	-

### CET 315 R1: Mini Project I

(Ver 1.0, Program Core, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	FET	100	40
					-	-	-

**Course Outcomes:** after the end of this course students will able to

**CO315.1** **Acquired**<sup>2</sup> knowledge within the chosen area of technology for project development

**CO315.2** **Identify**<sup>2</sup> and **justify**<sup>2</sup> the technical aspects of the chosen project with a comprehensive and systematic approach

**CO315.3** **Reproduce**<sup>3</sup>, improve and refine technical aspects for engineering projects

**CO315.4** work as an individual in development of technical projects

### Syllabus

Mini project may be carried out in one or more form of following:

- Product preparations, working/non-working models, prototype development, fabrication of setups, laboratory experiment development, process modification/development, simulation, software development, integration of software and hardware, statistical data analysis, survey, creating awareness in society.
- The student is required to submit a report based on the work. The evaluation of the project shall be on continuous basis.

CET316 R1		Industry Internship					
(Ver 1.0, Program Core, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-		1	Presentation	ISE	25	50

**Course Description:** The students are required to undergo rigorous field training for Three week in any of the Civil engineering firms to have an exposure to practical aspects. Student shall submit a report on field training and give presentation based on training.

**Course Outcomes:** after successful completion of this course students will able to

- CET316.1** Understand<sup>3</sup> and correlate<sup>3</sup> engineering knowledge and field practices in civil engineering.
- CET316.2** Correlate<sup>3</sup> theoretical concepts with practical implementation
- CET316.3** Acquire<sup>3</sup> skill for report preparation skill and work as an individual and team
- CET316.4** Acquire<sup>3</sup> skill for work as an individual and as team member

### Description

#### Industry Internship (Three Week)

The students are required to undergo rigorous field training for three weeks in any of the Civil engineering firms to have an exposure to practical aspects. Student shall submit a report on field training and give presentation based on training.

The Report Should Consist:

1. Introduction and Brief History of the Organization Plans, estimate etc.
2. Technical and Practical information gained during the training period
3. Daily Material Consumption Report
4. Daily Work Progress Report
5. Daily Muster of Labors on Site
6. Safety Measures
7. Site Layout
8. Site Details (Includes Plan)
9. Bar Chart of Work
10. Necessary certificate from the organization where such training is undertaken
11. Conclusion and Recommendations, Photo gallery, References, Appendices.

Note:

The faculty in charge shall personally visit the site at least once during the training period. Evaluation of Report by External should be done at the end of 6th semester



CET317 R1		Site Investigation Methods and Practices					
(Ver 1.0, Program Elective I, School of Technology)							
Lecture	Tutoria l	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	1	-	4	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

**Course Description:** This course intends to provide students a comprehensive knowledge on Geotechnical Exploration & Investigations. The course focuses the methods of exploration, instrumentation required for exploration. The course also focuses on the report writing aspects of the geotechnical exploration. This course is important, as geotechnical investigation is an important form of any Civil engineering project.

**Course Outcomes:** after the end of this course students will able to

- CET317.1 Explain<sup>2</sup>** importance of geotechnical exploration.
- CET317.2 Explain<sup>2</sup>** principles of exploration and site investigations.
- CET317.3 Describe<sup>2</sup>** various field techniques used in geotechnical engineering for ascertaining the nature and behavior of soil strata.
- CET317.4 Perform<sup>2</sup>** geotechnical exploration at various sites & prepare detailed site investigation report.

### Course Content

Units	Description	Hours
<b>I</b>	Importance and objectives of Geotechnical exploration, Principal methods of subsurface exploration, open pits and shafts. Types of borings, selection of suitable boring type, stabilization of boreholes, number, location and depth of boring for different structures, and for different nature of ground profile	07
<b>II</b>	Planning of subsurface exploration program for major civil engineering project, Indirect methods of exploration (Seismic refraction method, electrical resistivity method), qualitative and quantitative interpretation of test results, advantages, limitations and criteria for selection of method for investigation	07

<b>III</b>	Types of soil samples & their suitability, precautions in sampling, parameters for sampler design, boring and sampling records handling, preservation & shipment of samples, underwater sampling.	07
<b>IV</b>	Standard Penetration test, static cone and dynamic cone penetration tests, interpretation of test results and correlations for obtaining design soil parameters of cohesive and cohesion less soil, Design value of undrained strength of clays, correction factor, ground water table location.	07
<b>V</b>	Plate load test (PLT): purposes, procedure, advantages, limitations of PLT, interpretation for bearing capacity and settlement of foundation from PLT. Pressure meter test – Principle, equipment, use & interpretation of results, field vane shear test	07
<b>VI</b>	Technical Report writing, report format, recommendations for earth work structures, highway excavations and drainage works, dams, check report site preparation, investigation during construction and operation. Sub-surface Investigation Report: Salient features and boring logs; Soil survey and Mapping: methods of soil survey introduction of remote sensing	07

### **Tutorial**

One hour per week per batch tutorial is to be utilized for problem solving to ensure that students have properly learnt the topics covered in the lectures. This shall include assignment, tutorials, quiz, and surprise test, declared test, seminar, final orals and any others. The teacher may add any of other academic activity to evaluate student for his/her in semester performance.

### **References**

- 1 Site Investigation Practice, Joyce, M.D ESFN. SPON Publishers, 1982.
- 2 Basic and Applied soil mechanics: Gopal Ranjan & A.S. Rao, New Edge International Ltd., (2004)
- 3 Foundation Analysis & Design: Bowles, J.E., McGraw Hill (1996)
- 4 Site investigation by Clayton, Mathews and Simons
- 5 Geotechnical Engineering Investigation Manual by R.E. Hunt, Mc Graw Hill Co. New York

<b>CET318 R1</b>	<b>Fibre Reinforced Concrete</b>
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(Ver 1.0, Program Elective I, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

**Course Description:** Concrete structures are subjected to constant deterioration due to effects of ageing, inadequate maintenance, severe environmental exposure, penetration of catalytic agencies such as moisture, gases like CO<sub>2</sub> & oxygen, chloride ions, industrial pollutants, abuse etc. This deterioration needs to be timely arrested before it leads to irreversible damage making it imperative to repair and upgrade.

**Course Outcomes:** after the end of this course students will able to

- CET318.1 Appraise<sup>4</sup>** the historical aspect of fibre reinforced concrete (FRC)  
**CET318.2 Evaluate<sup>6</sup>** effect of fibres on fresh and hardened properties of concrete  
**CET318.3 Rewrite<sup>5</sup>** theoretical aspects and engineering applications of FRC  
**CET318.4 Examine<sup>4</sup>** effect of constituent materials on FRC.

Syllabus (Theory)		
Units	Description	Hours
<b>I</b>	<b>Introduction:</b> Historical development; Specifications and recommended procedures. Interaction between fibres and matrix Fibre interaction with homogeneous uncracked matrix; Fibre interaction in cracked matrix; Interpretation of test data and analytical models; Composition of the matrix.	07
<b>II</b>	<b>Basic concepts and mechanical properties :</b> Tension Basic concepts; Strong brittle fibres in ductile matrix; Strong fibres in a brittle matrix; Tension behaviour of fibre cement composites; Experimental evaluation of conventional fibre-cement composites; Elastic response in tension; Prediction of composite strength based on empirical approaches; Experimental evaluation of high volume fraction fibre composites.	07
<b>III</b>	<b>Basic concepts and mechanical properties:</b> Bending Mechanism of fibre contribution to bending; Flexural toughness; Prediction of load deflection response.	07

- |           |   |    |
|-----------|---|----|
| <b>IV</b> | <b>Properties of constituent material:</b> Cement; aggregates; water and water-reducing admixtures; Mineral admixtures; Other chemical admixtures; Special cements; Metallic fibres; Polymeric fibres; Carbon fibres; Glass fibres.   | 07 |
| <b>V</b>  | <b>Mixture Proportioning:</b> Mixing and Casting procedures, Mix proportions for FRC containing coarse aggregates; Mixing and casting procedures. Properties of freshly mixed FRC Containing coarse aggregates Workability tests; Tests for air content; Yield and unit weight; Steel fibre-reinforced concrete; Polmeric fibre- reinforced concrete; Other fibres. | 07 |
| <b>VI</b> | <b>Properties of Hardened FRC:</b> Behaviour under compression, tension, flexure, shear, torsion and bending – FRC with steel fibres, FRC with polymeric fibres.  | 07 |

#### Text Book

- 1 Neville, A.M; “Properties of Concrete”, Pitman Publishing Limited, London,1995
- 2 Shetty M. S, “Concrete Technology”, S. Chand and Company Ltd, New Delhi, 2003

#### References

- 1 Fibre reinforced cement composites by P.N. Balaguru and S.P. Shah, McGraw- Hill, 1992
- 2 Fibre reinforced cementous composites by A. Benturand and S. Mindess, Taylor & Francis, 1990.
- 3 Structural applications of fibre reinforced concrete , SP-182, ACI, 1998.

CET319 R1		Advanced Traffic Engineering					
(Ver 1.0, Program Elective I, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3		-	3	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

**Course Description:** This course is about traffic engineering its characteristics and application of ITS in-traffic engineering. Pre-requisites for this course are courses from transportation engineering-I and basic civil engineering.

**Course Outcomes:** after the end of this course students will able to

- CET319.1** Explain<sup>2</sup> the role of infrastructure in developing society, transport sector in India, development plans, traffic, its components, factors affecting road traffic
- CET319.2** Analyze<sup>4</sup> traffic speed study data and its presentation & Apply<sup>3</sup> the knowledge of sampling data in conducting various surveys and analysis.
- CET319.3** Apply<sup>3</sup> the knowledge of Trip generation and distribution in traffic analysis.
- CET319.4** Appraise<sup>4</sup> the advantages of ITS and Choose<sup>6</sup> the appropriate technologies for field conditions.

### Course Content

Units	Description	Hours
<b>I</b>	<b>Introduction</b>	07
	Infrastructure & its role in developing society; Transport sector in India – policy framework; Development plans –Airports, Highways –National highway development program (NHDP); JNNURM, Asian highways network (AH).	
<b>II</b>	<b>Traffic characteristics</b>	07
	Traffic characteristics – Road user characteristics, General human characteristics, Physical characteristics. Vision eye – movement peripheral vision, Visual attention, Visual sensitivity to light and colour, glare vision and recovery perception of space. Hearing, Stability sensation, Time factor in response, Theory of PIEV modifying factors, conditional responses; Vehicular Characteristics – types, dimensions, resistance, power requirement for different resistance, change in direction – minimum turning radius, off tracking, slip angle.	

<b>III</b>	<b>Traffic Engineering &amp; Speed Analysis, Traffic operation and management</b>	<b>07</b>
	<p><b>a) Traffic Engineering &amp; Speed Analysis:</b> Introduction, Speed studies, journey time and delay studies, Sampling in traffic studies &amp; application, Traffic surveys-types of volume count Planning, Problems on PCU, moving observer method and spot speed.</p> <p><b>b) Traffic operation and management:</b> Traffic systems management and Travel demand management - Congestion management-Cost effective management measures, Traffic control aids, Street furniture, Road Arboriculture–Traffic Regulation, Traffic Sign and Road Markings.</p>	
<b>IV</b>	<b>Trip generation and distribution</b>	<b>07</b>
	Factors governing trip generation and attraction –Application of Regression Analysis- Methods of trip distribution; Growth and Synthetic Models Calibration and Application of gravity model.-Category analysis.	
<b>V</b>	<p>a) Introduction to intelligent transportation systems (ITS) and its functional areas</p> <p>Definition, Objectives, Historical Background, Benefits of ITS -ITS Data collection techniques –Detectors, Automatic vehicle location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), Video data collection.</p> <p>b) ITS functional areas Advanced traffic management systems (ATMS), Advanced traveller information Systems (ATIS), Commercial vehicle operations (CVO), Advanced vehicle control systems (AVCS), Advanced Public transportation systems (APTS), and Advanced rural transportation systems (ARTS).</p>	<b>07</b>
<b>VI</b>	<b>Public transport system</b>	<b>07</b>
	History and role of Transit, Transit system and transit mode characteristics, Transportation technology Vision–2020, Role of various modes of Mass Transport and their Impact, Indian condition Bus Rapid Transit Systems (BRTS)-Rapid transit Rail-Metro & Mono rails.	

#### **Text Book**

- 1 Kadiyali L.R. and N.B. Lal (2004): Principles and Practice of Highway Engineering Including Expressways and Airport Engineering), Khanna Publishers, New Delhi.

- 2 Kadiyali L.R. (1994): Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi.
- 3 ParthaChakroborty and Animesh Das (2003): Principles of Transportation Engineering, Prentice-Hall India, New Delhi.

#### **References**

- 1 Black John (1981): Urban Transportation Planning. Croom Helm Ltd. London.
- 2 BPR (1970): Urban Transportation Planning: General Information and Introduction to System 360. Bureau of Public Roads, Washington D.C.
- 3 Bruton M.J. (1975): Introduction to Transportation Planning. II Edn. Hutchinson, London
- 4 Drew D.R. (1968): Traffic Flow Theory and Control, McGraw-Hill, New York.
- 5 Hutchinson B.G. (1974): Principles of Urban Transport Systems Planning. McGraw-Hill Book Co., New York.
- 6 McShane W.R. and Roess R.P. (1990): Traffic Engineering, Prentice-Hall Inc., New Jersey

CET 320 R1		Quality Control and Safety Management					
(Ver 1.0, Program Elective I, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

**Course Description:** This includes a complete understanding on quality planning, quality assurance, quality control and safety management.

**Pre-requisite:** Engineering Management.

**Course Outcomes:** after the end of this course students will able to

- CET320.1 Exposed<sup>5</sup>** to quality management system & elements of quality planning and the implication
- CET320.2 Developed<sup>5</sup>** awareness of quality standards and inspection required for total quality management in construction.
- CET320.3 Describe<sup>3</sup>** Failure Mode, Effect & analysis
- CET320 .4 Setup<sup>5</sup>** safety measure on construction site

### Course Content

Units	Description	Hours
<b>I</b>	<b>Quality Management Systems :</b> Concepts regarding QMS, Purpose of Quality Management System, Determinants of Quality, types of quality, Principles of the Quality Management, Methods of Quality Management, Basic tools of quality, Inspection & quality control, Quality circle, function and Organization of Quality Circle.	07
<b>II</b>	<b>Quality Assurances and Quality Control:</b> Concepts of QA & QC, Difference between QA & QC , Customer satisfaction, Method of measurement of customer feedback , Statistical tolerance, Taguchi's concept of quality, Total Quality Management	07
<b>III</b>	<b>Quality Management in Construction Projects:</b> Need of quality control in construction, factors influencing construction quality, quality	07



management at different stages of construction, Quality control during construction.

- |           |   |    |
|-----------|---|----|
| <b>IV</b> | <b>Codes and Standards:</b> Organizations for the comparative analysis of standards or specifications, ISO 9000 series, contract documents for construction project ,construction programming, inspection, necessity for inspection ,types of quality inspection, cost of quality                   | 07 |
| <b>V</b>  | <b>Failure Mode ,Effect &amp; analysis:</b> FMEA terms, Risk Priority number, Process of develop an FMEA ,Structure and example of FMEA Form, Reliability and Reliability Engg., Methods of reliability Engg. Life cycle costing, Value engineering and value analysis                              | 07 |
| <b>VI</b> | <b>Safety in Construction Activity:</b><br>Importance of safety, Construction activity, environmental safety. Social and environmental factors, Ability of systems to protect fire, Preventive systems, Planning for pollution free construction environmental, Hazard free Construction execution. | 07 |

#### Text Book

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|---|--|
| 1 | James, J.O Brian, “Construction Inspection Handbook -Quality Assurance and Quality Control”, Van Nostrand, New York, 2009. |
|---|--|

#### References

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|---|---|
| 1 | Kwaku, A., Tenah, Jose. M. Guevara, “Fundamentals of Construction Management and Organization”, Reston Publishing Co., Inc., Virginia, 2005 |
| 2 | Juran Frank, J.M. and Gryna, F.M. “Quality Planning and Analysis”, Tata McGraw Hill 2002.   |
| 3 | Clarkson H. Oglesby, “Productivity Improvement in Construction”, McGraw-Hill, 2009.   |
| 4 | L. Ashford, “The Management of Quality in Construction”, E & F.N, Spon. New York, 2009.   |
| 5 | Steven McCabe, “Quality Improvement Techniques in Construction”, Addison Wesley Longman Ltd, England. 2008.                                 |

CET321 R1		Advanced Fluid Mechanics					
(Ver 1.0, Program Elective I, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	1	-	4	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

**Course Description:** Advanced fluid mechanics deals with knowledge of in depth study of **Kinematics of Flow, Boundary Layer Theory** and compressible flow. Fluid statics will be dealt with detail.

**Pre-requisite:** Pre-requisites for this course are courses from courses dealing with flow through pipes and open channel hydraulics, mathematics and engineering mechanics. This course also deals with open channel hydraulics

**Course Outcomes:** after the end of this course students will able to

- CET321.1** Recognize<sup>2</sup> the basics of fluid mechanics, **Explain**<sup>2</sup> and **Discuss**<sup>4</sup> kinematics of fluid flow
- CET321.2** Discuss<sup>1</sup> concept of conformal mapping
- CET321.3** Discuss<sup>2</sup> boundary behavior
- CET321.4** Explain<sup>2</sup> and Discuss<sup>4</sup> compressible flow concept

#### Course contents

Units	Description	Hours
<b>I</b>	<b>Basics:</b> Revision of concepts in basic Fluid Mechanics such as classification of flows, Equation of continuity for three dimensional flow in Cartesian co-ordinates, equation of continuity for one-dimensional flow along a streamline, types of motion, rotational and irrotational motion, velocity potential, stream function and flow net, Euler's equation of motion along a streamline and its integration, Bernoulli's equation	<b>7</b>
<b>II</b>	<b>Kinematics of Flow</b> Continuity Equation in polar and cylindrical coordinates, solving laplace's equation by graphical & relaxation method.	<b>7</b>
<b>III</b>	<b>Conformal mapping:</b> Standard two-dimensional flow pattern, source, sink, doublet and their combination.	<b>7</b>

- |           |   |          |
|-----------|---|----------|
| <b>IV</b> | <p><b>Laminar Flow</b></p> <p>Navier Stokes equation-derivation, exact flow between parallel plates-it's exact solution. Flow near an oscillating plate &amp; suddenly accelerated plate.</p> <p><b>Turbulent Flow</b></p> <p>Reynold's equation of motion, typical solution, Energy and Momentum equation</p> <p>Statistical theory of turbulence, Isotropic and homogeneous turbulence, probability density function.</p> | <b>7</b> |
| <b>V</b>  | <p><b>Boundary Layer Theory</b></p> <p>Development of boundary layer on a flat plate nominal, displacement, momentum, energy thicknesses, laminar, transitional and turbulent boundary layer, laminar sub layer, Local and mean drag coefficients. Karman's momentum integral equation, Karman Pohlhausen's solution, Boundary layer separation.</p>  | <b>7</b> |
| <b>VI</b> | <p><b>Principles of Compressible Flow</b></p> <p>Compressible fluid flow-fundamental equation, continuity equation, energy equation, velocity of propagation. Pressure, density and temperature in terms of Mach No.</p> <p>Normal shock in one dimensional compressible flow &amp; compressible flow around immersed bodies.</p>   | <b>7</b> |

#### Text Book

- 1 Modi. P. M. and Seth S. N., "Fluid mechanics & hydraulics", 10<sup>th</sup> Edition, Standard Publications (2015).
- 2 R. K. Bansal, "Fluid mechanics & hydraulics", 14<sup>th</sup> Edition, Khanna publications (2009).

#### References

- 1 Fluid Mechanics – A.K. Jain – Khanna Pub., Delhi
- 2 Fluid Mechanics – Hydraulic and Hydraulic Mechanics -Modi/Seth – Standard Book House, Delhi
- 3 Fluid Mechanics – S. Nagrathanam – Khanna Pub., Delhi
- 4 Fluid Mechanics through Problems – Garde R. J.
- 5 Fundamentals of Fluid Mechanics, Munson, Young, Okiishi, Huebesch, Wiley Publication
- 6 Fluid Mechanics – A.K. Jain – Khanna Pub., Delhi

CET322 R1		Disaster Management & Mitigation					
(Ver 1.0, Program Elective I, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	2	4	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

**Course Description:** This includes Introduction to Disasters, its types and mitigation & management of disasters. This course is divided into six units in two sections. Section – I contain Disasters, its types and disaster reduction measures. Section –II includes relationship between disaster & development, disaster management in India and Applications of GI, case studies in disaster management.

**Pre-requisite:** Disaster management.

**Course Outcomes:** after the end of this course students will able to

**CET 322.1 Understand<sup>2</sup>** disaster & relationship between vulnerability, disasters, disaster prevention and risk reduction.

**CET 322.2 Understand<sup>2</sup>** various methods of risk reduction as well as mitigation.

**CET 322.3 Understand<sup>2</sup>** Disaster damage assessment and management.

**CET 322.4 Understand<sup>2</sup>** applications and disaster management case studies.

#### Course Content

Units	Description	Hours
	<b>Section-I</b>	
<b>I</b>	<b>Introduction to disasters</b> Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity – Disaster and Development, and disaster management	07
<b>II</b>	<b>Types, trends, causes, consequences and control of disasters</b> Geological Disasters; Hydro-Meteorological Disasters; Biological Disasters; Technological Disasters and Manmade Disasters Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters	07
<b>III</b>	<b>Disaster management cycle</b>	07

Disaster Management Cycle, DRR (Disaster Risk Reduction); Pre-Disaster, During Disaster, Post-disaster; IDNDR, Yokohama Strategy, Hyogo Framework of Action

#### Section-II

- |           |  |    |
|-----------|--|----|
| <b>IV</b> | <b>Inter-relationship between disasters and development</b><br>Factors affecting Vulnerabilities, differential impacts, impact of Development projects, Climate Change Adaptation  | 07 |
| <b>V</b>  | <b>Disaster management in India</b><br>Disaster profile of India – mega disasters in India and disaster management act 2005, national policy on disaster management, national guidelines and plans on disaster management; role of government, non-government and inter-governmental agencies  | 07 |
| <b>VI</b> | <b>Disaster management: applications and case studies</b><br>Geo-informatics in Disaster Management, Disaster Communication System, Land Use Planning and Development Regulations, Disaster Safe Designs and Constructions, Structural and Non Structural Mitigation of Disasters ,Study of Recent Disasters and Preparation of Disaster Risk Management Plan of an Area | 07 |

#### Practical

- (A) One assignment on each unit .  
 (B) Seminar report on any one topic on Disasters Management

#### Text Book

- 1 Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
- 2 Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
- 3 Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
- 4 Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

#### References

- 1 An overview on natural & man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi
- 2 Disasters in India Studies of grim reality, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur 8
- 3 Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005

- 4 Government of India, National Disaster Management Policy, 2009.
- 5 High Power Committee Report, 2001, J.C. Pant
- 6 Management of Natural Disasters in developing countries, H.N.  
Srivastava & G.D. Gupta, Daya Publishers, Delhi, 2006, 201 pages
- 7 Manual on natural disaster management in India, M C Gupta, NIDM, New  
Delhi

CET323 R1		Earth Retaining Structures					
(Ver 1.0, Program Elective II, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	1	-	4	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

**Course Description:** This course provides knowledge about different types of retaining structures. The course shall be taught using a combination of lectures, interactive tutorials. This course focuses on the principles of design of retaining structures. It also focuses on the analysis, design and construction aspects of retaining structures.

**Course Outcomes:** after the end of this course students will able to

- CET323.1 Explain<sup>2</sup>** lateral earth pressure theories design retaining walls.
- CET323.2 Analyze<sup>2</sup>** and design anchored bulkheads by different methods.
- CET323.3 Explain<sup>2</sup>** pressure envelops and design various components in braced cuts and cofferdams.
- CET323.4 Determine<sup>2</sup>** stability of earth dams and suggest protection measures

### Course Content

Units	Description	Hours
<b>I</b>	<b>Lateral Pressure:</b> Basic concepts, Rankine and Coulomb earth pressure theories, graphical methods. Determining active and passive pressures: Culmanns, Rebhan's, friction circle method. Consideration of surcharge, seepage, stratification, type of backfill, wall friction and adhesion.	07
<b>II</b>	<b>Retaining walls:</b> Uses, types, stability and design principles of retaining walls, backfill drainage, settlement and tilting.	07
<b>III</b>	<b>Anchored bulkheads:</b> Classification of anchored bulkheads, free and fixed earth support methods. Rowe's theory for free earth supports, equivalent beam methods for fixed earth supports.	07

- |           |  |    |
|-----------|--|----|
| <b>IV</b> | <b>Braced cuts and Cofferdams:</b> Braced excavations and stability of vertical cuts, lateral pressures in sand and clay, Braced and cellular cofferdams: uses, types, components, stability, piping and heaving. Stability of cellular cofferdams, cellular cofferdams in rock and in deep soils. | 07 |
| <b>V</b>  | <b>Earth dams- Stability analysis:</b> Classification, seepage control in embankments and foundations, seepage analysis, stability analysis: upstream and down stream for steady seepage, rapid draw down, end of construction, method of slices and Bishop's method.                              | 07 |
| <b>VI</b> | <b>Earth dams -Protection &amp; Construction:</b> Slope protection, filters, embankment construction materials and construction, quality control, grouting techniques. Instrumentation and performance observations in earth dams.   | 07 |

### Tutorial

One hour per week per batch tutorial is to be utilized for problem solving to ensure that students have properly learnt the topics covered in the lectures. This shall include assignment, tutorials, quiz, and surprise test, declared test, seminar, final orals and any others. The teacher may add any of other academic activity to evaluate student for his/her in semester performance.

### Text Book

- 1 Basic & Applied soil mechanics – Gopal Ranjan & ASR Rao, New Age International Publishers, 2011.

### References

- 1 Foundation design by W. C. Teng, Prentice Hall, 1962
- 2 Analysis and design of foundations by Bowles. J. W McGraw Hill, 4th edition, 1955.
- 3 Earth and Rock-Fill Dams: General Design and Construction considerations by United States Army Corps of Engineers, University Press of the Pacific, 2004
- 4 Soil mechanics in engineering and practice by Karl Terzaghi, Ralph B. Peck, Gholamreza Mesri, 3rd Edition. Wiley India Pvt Ltd, 2010.



CET324 R1		Advanced Design of Concrete Structure					
(Ver 1.0, Program Elective II, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3		-	3	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

**Course Description:** This course requires the student to know about the basic concepts of theory of elasticity, fundamentals of reinforce concrete design, use of IS 456: 2000, IS 3370: 1991(Part 1) Code of Practice for concrete structures for the storage of liquids.

**Course Outcomes:** after the end of this course students will able to

- CET324.1** Analyze<sup>4</sup> and design<sup>5</sup> Structural elements like continuous beams and overhead water tanks.
- CET324.2** Analyze<sup>4</sup> and design<sup>5</sup> long span roofs structures like Flat slab and Grid floor by I.S. code method.
- CET324.3** Analyze<sup>4</sup> and design<sup>5</sup> cantilever and counter fort retaining wall.
- CET324.4** Describe<sup>1</sup> yield line theory and analyze<sup>4</sup> rectangular and circular slab by yield line theory

### Course Content

Units	Description	Hours
<b>I</b>	Continues Beam: Effective span, Loading Pattern, Moment redistribution, bending moment envelope, Design moment and shear force & design of two span three span continuous beam.	07
<b>II</b>	Water tanks: circular and rectangular tanks resting on ground. Design based on IS 3370.	07
<b>III</b>	Large span concrete roofs: Classification- Behavior of Flat slabs- Direct design and equivalent frame method- Codal provisions	07
<b>IV</b>	Grid Floor: Size of Beams, Analysis of slab, IS:456 recommendations, I.S. Code method & Rankine Grashoff method for design of grid floors.	07

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|-----------|---|----|
| <b>V</b>  | Retaining Wall: Analysis and Design of cantilever and counter fort retaining walls with horizontal and inclined surcharge   | 07 |
|           |   |    |
| <b>VI</b> | Yield line analysis of slabs: virtual work and equilibrium method of analysis- simply supported rectangular slabs with corners held down- uniform and concentrated loads- design of simply supported rectangular and circular slabs | 07 |

#### **Text Book**

- 1 Bhavakatti S.S., Advance R.C.C. Design, (R.C.C. Volume-II) New Age International Publishers.
- 2 Krishnaraju N. Advanced Reinforced Concrete Design, C.B.S. Publishers and distributars.

#### **References**

- 1 Purushothaman. P, Reinforced Concrete Structural Elements, Tata McGraw Hill
- 2 Varghese P.C. Advanced Reinforced Concrete Design Printce Hall oF India 2009.
- 3 Subramanian N., Design of Reinforced Concrete Structures, Oxford University Press.
- 4 IS: 456:2000-Code of practice for Plain and Reinforced Concrete.
- 5 SP:16-1978-Design Aids to IS:456: 1978.
- 6 IS:3370: (part I to IV) Code of practice for Concrete Structures for the storage of Liquids.

CET 325 R1		Engineering Economics and Finance					
(Ver 1.0, Program Elective II, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

**Course Description:** This course about importance of engineering economy and finance Also helps in understanding application of engineering economy in construction field This

**Course Outcomes:** after the end of this course students will able to

- CET325.1** Apply<sup>3</sup> knowledge of economy in decision making  
**CET325.2** Explain<sup>3</sup> importance of depreciation and inflation  
**CET325.3** Explain<sup>3</sup> Concept and application of equipment economics  
**CET325.4** Understand<sup>3</sup> use of financial management in construction

Units	Description	Hours
<b>I</b>	<b>Economy</b> Introduction, equivalence cash flow diagram derivation of economic factors cash flow involving arithmetic gradient, Cash flow involving geometric gradient series	07
<b>II</b>	<b>Comparisons of Alternatives</b> P-W method, EUAC method, NPV method, Future worth method, ROR method, incremental rate of return method, pay back conventional and discounted payback period method, Benefit cost ratio methods, NPV method capitalized cost method break even analysis method	07
<b>III</b>	<b>Depreciation and Inflation</b> Definition method for calculating depreciation Switching between different depreciation methods, inflation and depreciation effect on cash flow	07
<b>IV</b>	<b>Equipment Economics</b> Equipment cost, operating cost, buy rent and lease option, replacement analysis	07
<b>V</b>	<b>Financial Management</b> Introduction need, charts of accounts , balance sheet, financial ratio, working capital management Construction accounting, Income statement, Financial statements	07

<b>VI</b>	<b>Private participation in government</b>	<b>07</b>
	Need, advantages and disadvantages of PPP	
	Joint venture. Different types of PPP, international financing	

**Text Book**

- 1 Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, McGraw Hill Publishing Company, New Delhi, 1998.

**References**

- 1 Leland Blank, Anthony Tarquin, Engineering Economy, Tata McGraw Hill Publishing Company, New Delhi,
- 2 Halpin, D. W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.
- 3 Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015

CET326 R1		Road Safety Management					
(Ver 1.0, Program Elective II, School of Technology)							
Lecture	Tutorials	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

**Course Description:**

This includes identification of causes of road accidents, ways of ensuring traffic safety in road design and road reconstruction, during repair and maintenance, principles of safety audit and traffic management techniques.

**Pre-requisite:** Transportation Engineering.

**Course Outcomes:** after the end of this course students will able to

- CET326.1** Explain<sup>2</sup> the causes of accidents, statistical measures of accident data analysis & traffic safety for designing new roads.
- CET326.2** Analyze<sup>4</sup> the factors affecting the reconstruction of existing roads & the operation condition of road.
- CET326.3** Explain<sup>3</sup> traffic safety in road reconstruction & road operation
- CET326.4** Evaluate<sup>6</sup> the effectiveness of various management techniques adopted in reducing road accident.

Course content (Theory)		
Units	Description	Hours
<b>I</b>	<b>Road accidents, Causes, Investigations and Data Collection:</b> Analysis of Individual accidents to arrive at Real Causes, Statistical Methods of Analysis of Accident Data, Application of Computer Analysis of Accident Data.	07
<b>II</b>	<b>Ensuring Traffic Safety in Designing New Roads:</b> Ways of Ensuring Traffic Safety in Road Design considering the Features of Vehicle Fleet, Psychological Features of Drivers, Natural and Meteorological Conditions, Structure of Traffic Streams, Orientation of a Driver on the Direction of a Road beyond the Limits of Actual Visibility and Roadway Cross Section & Objects on the Right of- Way.	07

- III Ensuring Traffic Safety in Road Reconstruction:**  
 Road Reconstruction and Traffic Safety, Reconstruction Principles, Plotting of Speed Diagram for Working out Reconstruction Projects, Use of Accident Data in Planning Reconstruction of Roads, Examples of Reconstruction of Selected Road Sections for Improving Traffic Safety, Improving Traffic Conditions on Grades, Sharp Curves, Redesign of Intersections, Channelized At-Grade Intersections, Bus Stops, Parking & Rest Areas and Effectiveness of Minor Road Improvements. 07
- IV Ensuring Traffic Safety in Road Operation:**  
 Ensuring Traffic Safety during Repair and Maintenance, Prevention of Slipperiness and Influence of Pavement Smoothness, Restriction speeds on Roads, Safety of Pedestrians, Cycle Paths, Informing Drivers on Road Conditions with Aid of Signs, Traffic Control Lines & Guide Posts, Guardrails & Barriers and Road Lighting. 07
- V Safety Audit and Traffic Management Techniques**  
 Principles-Procedures and Practice, Code of Good Practice and Checklists. Road safety issues and engineering, education, enforcement measures for improving road safety. 07
- VI Traffic Management Techniques**  
 Local area management. Low cost measures, area traffic control. Various types of medium and long term traffic management measures and their uses. Evaluation of the effectiveness and benefits of different traffic management measures, management and safety practices during road works 07

#### Text Book

- 1 Babkov, V.F. 'Road conditions and Traffic Safety', MIR publications, Moscow - 1975.
- 2 K.W. Ogden, 'Safer Roads – A Guide to Road Safety Engg.' Averbury Technical, Ashgate Publishing Ltd., Aldershot, England, 1996.
- 3 Kadiyali, L.R., 'Traffic Engineering and Transport Planning', Khanna Publications, New Delhi, 2009.

#### References

- 1 Jotin Kishty and B. Kent Lall, 'Transportation Engineering-An Introduction', Third Edition, Prentice Hall of India Private Limited, New Delhi, 2006
- 2 Latest Editions of Relevant Indian Roads Congress (IRC) Publications for Design of Roads and Road Safety.
- 3 Free softwares and mobile applications.

CET327 R1		Water Power Engineering					
(Ver 1.0, Program Elective II, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	1	-	4	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

**Course Description:** Advanced fluid mechanics deals with knowledge of in depth study of **Kinematics of Flow, Boundary Layer Theory** and compressible flow. Fluid statics will be dealt with detail.

**Pre-requisite:** Pre-requisites for this course are courses from courses dealing with flow through pipes and open channel hydraulics, mathematics and engineering mechanics. This course also deals with open channel hydraulics

**Course Outcomes:** after the end of this course students will able to

**CET327.1 Know<sup>2</sup>** the role of hydropower in a power system

**CET327.2 Describe<sup>2</sup>** flow duration curves of gauged and ungauged streams, **Know<sup>2</sup>** the general arrangement of run of river plants

**CET327.3 Describe<sup>2</sup>** classification, design criteria of penstock, **Know<sup>2</sup>** Types and losses of intake structures, Introduction and types of turbines

**CET327.4 Explain<sup>3</sup>** Types and losses of intake structures, Introduction and types of turbines, **Describe<sup>2</sup>** water Hammer and Surges

### Course contents

Units	Description	Hours
<b>I</b>	<b>Water Power:</b> Sources of energy, role of hydropower in a power system. Estimation of Water Power Potential, gross head, net head, storage and pondage, hydrographs, mass curves, flow duration curves	7
<b>II</b>	<b>Types of Hydro-power Plants:</b> Run of river plants, general arrangement of run of river plants, valley dam plants, diversion canal plants, high head diversion plants, storage and pondage, pumped storage power plants.	7
<b>III</b>	<b>Components of hydro-power plants:</b> Flow duration curves of gauged and ungauged streams, load curve, load factor, capacity factor, utilization	7

factor, diversity factor, load duration curve, firm power, secondary power, prediction of load.

- |           |   |   |
|-----------|---|---|
| <b>IV</b> | <b>Intakes:</b> Types, losses, air entrainment, anti-vortex device, air vent, power channels, fore bay, tunnel. Turbines: Introduction, types of turbines, hydraulics of turbines, velocity triangles, draft tubes, cavitation in turbines, turbine model testing, characteristics of turbines.   | 7 |
| <b>V</b>  | <b>Penstocks:</b> General classification, design criteria, economical diameter, losses, anchor blocks, valves, bends and manifolds. Trash racks: Types, losses, design, stability.  | 7 |
| <b>VI</b> | <b>Design of turbine:</b> Classification of turbines, characteristics of different types, choice of type of turbine, turbine setting and cavitation, Tail Race, draft tubes, function and types, Hydraulic Design<br><b>Water Hammer and Surges:</b> Introduction, water hammer, transients caused by turbine, load acceptance and rejection, resonance in penstocks, surge tanks, channel surges | 7 |

#### Text Book

- 1 Dandekar, M.M., and Sharma, K.N., "Water Power Engineering", Vikas Publishing House Pvt. Ltd.
- 2 Barrows, H.K., "Water Power Engineering", Tata McGraw Hill Publishing Company Ltd.
- 3 Varshney, R.S., "Hydro Power Structures", Nem Chand & Bros

#### References

- 1 Nigam, P.S., "Hydro Electric Engineering", Nem Chand & Bros. 2001
- 2 Choudhary, M.H., "Applied Hydraulic Transients", Van Nostrand Reinhold Company
- 3 Streeter, V.L., and Wylie, B., "Fluid Transients", McGraw-Hill Book Company
- 4 Modi, P. N. Irrigation and Water Power Engineering, Standard Book House, 2015.



CET328 R1		Solid and Hazardous Waste Management					
(Ver 1.0, Program Elective II, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	-	-	3	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

**Course Description:** This course gives knowledge on the elements of managing solid wastes from Municipal and Industrial sources including the related engineering principles, design criteria, methods and equipment.

**Pre-requisite:** Environmental science, engineering mathematics I, II and III.

**Course Outcomes:** after the end of this course students will able to

- CET328.1 Recognize<sup>2</sup>** the functional elements of solid waste with management, biomedical and Hazardous Wastes management.
- CET328.2 Demonstrate<sup>2</sup>** knowledge for solving and communication skills to specific problems in order to practice the role of health and safety professionals in managing hazardous materials and wastes.
- CET328.3 Discuss<sup>2</sup>** fundamental principles of existing and emerging technologies for the treatment of waste.
- CET328.4 Analyze<sup>4</sup>** engineering, financial and technical options for waste management for recycling and reuse options

Course content		
Units	Description	Hours
<b>I</b>	<b>Sources, Classification &amp; Regulatory Framework:</b> Types and Sources of solid and hazardous wastes; Need for solid and hazardous waste management; Elements of integrated waste management and roles of stakeholders; Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, lead acid batteries, electronic wastes, plastics and fly ash; Financing waste management	07
<b>II</b>	<b>Waste Characterization and Source Reduction:</b> Solid waste generation rate: Definition, Typical values for Indian cities, Factors affecting. Storage	07

and collection: General considerations for waste storage at source, Types of collection systems.

Transfer station: Meaning, Necessity, Location, Economic analysis.

Transportation of solid waste: Means and methods, Routing of vehicles

- |            |   |    |
|------------|---|----|
| <b>III</b> | <b>Waste Characterization and Source Reduction:</b> Composition, physical, chemical and biological properties of solid wastes, Sorting and material recovery: Objectives, Stages of sorting, Sorting operations, Guidelines for sorting for material recovery, Typical material recovery facility for a commingled solid waste.   | 07 |
| <b>IV</b>  | <b>Biomedical Waste:</b> Generation, identification, storage, collection, transport, treatment, common treatment and disposal, occupational hazards and safety measures. Biomedical waste legislation in India. E-waste management.   | 07 |
| <b>V</b>   | <b>Waste Processing Technologies:</b> Objectives of waste processing, biological and chemical conversion technologies, methods and controls of Composting, thermal conversion technologies and energy recovery, composting of solid waste: Principles, Methods, Factors affecting, Properties of compost, Vermicomposting. Energy recovery from solid waste: Parameters affecting, Bio methanation, Fundamentals of thermal processing, Pyrolysis, Incineration, Advantages and disadvantages of various technological options              | 07 |
| <b>VI</b>  | Definition and identification of Hazardous Wastes, Sources and Characteristics of hazardous wastes, Hazardous waste in municipal waste, Hazardous waste regulations and legislations, Minimization of Hazardous wastes, Handling and storage of Hazardous wastes, Hazardous Waste Treatment technologies, Physical, chemical & thermal methods of stabilizations, Solidification, Chemical Fixation & encapsulation, Incineration of Hazardous waste landfills, Reclamation of Hazardous waste landfill sites. Radioactive waste management | 07 |

#### Text Book

- 1 H.S. Peavy, D.R. Row & G. Tchobanoglous, Environmental Engineering, Mc Graw Hill International Edition
- 2 Hilary Theisen and Samuel A, Vigil, George Tchobanoglous, "Integrated Solid Waste Management", McGraw- Hill, New York, (1993)

#### References

- 1 Manual on Municipal Solid waste management by Central Public Health and Environmental Engineering Organization (CPHEEO), Government of India, New Delhi, latest edition
- 2 Vesilind P.A., Worrell W and Reinhart, “Solid waste Engineering”, Thomson Learning Inc., Singapore, (2002)
- 3 Charles A. Wentz ,“Hazardous Waste Management”, Second Edition, Pub: McGraw Hill International Edition, New York, (1995)

CET329 R1		Site Investigation Methods and Practices Lab					
(Ver 1.0, Program Elective I, School of Technology)							
Lecture	Tutorial I	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	40
					POE	25	

**Course Outcomes:** after the end of this course students will able to

**CET329.1 Plan<sup>1</sup>** subsurface exploration & explain indirect methods of site explorations.

**CET329.2 Explain<sup>2</sup>** penetration tests for different types of soils.

**CET329.3 Explain<sup>2</sup>** plate load test and interpretation of results.

**CET329.4 Prepare<sup>2</sup>** technical report of site investigations.

### Laboratory Work

The students are expected to perform following assignments / experiments and submit report of the same.

- 1 Assignment on importance and objectives of geotechnical exploration.
- 2 Assignment on planning of subsurface exploration.
- 3 Assignment on types of soil samples and their suitability.
- 4 Assignment on plate load test.
- 5 Assignment on standard penetration test.
- 6 Assignment on preparation of technical report on site investigation.
- 7 Prepare case of study of 3 real-time projects.

### References

1. Site Investigation Practice, Joyce, M.D ESFN. SPON Publishers, 1982.
2. Basic and Applied soil mechanics: Gopal Ranjan & A.S. Rao, New Edge International Ltd., (2004)
3. Foundation Analysis & Design: Bowles, J.E., McGraw Hill (1996)
4. Site investigation by Clayton, Mathews and Simons
5. Geotechnical Engineering Investigation Manual by R.E. Hunt, Mc Graw Hill Co. New York

<b>CET330 R1</b>	<b>Fiber Reinforced Concrete Lab</b>
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(Ver 1.0, Program Elective I, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	40
					EOE	25	

**Course Outcomes:** after the end of this course students will able to

**CET330.1 Appraise<sup>4</sup>** the historical aspect of fibre reinforced concrete (FRC)

**CET330.2 Evaluate<sup>6</sup>** effect of fibres on fresh and hardened properties of concrete

### Laboratory Work

The students are expected to perform all experiments list given below and submit report of same;

- 1 To determine compressive strength, tensile and flexural strength of polypropylene FRC.
- 2 To determine compressive strength, tensile and flexural strength of Steel FRC.
- 3 To determine compressive strength, tensile and flexural strength of Plastic FRC.
- 4 To determine elastic properties such as Poisson ratio, modulus of elasticity of polypropylene FRC.
- 5 To determine NDT testing such as Rebound Hammer, UPV test of polypropylene FRC.

### Text Book

- 1 Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London,1995
- 2 Shetty M. S, "Concrete Technology", S. Chand and Company Ltd, New Delhi, 2003

### References

- 1 Fibre reinforced cement composites by P.N. Balaguru and S.P. Shah, McGraw- Hill, 1992
- 2 Fibre reinforced cementous composites by A. Benturand and S. Mindess, Taylor & Francis, 1990.
- 3 Structural applications of fibre reinforced concrete , SP-182, ACI, 1998.

CET331 R1		Advance Traffic Engineering Lab					
(Ver 1.0, Program Elective I, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	40
					POE	25	

**Course Outcomes:** after the end of this course students will able to

- CET331.1** **Acquire**<sup>2</sup> and apply knowledge of traffic, its components, factors affecting road traffic
- CET331.2** **Analysis**<sup>4</sup> traffic speed study data and its presentation
- CET331.3** **Apply**<sup>3</sup> the knowledge of sampling data in conducting various Surveys.
- CET331.4** **Analyze**<sup>4</sup> traffic survey data

#### Laboratory Work

Two hours per week per batch practical is to be utilized for

(A) One assignment on each unit

(B) On field practices.

- 1) Speed Study
- 2) Volume Study
- 3) O-D Study
- 4) Parking Study

#### Text Book

- 1 Kadiyali L.R. and N.B. Lal (2004): Principles and Practice of Highway Engineering Including Expressways and Airport Engineering), Khanna Publishers, New Delhi.
- 2 Kadiyali L.R. (1994): Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi.
- 3 Partha Chakroborty and Animesh Das (2003): Principles of Transportation Engineering, Prentice-Hall India, New Delhi.

#### Reference

- 1 Black John (1981): Urban Transportation Planning. Croom Helm Ltd. London.
- 2 BPR (1970): Urban Transportation Planning: General Information and Introduction to System 360. Bureau of Public Roads, Washington D.C.
- 3 Bruton M.J. (1975): Introduction to Transportation Planning. II Edn. Hutchinson, London
- 4 Drew D.R. (1968): Traffic Flow Theory and Control, McGraw-Hill, New York.

- 5      Hutchinson B.G. (1974): Principles of Urban Transport Systems  
Planning. McGraw-Hill Book Co., New York.

CET 332 R1		Quality Control and Safety Management Lab					
(Ver 1.0, Program Elective I, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	40
					EOE	25	

**Course Description:** This course helps to explain quality of a project. This course intends to involve students to apply various methods of quality management system.

Pre-requisites for this course are basic knowledge of quality management system.

**Pre-requisite:** Engineering Management.

**Course Outcomes:** after the end of this course students will able to

**CET 332.1 Exposed<sup>3</sup>** to means of quality management system

**CET 332.2 Develop<sup>5</sup>** awareness of quality standards and inspection

**CET 332.3 Describe<sup>2</sup>** total quality management

**CET 332.4 Explain<sup>2</sup>** safety measure on construction site

#### Term Work

#### Description

(A) One assignment on each unit.

(B) Visit on quality control safety management system.

#### Text Book

- 1 James, J.O Brian, "Construction Inspection Handbook -Quality Assurance and:Quality Control", Van Nostrand, New York, 2009.

#### References

- 1 Kwaku, A., Tenah, Jose. M. Guevara, "Fundamentals of Construction Management and Organization", Reston Publishing Co., Inc., Virginia, 2005
- 2 Juran Frank, J.M. and Gryna, F.M. "Quality Planning and Analysis", Tata McGraw Hill 2002.
- 3 Clarkson H. Oglesby, "Productivity Improvement in Construction", McGraw-Hill, 2009.
- 4 L. Ashford, "The Management of Quality in Construction", E & F.N, Spon. New York, 2009.
- 5 Steven McCabe, "Quality Improvement Techniques in Construction", Addison Wesley Longman Ltd, England. 2008.



CET333 R1		Advanced Fluid Mechanics lab					
(Ver 1.0, Program Elective I, School of Technology)							
Lecture	Tutoria l	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	40
					EOE	50	

**Course Outcomes:** after the end of this course students will able to

- CET333.1 Recognize<sup>2</sup>** the basics of fluid mechanics  
**CET333.2 Explain<sup>2</sup>and Discuss<sup>4</sup>** kinematics of fluid flow  
**CET333.3 Discuss<sup>1</sup>** concept of conformal mapping  
**CET333.4 Explain<sup>2</sup>** concept of laminar and turbulent flow

#### Laboratory Work

The students are expected to perform following experiments/assignments and submit report of same

- 1 Assignment on Basics of fluid mechanics
- 2 Assignment on Kinematics of Flow
- 3 Assignment on Conformal mapping
- 4 Assignment on Laminar Flow and Turbulent Flow
- 5 Assignment on Boundary Layer Theory

#### Text Book

- 1 Modi. P. M. and Seth S. N., “Fluid mechanics & hydraulics”, 10<sup>th</sup> Edition, Standard Publications (2015).
- 2 R. K. Bansal, “Fluid mechanics & hydraulics”, 14<sup>th</sup> Edition, Khanna publications (2009).

#### References

- 1 A. K. Jain, “Fluid Mechanics” 2<sup>nd</sup> Edition, Khanna Pub., Delhi (2015).
- 2 Garde R. J. and Mirajgaonkar A. G., Engineering Fluid Mechanics, Tata McGraw Hill.
- 3 R. J. Garde, Fluid Mechanics Through Problems, Tata McGraw Hill
- 4 Rangaraju, “Open Channel flow”, Tata McGraw-Hill Pub. Co., Delhi
- 5 Streeter, “Fluid Mechanics”, McGraw-Hill International Book Co., Auckland
- 6 K. L. Kumar, “Fluid Mechanics”, Eurasia Publication House, Delhi

CET334 R1		Disaster Management & Mitigation Lab					
(Ver 1.0, Program Elective I, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	40
					EOE	25	

**Course Description:** This course helps to explain disaster management & its mitigation methods.

**Pre-requisite:** Disaster management.

**Course Outcomes:** after the end of this course students will able to

**CET334.1 Differentiate<sup>4</sup>** the types of disasters and causes.

**CET334.2 Understand<sup>4</sup>** various methods of risk reduction measures as well as mitigation

**CET334.3 Assess<sup>3</sup>** Disaster damage and its management.

**CET334.4 Understand<sup>4</sup>** applications and disaster management case studies.

#### Term Work

#### Description

Two hours per week per batch practical is to be utilized for

(A) Term work shall consist of at least one assignment on each unit

(B) Study report on recent disaster and its management in India.

#### Text Book

- 1 Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
- 2 Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
- 3 Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
- 4 Kapur Anu Vulnerable India: A Geographical Study of Disasters, IAS and Sage Publishers, New Delhi, 2010.

#### References

- 1 An overview on natural & man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi
- 2 Coppola D P, 2007. Introduction to International Disaster Management, Elsevier Science (B/H), London.
- 3 Disasters in India Studies of grim reality, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur 8
- 4 Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005

CET335 R1		Earth Retaining Structure Lab					
(Ver 1.0, Program Elective II, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	40
					POE	25	

**Course Outcomes:** after the end of this course students will able to

- CET335.1 Determine<sup>2</sup>** lateral earth pressure on retaining structures.  
**CET335.2 Explain<sup>2</sup>** stability and design principles of retaining structures.  
**CET335.3 Classify<sup>1</sup>** and analyze anchored bulkheads by free and fixed earth support methods.  
**CET335.4 Analyze<sup>4</sup>** stability of earthen dams by using Swedish slip circle method.

#### Laboratory Work

The students are expected to perform following assignments / experiments and submit report of the same.

- 1 Assignment on lateral earth pressure calculations.
- 2 Assignment on stability analysis of retaining walls.
- 3 Assignment on design of anchored bulkheads.
- 4 Assignment on braced cuts and cofferdams.
- 5 Assignment on stability analysis of earthen dams.
- 6 Assignment on protection and construction of earthen dams.
- 7 Determination of angle of repose for different types of soils.

#### Text Book

1. Basic & Applied soil mechanics – Gopal Ranjan & ASR Rao, New Age International Publishers, 2011.

#### References

1. Foundation design by W. C. Teng, Prentice Hall, 1962
2. Analysis and design of foundations by Bowles. J. W McGraw Hill, 4th edition, 1955.
3. Earth and Rock-Fill Dams: General Design and Construction considerations by United States Army Corps of Engineers, University Press of the Pacific, 2004
4. Soil mechanics in engineering and practice by Karl Terzaghi, Ralph B. Peck, Gholamreza Mesri, 3rd Edition. Wiley India Pvt Ltd, 2010.

CET336 R1		Advanced Design of RCC Structures Lab					
(Ver 1.0, Program Elective II, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	40
					POE	25	

**Course Outcomes:** after the end of this course students will able to

**CET336.1** Analyze<sup>4</sup>, design<sup>5</sup> and detail<sup>5</sup> Continues beams

**CET336.2** Analyze<sup>4</sup>, design<sup>5</sup> and detail<sup>5</sup> Water tanks

**CET336.3** Analyze<sup>4</sup> design<sup>5</sup> and detail<sup>5</sup> ordinary slab, Flat Slab and Grid Slab and compare<sup>6</sup> the design results.

**CET336.4** Analyze<sup>4</sup>, design<sup>5</sup> and detail<sup>5</sup> retaining walls.

### Laboratory Work

The students are expected to solve manually or using software six design problems and prepare detailed report of design calculations with detailed CAD drawings.

- 1 Analysis of continues beam of variable span (4 spans) using software and design of the beam considering the redistribution of moments..
- 2 Design of Circular, Rectangular water tank resting on ground and overhead water tank with flat base.
- 3 Analysis and design of Flat slab both interior and exterior panel.
- 4 Analysis and design of Grid floor using IS code method.
- 5 Analysis and design of Cantilever and Counterfort type retaining wall..
- 6 Analysis and design of Rectangular and Circular slabs by Yield line theory.

### Text Book

- 1 Bhavakatti S.S., Advance R.C.C. Design, (R.C.C. Volume-II) New Age International Publishers.
- 2 Krishnaraju N. Advanced Reinforced Concrete Design, C.B.S. Publishers and distributors.

### References

- 1 Varghese P.C. Advanced Reinforced Concrete Design Printce Hall of India 2009.
- 1 Subramanian N., Design of Reinforced Concrete Structures, Oxford University Press.

- 2 IS: 456:2000-Code of practice for Plain and Reinforced Concrete.
- 3 SP:16-1978-Design Aids to IS:456:1978.
- 4 IS:3370: (part I to IV) Code of practice for Concrete Structures for the storage of Liquids.

CET337 R1		Engineering Economics and Finance Lab					
(Ver 1.0, Program Elective II, School of Technology)							
Lecture	Tutorial	Practica 1	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	40
					EOE	25	

**Course Description:** This course about importance of engineering economy and finance Also helps in understanding application of engineering economy in construction field This

**Course Outcomes:** after the end of this course students will able to

- CET337.1** Apply<sup>3</sup> knowledge of economy in decision making  
**CET337.2** Explain<sup>2</sup> importance of depreciation and inflation  
**CET337.3** Explain<sup>3</sup> Concept and application of equipment economics  
**CET337.4** Understand<sup>2</sup> and apply<sup>3</sup> use of financial management in construction industry

### Lab Work

#### Description

Two hours per week per batch practical is to be utilized for

(A) One assignment on each unit

(B) Prepare financial statements for small construction firm

(C) Prepare comparisons between various PPP models

#### Text Book

- 1 Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, McGraw Hill Publishing Company, New Delhi, 1998.

#### References

- 1 Leland Blnak, Anthony Tarquin, Engineering Economy , Tata McGraw Hill Publishing Company, New Delhi,
- 2 Halpin, D. W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.
- 3 Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015

CET338 R1		Road Safety Management Lab					
(Ver 1.0, Program Elective II, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	40
					EOE	25	

**Course Description:** This course helps to explain road safety management. This course intends to involve students to apply road safety management techniques for evaluating live road projects, Pre-requisites for this course are basic knowledge of road safety and management.

**Pre-requisite:** Transportation Engineering.

**Course Outcomes:** after the end of this course students will able to

- CET 338.1** Explain<sup>3</sup> concept of road safety identification
- CET 338.2** Understand<sup>3</sup> importance of social benefit and safety
- CET 338.3** Explain<sup>3</sup> concept of accidental analysis
- CET 338.4** Apply<sup>3</sup> the knowledge of design a road safety management

#### Term Work

#### Description

- (A) One assignment on each unit.
- (B) Life road safety demonstration on field using ICT/ Applications.
- (C) Safety demonstration for junction and models.
- (D) Use of sensors to improve road safety.

#### Text Book

- 1 Babkov, V.F. 'Road conditions and Traffic Safety', MIR publications, Moscow - 1975.
- 2 K.W. Ogden, 'Safer Roads – A Guide to Road Safety Engg.' Averbury Technical, Ashgate Publishing Ltd., Aldershot, England, 1996.
- 3 Kadiyali, L.R., 'Traffic Engineering and Transport Planning', Khanna Publications, New Delhi, 2009.

#### References

- 1 JotinKishty and B. Kent Lall, 'Transportation Engineering-An Introduction', Third Edition, Prentice Hall of India Private Limited, New Delhi, 2006
- 2 Latest Editions of Relevant Indian Roads Congress (IRC) Publications for Design of Roads and Road Safety.
- 3 Free softwares and mobile applications.

CET339 R1		Water Power Engineering Lab					
(Ver 1.0, Program Elective II, School of Technology)							
Lecture	Tutoria l	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	40
					EOE	50	

**Course Outcomes:** after the end of this course students will able to

- CET339.1 Know<sup>2</sup>** the role of hydropower in a power system  
**CET339.2 Describe<sup>2</sup>** flow duration curves of gauged and ungauged streams  
**CET339.3 Know<sup>2</sup>** the general arrangement of run of river plants  
**CET339.4 Describe<sup>2</sup>** classification, design criteria of penstock

### Laboratory Work

The students are expected to perform following experiments and submit report of same;

- 1 Assignment on estimation of Water Power Potential
- 2 Assignment on types of Hydro-power Plants
- 3 Assignment on design of hydro-power plants
- 4 Assignment on components of penstocks
- 5 Assignment on intake works
- 6 Assignment on design of turbines

### Text Book

- 1 Dandekar, M.M., and Sharma, K.N., "Water Power Engineering", Vikas Publishing House Pvt. Ltd.
- 2 Barrows, H.K., "Water Power Engineering", Tata McGraw Hill Publishing Company Ltd.
- Varshney, R.S., "Hydro Power Structures", Nem Chand & Bros

### References

- 1 Nigam, P.S., "Hydro Electric Engineering", Nem Chand & Bros. 2001
- 2 Choudhary, M.H., "Applied Hydraulic Transients", Van Nostrand Reinhold Company
- 3 Streeter, V.L., and Wylie, B., "Fluid Transients", McGraw-Hill Book Company
- 4 Modi, P. N. Irrigation and Water Power Engineering, Standard Book House, 2015.



CET340 R1		Solid and Hazardous Waste Management Lab					
(Ver 1.0, Program Elective II, School of Technology)							
Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	40
					POE	25	

**Course Outcomes:** after the end of this course students will able to

**CET340.1 Recognize<sup>2</sup>** the functional elements of solid waste management

**CET340.2 Explain<sup>2</sup>** the functional units of biomedical and Hazardous Wastes management.

**CET340.3 Analyze<sup>4</sup>** engineering, financial and technical options for waste management

**CET340.4 Identify<sup>1</sup>** recycling and reuse options

### Laboratory Work

- A] Visit to Biomedical waste management plant or system
- B] Study of any one solid waste functional unit.
- C] One Assignment on each unit.

### Text Book

- 1 H.S. Peavy, D.R. Row & G. Techobanoglous, Environmental Engineering, McGraw Hill International Edition
- 2 Hilary Theisen and Samuel A, Vigil, George Techobanoglous, "Integrated Solid Waste Management", McGraw- Hill, New York, (1993)

### References

- 1 Manual on Municipal Solid waste management by Central Public Health and Environmental Engineering Organization (CPHEEO), Government of India, New Delhi, latest edition
- 2 Vesilind P.A., Worrell W and Reinhart, "Solid waste Engineering", Thomson Learning Inc., Singapore, (2002)
- 3 Charles A. Wentz, "Hazardous Waste Management", Second Edition, Pub: McGraw Hill International Edition, New York, (1995)

<b>CET341 R1</b>	<b>Advanced Concrete Technology</b>
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(Ver 1.0, Program Elective I, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
3	1	-	4	Theory (100)	FET	20	40
					CAT I	15	
					CAT II	15	
					ESE	50	40

**Course Description:** Concrete structures are subjected to constant deterioration due to effects of ageing, inadequate maintenance, severe environmental exposure, penetration of catalytic agencies such as moisture, gases like CO<sub>2</sub> & oxygen, chloride ions, industrial pollutants, abuse etc. This deterioration needs to be timely arrested before it leads to irreversible damage making it imperative to repair and upgrade.

**Course Outcomes:** after the end of this course students will able to

- CET341.1 Appraise<sup>4</sup>** the development aspect of advanced concrete and to study light weight concrete and ferro cement material.
- CET341.2 Evaluate<sup>6</sup>** effect of fibres on fresh and hardened properties of concrete
- CET341.3 Evaluate<sup>6</sup>** effect of high-performance concrete on fresh and hardened properties of concrete
- CET341.4 Study<sup>4</sup>** special concrete technique and its applications on site.

### Syllabus (Theory)

Units	Description	Hours
<b>I</b>	<b>Introduction to Advanced Concrete:</b> Components and developments in the process and constituent materials, Role of constituents, Development in cements and cement replacement materials, pozzolona, fly ash, silica fume, rice husk ash, recycled aggregates, chemical admixtures. Mix proportioning of Concrete: Principles and methods.	07
<b>II</b>	<b>Light Weight concrete:</b> Introduction, classification, properties, strength and durability, mix proportioning and problems. High density concrete: Radiation shielding ability of concrete, materials for high density concrete, mix proportioning, properties in fresh and hardened state, placement methods.	07
<b>III</b>	<b>Ferro cement:</b> Ferrocement materials, mechanical properties, cracking of ferrocement, strength and behaviour in tension, compression and flexure,	07

Design of ferrocement in tension, ferrocement constructions, durability, and applications.

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| <b>IV</b> | <b>Fibre Reinforced Concrete:</b> materials, mix proportioning, distribution and orientation, interfacial bond, properties in fresh state, strength and behavior in tension, compression and flexure of steel fibre reinforced concrete, mechanical properties, crack arrest and toughening mechanism, applications. | 07 |
| <b>V</b>  | <b>High Performance concrete:</b> constituents, mix proportioning, properties in fresh and hardened states, applications and limitations. Ready Mixed Concrete-QCI-RMCPC scheme requirements, Self-Compacting Concrete, Reactive powder concrete, and bacterial concrete.  | 07 |
| <b>VI</b> | <b>Special concreting techniques:</b> Pumped concrete, concrete, underwater concrete, pre-placed concrete, vacuum dewatered concrete, hot and cold weather concreting.   | 07 |

#### Text Book

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|---|--|
| 1 | Neville, A.M; “Properties of Concrete”, Pitman Publishing Limited, London,1995 |
| 2 | Shetty M. S, “Concrete Technology”, S. Chand and Company Ltd, New Delhi, 2003  |

#### References

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|---|---|
| 1 | Fibre reinforced cement composites by P.N. Balaguru and S.P. Shah, McGraw- Hill, 1992         |
| 2 | Fibre reinforced cementous composites by A. Benturand and S. Mindess, Taylor & Francis, 1990. |
| 3 | Structural applications of fibre reinforced concrete , SP-182, ACI, 1998.                     |

<b>CET342 R1</b>	<b>Advanced Concrete Technology Lab</b>
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(Ver 1.0, Program Elective I, School of Technology)

Lecture	Tutorial	Practical	Credits	Evaluation Scheme for (Theory and Practical)			
				Component	Exam	WT	Pass %
-	-	2	1	Practical	ISE	50	40
					EOE	50	

**Course Outcomes:** after the end of this course students will able to

**CET342.1 Appraise<sup>4</sup>** the historical aspect of advanced concrete Technology (ACT)

**CET342.2 Evaluate<sup>6</sup>** effect of fibres on fresh and hardened properties of concrete

### Laboratory Work

The students are expected to perform all experiments list given below and submit report of same;

- 1 To determine compressive strength of Fly ash / micro silica concrete.
- 2 To determine compressive strength and flexural strength of light weight concrete.
- 3 To determine compressive strength and flexural strength of ferrocement concrete.
- 4 To determine compressive strength, tensile and flexural strength of Steel FRC.
- 5 To determine compressive strength and flexural strength of Plastic FRC.
- 6 To determine properties fresh and hardened concrete.

### Text Book

- 1 Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London,1995
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- 1 Fibre reinforced cement composites by P.N. Balaguru and S.P. Shah, McGraw- Hill, 1992
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