Department of Civil Engineering

4th Year Syllabus

2020-21

VII SEMESTER

	DEPARTMENT OF CIVIL ENGINEERING SCHEME OF TEACHING AND EXAMINATION VII SEMESTER B.E (AUTONOMOUS SCHEME)						
Sl.No.	**Subject Code**	**Subject**	**Category**	**L**	**T**	**P**	**Cr.**
1	CV0413	Quantity Surveying & Estimation	GC	4	0	0	4
2	CV0414	Transportation Engineering	FCT	4	0	0	4
3	CV0434	Waste Water Engineering	FCE	4	0	0	4
4	CV0438	Design of Steel Structures	FCS	3	2	0	4
5		Elective -III		3	0	0	3
6	CV0120	Environmental Engineering Laboratory	FCE	0	0	3	1.5
7	CV0121	Concrete and NDT Laboratory	FCS	0	0	3	1.5
8	CV0213	Detailing of Steel Structures	FCS	1	0	2	2
9	CV0125	Stacked Project	GC	-	-	-	1
	Total Credits						**25**
	Total Contact Hrs						**29**

Sl.No.	**Subject Code**	**Elective –III**	**Category**
1	CV0316	Pavement Evaluation and Management	FET
2	CV0323	Repair & Rehabilitation of Structures	FES
3	CV0328	Disaster Management	GE
4	CV0335	Foundation Engineering	FEG
5	CV0336	Pipe Network Analysis and Design	FEH

GC	Core
FCS	Foundation Core- Structure
FCE	Foundation Core- Environmental
FCG	Foundation Core- Geotechnical
FCT	Foundation Core- Transportation
GE	Elective
FES	Foundation Elective- Structure
FEG	Foundation Elective- Geotechnical
FET	Foundation Elective- Transportation
FEH	Foundation Elective- Hydraulics and water resources

Shortlisted Courses for 7th semester

Regarding the enrollment for value added courses of Massive Open Online Courses-MOOC (NPTEL-National Programme on Technology Enhanced Learning) for 7thsemester Civil Engineering students.

As per the University guidelines it is advised that Final year students are informed to enroll into any one course from the NPTEL shortlisted courses to enhance their level of competency.

Sl. No	Course Id	Discipline/ Category	Course Name	Host Institute	Course Duration	Course Start Date	Course End Date	Exam date
1	noc20-ce44	Civil Engineering	Project Planning & Control	IITM	8 Weeks	14 Sep 2020	06-NOV-2020	Dec-18-2020
2	noc20-ce47	Civil Engineering	Glass in buildings : Design and applications	IITM & Glass Academy	12 Weeks	14 Sep 2020	09-Dec-20	Dec-19-2020
3	noc20-ce52	Civil Engineering	Earthquake Resistant Design of Foundations	IITR	8 Weeks	14 Sep 2020	06-NOV-2020	Dec-19 2020
4	noc20-ce53	Civil Engineering	Introduction to Multimodal Urban Transportation Systems (MUTS)	IIT KGP	12 Weeks	14 Sep 2020	04 Dec 2020	19 Dec 2020
5	Noc20-ce58	Civil Engineering	Remote Sensing and GIS	IITG	8 weeks	14 Sep 2020	06 Nov 2020	18 Dec 2020
6	noc20-hs60	Humanities and Social Sciences	Soft skills	IITR	12 Weeks	14 Sep 2020	09-Dec-2020	Dec 19-2020

VIII SEMESTER

	DEPARTMENT OF CIVIL ENGINEERING SCHEME OF TEACHING AND EXAMINATION VIII SEMESTER B.E (AUTONOMOUS SCHEME)						
Sl.No.	**Subject Code**	**Subject**	**Category**	**L**	**T**	**P**	**Cr.**
1	CV0342	Construction and Project Management	GC	3	0	0	3
2	CV0435	Engineering Economics and Financial Management	GC	4	0	0	4
3	CV0436	Pre-stressed Concrete Structures	FCS	4	0	0	4
4		Elective –IV		3	0	0	3
5		Elective –V		1	2	0	2
6	CV0210	Design & Drawing of Bridges	FCS	1	0	2	2
7	CV0601	Major Project	GC	0	0	12	6
	Total Credits						**24**
	Total Contact Hrs						**32**

Sl.No.	**Subject Code**	**Elective –IV**	**Category**
1	CV0314	Advanced RCC Structures	FES
2	CV0333	Environmental Sanitation	FEE
3	CV0334	Structural Dynamics and Earthquake Engineering	FES
4	CV0339	Earth Retaining Structures	FEG
5	CV0338	Water Resources Engineering and Management	FEH
6	CV0344	Airport Engineering	FET

Sl.No.	Subject Code	Elective –V	Category
1	CV0211	Construction Surveying	GE
2	CV0212	Professional Communication	GE

GC	Core
FCS	Foundation Core- Structure
GE	Elective
FES	Foundation Elective- Structure
FEG	Foundation Elective- Geotechnical
FEH	Foundation Elective- Hydraulics and water resources
FEE	Foundation Elective – Environmental
FET	Foundation Elective – Transportation

QUANTITY SURVEYING & ESTIMATION (4:0:0)

Sub code: CV0413 **CIE : 50% marks**

Hrs/week: 4+0+0 **SEE : 50% marks**

SEE Hrs: 3 Hrs **Max. Marks: 100**

Course Outcomes

Upon successful completion of this course, students will be able to prepare

1. Bill of quantities for civil Engg. Structures by different methods.
2. Financial estimates of civil Engg. Structure.
3. Rate analysis of civil Engg. Component.
4. Detailed specification for different civil Engineering works.

Unit-I

Introduction

Different types of estimates, various types of drawings required for preparation of estimates, units of measurement. **4 Hrs**

Self-learning Exercises: *Important terms used in estimates*

Unit-II

Specifications

Definition of specifications, objective of writing specifications, general specification. **6 Hrs**

Self-learning Exercises: *Detailed specification of general items works in buildings.*

Unit -III

Rate analysis

Definition, purpose, working out data procedure for quantities and rates of cement concrete of different mixes, brick and size stone masonry, flooring, plastering, painting, form work for different RCC items. **10 Hrs**

Self-learning Exercises: *Doors, windows and ventilators, various types of claddings.*

Unit -IV

Quantity Surveying & Risk Management in Estimation

Methods of estimating the quantities of earth works excavation, foundation, masonry, plastering work, concrete work. Risk management in estimation. 6**Hrs**

Self-learning Exercises: *Form work*

Unit -V

Estimation of building and Civil Engineering structures

Method of measurement of building and civil engineering works (Using IS 1200), preparation of detailed and abstract estimates for residential buildings for masonry and framed structures (Two and three bed room houses with GF and FF). **20 Hrs**

Self-learning Exercises: *Detailed estimate for framed structure with sloped roof.*

Unit -VI

Estimation of Civil Engineering Structure

Septic tank, Manhole and Slab culvert. **6 Hrs**

Self-learning Exercises: *Masonry structure, Usage of software for bill of quantities.*

Text Book

1. B.N. Dutta,**" Estimating and costing in civil Engineering Theory and practices''**, UBS Publishers & Distributors, 2010
2. IS 1200 Code Book.

Reference Books

1. M. Chakroborti, **"Estimating, costing & Specification in Civil Engineering"**, S Chand Publishing House, 2006.
2. S.C. Rangwala, **"Valuation of real properties"**, Charotar Publishing House, 2008.
3. K.K. Chitkara, **" Construction project management"**, Tata McGraw-Hill, 2009.

TRANSPORTATION ENGINEERING (4:0:0)

Sub Code : CV0414 **CIE : 50% Marks**

Hrs/Week : 4+0+0 **SEE : 50% Marks**

SEE Hrs : 03 Hrs **Max. Marks : 100**

Course Outcomes

Upon successful completion of this course, students will be able to
1. Design geometrical features and estimate the quantity of materials of permanent way.
2. Select site, plan & design of run ways and taxi-ways of an airport
3. Design basic components of harbour and tunnels.
4. Describe bridge components and to compute economic span and scour depth

Unit – I

Introduction

Role of railways in transportation, Indian railways, and selection of routes.

Permanent Way

Introduction, requirements for an ideal permanent way, typical cross sections of single and double line B.G. tracks in cutting, embankment and electrified tracks, Gauges and types of gauges with dimensions. Rail functions, requirements types of rail sections, length of rails, defects in rails. Wear on rails, rail joints, welding of rails, creep of rails. **9Hrs**

Self-Learning Exercise: *Coning of wheels and tilting of rails*

Unit – II

Ballast and Sleepers

Functions, requirements, types. Calculation of quality of materials needed for laying a track. Traction and tractive resistances, tractive power. Hauling capacity, problems on above.

Geometric Design of Track

Necessity of Geometric design of railway track, gradient & types of gradient. Speed of train, curve, super elevation, cant deficiency, negative cant, and speed calculation based on Indian railways formulae for high speed tracks only- problems on above. **10 Hrs**

Self-Learning Exercise: *Track fittings and fasteners, Transition curve*

Unit – III

Points and Crossing

Necessity and its components, turnout, design of turnout, crossings, track junctions, track defects, track maintenance, Indian railway standards. **7Hrs**

Self-Learning Exercise: *Stations & Yards*

Unit – IV

Airport Engineering

Introduction to airport engineering, recent development by AAI. Layout of an airport with component parts and functions of each, Aircraft characteristics – Airport classification – site selection – regional planning.

Runway and Taxiway Design

The runway configurations – basic length of runway corrections to runway length by ICAO and FAA specification – runway cross sections – problems on above. Factor affecting the layout of the taxiway- geometrics of taxiway- design of exit taxi ways- ICAO specification – problems on above**.** **9 Hrs**

Self-Learning Exercise: *Orientation of runway by using wind-rose diagram.*

Unit – V

Tunnel Engineering

Introduction – types of tunnels, advantages and disadvantages, economics of tunneling, Design of shape and size of tunnel, methods of tunneling in soft soil (only fore poling and needle beam method), tunnel lining and ventilation.

Harbour Engineering

Introduction, ocean parameters, classification, natural phenomenon affecting the design of harbour viz wind, wave, tide and currents. Harbour layout with component parts, break waters, Jetties and piers, sea walls**.** **9 Hrs**

Self-Learning Exercise: *Tunnelling in rock, Dry dock & wet dock*

Unit – VI

Introduction to bridges and viaducts

Definitions, components, classification, types of bridges.

Investigation for Bridges

Selection of bridge site, data collection, design discharge, linear water way, economical span, clearance above HFL, scour depth. **8Hrs**

Self-Learning Exercise: *Choice of bridge types.*

Text Books

1. Saxena and Arora, **"Railway Engineering"**, Dhanpat Rai and sons, New Delhi, 2010.
2. S. C. Saxena, "Airport Engineering: Planning and Design", CBS Publishers, 2010
3. Srinivasan R, **"Harbour Dock & Tunnel Engineering"**, Charotar Publishing, 2010.
4. Ponnuswamy, **"Bridge Engineering"**, Tata McGraw hill, 2nd edition, 2007.

Reference Books

1. Agarawal M.M, **"Indian Railway Track"**, Jaico Publications Mumbai, 2008.
2. Mundery J.S, **"Railway Track Engineering"**, Tata McGraw Hill Publishers, 2010.
3. AntiaK.F ,**"Railway Track"**, New Book Co. Ltd., 2008.
4. Horonjeff, **"Planning & Design of Airport"**, McGraw Hill Publications New Delhi, 1994.
5. L.R. Kadiyali, **"Traffic Engineering & Transport Planning"**, Khanna Publishers, New Delhi, 2009.

WASTEWATER ENGINEERING (4:0:0)

Sub Code : CV0434 **CIE : 50% Marks**

Hrs/week : 4+0+0 **SEE : 50% Marks**

SEE Hrs : 3 Hrs **Max. Marks : 100**

Course Outcomes

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

1. Estimate sewage generation and to design and detail the components of sewerage system;
2. Characterize wastewater and to plan and design a complete sewage treatment scheme;
3. Design and detail the disposal system in sewered and unsewered areas with emphasis on recycle and reuse.

Unit- I

Introduction

Necessity of sanitation, basic definitions, systems of sanitation, sewerage systems-classification and suitability.

Wastewater Flow Rates

Dry weather flow, factors affecting dry weather flow, flow variations & their effects on design of sewerage system, computation of design flow, Storm flow - estimation through rational method (inclusive of concepts of Time of concentration, use of rainfall intensity curves, etc.) and empirical formulae.

Sewers and Storm Water Drains

Hydraulic formulae for velocity, effects of flow variations on velocity, self-cleansing and non-scouring velocities, hydraulic elements for circular sewers flowing full and flowing Partially full, Storm water drains. **9 Hrs**

Self-learning Exercises: *Waterborne diseases and sanitation.*

Unit –II

Sewers Construction & Maintenance

Sewer materials, shapes of sewers, storm water drains, laying of sewers, joints and testing of sewers, ventilation and cleaning of sewers.

Sewer Appurtenances

Manholes catch basins, street inlets, inverted siphons, oil and traps, wet wells and design of pumping stations.

Drainage in Buildings

Basic principles of drainage in buildings, Pipes, traps and sanitary fittings, typical layout plan showing house drainage connections**.** **9 Hrs**

Self-learning Exercises: *Systems of plumbing (single stack system, one pipe system, partially ventilated single stack system, two pipe system.*

Unit -III

Waste Water Characterization

Sampling, sample preservation, compositing (space & time compositing), sampling techniques & equipments, Physical, Chemical and Biological characteristics, Aerobic and Anaerobic activity. CNS cycles & role of nutrients for optimal growth, BOD and COD, their significance & limitations. **8 Hrs**

Self-learning Exercises: *MPN and determination of MPN.*

Unit -IV

Municipal Sewage Treatment

Flow diagram of municipal sewage treatment plant.

Primary Treatment

Screening, Grit chambers, Skimming tanks, Primary sedimentation tanks, (Design criteria & Design examples)

Secondary Treatment

Suspended growth - Activated sludge process- Principle and flow diagram. Design of ASP, Modifications of ASP, Fixed film bioprocess- Trickling filter – theory and operation, types and designs. **9 Hrs**

Self-learning Exercises: *UASB Reactors and principle of working*.

Unit -V

Treatment and Disposal of Sludge

Anaerobic Sludge digestion, Sludge digestion tanks, Design of Sludge drying beds.

Disposal of Effluents

Disposal of Effluents by dilution - Self- purification phenomenon in water bodies, Oxygen sag curve, Zones of purification (Numerical Problems - Streeter Phelps equation). Disposal of Effluents on land - Sewage farming, sewage sickness. **9 Hrs**

Self-learning Exercises: *Effluent Disposal standards for land, and water*

Unit -VI

Low Cost Sewage Treatment (Isolated Buildings and Small Communities)

Septic tank and soak pits, Stabilization ponds, DEWATS and constructed wet lands.

Reuse and Recycle of Waste Water

Disinfection of sewage by chlorination, tertiary treatment, direct and indirect reuse of wastewater – Municipal, Industrial, Agriculture, Recreational, and Groundwater reuse.

8 Hrs

Self-learning Exercises: *Twin Pit Latrine and Eco Sanitation*

Text Book

1. Santosh Kumar Garg, **"Sewage disposal & Air pollution Engineering**", Khanna Publishers, New Delhi, 2010

Reference Books

1. Hammer, M.J. and Hammer, M. J. Jr. **"Water and waste Water Technology"**, 6th Edition, Prentice Hall, Inc., New Jersey, 2007.
2. Howard S. Peavy, Donald R. Rowe and George Tchnobanoglous, **"Environmental Engineering"**- McGraw Hill International Edition, 2013
3. CPHEEO, **"Manual on Waste Water Treatment:"**, Ministry of Urban Development, New Delhi, 2012
4. Fair, Geyer and Okun, **"Water and Wastewater Engineering Vol-II"**, John Willey Publishers, New York, 2010
5. Metcalf and Eddy inc **"Waste Water Treatment, Disposal and Reuse"**, Tata McGraw Hill Publications, 2003

DESIGN OF STEEL STRUCTURES (3:2:0)

Sub Code : CV0438 **CIE : 50% Marks**

Hrs/Week: L+T+P - 3+2+0 **SEE: 50% Marks**

SEE Hrs : 03 Hrs **Max. Marks: 100**

Course Outcomes

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

1. Apply the knowledge of loads, load combinations and design considerations
2. Design bolted connections
3. Design welded connections
4. Design tension members
5. Design compression members and column bases
6. Design laterally supported beams

Unit-I

Introduction

Advantages and Disadvantages of Steel structures, Loads and Load combinations, Design considerations, Limit State Method (LSM) of design, Failure criteria for steel. **4 Hrs**

Self-Learning Exercise: *Codes and Specifications, Section classification.*

Unit-II

Bolted Connections

Introduction, Behaviour of Bolted joints, Failure of bolted joints, Design strength of ordinary Black Bolts, Design strength of High Strength Friction Grip bolts (HSFG),Simple Connections, Moment resistant connections - twisting moment is in the plane of connection**.** **8 Hrs**

Self-Learning Exercise: *Pin Connections*

Unit-III

Welded Connections

Introduction, Welding process, Welding electrodes, Advantages of Welding, Types and Properties of Welds, Types of joints, Weld symbols, Weld specifications, Effective areas of welds, Failure of welds, Design of welds, Simple joints, Moment resistant connections - twisting moment is in the plane of weld. **8 Hrs**

Self-Learning Exercise: *Distortion and residual stresses in welded joints*

Unit-IV

Design of Tension Members

Introduction, Types of tension members, Design of strands, Slenderness ratio, Behaviour of tension members, Modes of failure, Factors affecting the strength of tension members, Angles under tension, other sections, Design of tension member, Lug angles. **6Hrs**

Self-Learning Exercise: *Splices in tension members*

Unit-V

Design of Compression Members

Introduction, Possible failure modes, Slenderness Ratio, Behaviour of compression members, Elastic buckling of slender compression members, Sections used for compression members, Effective length of compression members, Design of compression members, splice of compression members.

Design of Column Base

Introduction, Types of column bases, Slab base and Gusset base. **10 Hrs**

Self-Learning Exercise: *(i) Built up compression members (ii) Types of Foundation bolts*

Unit-VI

Design of Beams

Introduction, Beam types, Lateral stability of beams, Behaviour of beams in bending, Design of laterally supported beams, Maximum deflection, splice of beam members.

6 Hrs

Self-Learning Exercise: *Design of Compound beam*

Text Book

1. S. K. Duggal, "**Limit state Design of steel Structures"**, Tata McGraw Hill, 2010.

Reference Books

1. N. Subramanian, "**Design of Steel Structures"**, Oxford Publications, 2008
2. M. L. Gambir, "**Fundamentals of Structural Steel Design"**, Tata McGraw Hill, 2017.
3. Ramachandra and Virendra Gehlot, "**Limit State Design of Steel structures**", Scientific Publishers, 2012
4. M. R. Shiyekar, "**Limit State Design in Structural Steel"**, PHI, 2010
5. V. L. Shah and Veena Gore, "**Limit State Design of Steel Structures"**, Structure Publications, 2009
6. S. S. Bhavikatti, "**Design of Steel Structures"**, I.K. International publishing house, 2009
7. D.S.Rajendra Prasad, "**Design of Steel Structures"**, Sapna Book House, 2010
8. Abraham J. Rokach, "**Theory and Problems of Structural steel Design**", McGraw Hill, 1991
9. Bureau of Indian Standards, **IS 800-2007; IS 875 - 1987; SP- 6 (1)** or "**Steel Tables**"

ENVIRONMENTAL ENGINEERING LABORATORY (0:0:3)

Sub Code : CV0120 **CIE : 50% Marks**

Hrs/Week : 0+0+3 **SET : 50% Marks**

SET Hrs : 03 Hrs **Max. Marks : 100**

Course Outcomes

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

1. Analyze the characteristics of water and wastewater and based on relevant standards.

Lab Experiments

1. To determine the Chloride present in given sample using Argentometric method.
2. To determine the a) Chlorine in bleaching powder using iodometric method.
   b) pH value in a sample of water and
   c) Conductivity.
3. To determine the different types of hardness in given sample using EDTA titrimetric method.
4. To determine the Alkalinity and Acidity in water sample using titration method.
5. To determine the Dissolved oxygen using Modified Wrinkler's method
6. To determine a) the Optimum coagulant dosage using Jar Test Apparatus and Nephelometer.b) Sieve analysis for determination of Effective size and Uniformity Coefficient for stock sand and preparation of filter sand from stock sand
7. To determine a) the Fluorides in sample of water using Colorimetric method
8. To determine the Residual chlorine and Chlorine demand.
9. To determine the Sulphates, Nitrate, Phosphate, Iron in sample of water using Spectrophotometer.
10. To determine Solids in Sewage: Total Solids, Suspended Solids, Dissolved Solids, andVolatile Solids, Settle able Solids.
11. Demonstration of test to determine Sodium and Potassium using Flame Photometer.
12. Demonstration of BOD test
13. Demonstration of COD test
14. Demonstration of the Biological tests –a)H_2S Paper Test b)MPN test

Self-Learning Exercise: *Sampling procedure.*

Reference Books

1. Sawyer, McCarty and Parkin. "**Chemistry for Environmental Engineering and science**" McGraw-Hill publication, 5th Edition, 2003.
2. Eugene W. Rice, Rodger B. Baird, Andrew D. Eaton, Lenore S. Clesceri (Eds.) "**Standard methods for the examination of water and wastewater",** American Public Health Association, Washington DC, 21st Edition, 2012.
3. "**Manual on water and wastewater analysis**", NEERI, Nagpur 1988.
4. **Indian Standard codes** IS 3025 and parts thereof, IS 10500, IS 2490.

CONCRETE AND NDT LABORATORY (0:0:3)

Sub Code : CV0121 **CIE : 50% marks**

Hrs/Week: 0+0+3 **SEE: 50% marks**

SEE Hrs : 03 Hrs **Max. Marks: 100**

Course Outcomes

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

1. Conduct tests on cement, aggregates, wet and dry concrete.
2. Use NDT equipments for assessing strength of existing structures.

Lab Experiments

1. Test on Cement
   Normal Consistency, Setting Time, Compressive strength, Specific Gravity, Fineness of Cement (By dry sieveing),
2. Test on Aggregates (c/a & f/a)
   Sieve analysis, specific gravity, water absorbtion, bulk density for river and M-sand
3. Mix Design and Workability Tests
   Slump test, compaction factor, Vee-Bee apparatus test.
4. Tests on Hardened Concrete
   Compressive strength, split tensile test.
5. Rebound Hammer Test
6. Ultrasonic Pulse Velocity Test
7. Determination of Extent of Corrosion in RC Elements
8. Rebar Locator
9. Durability test: Sorptivity test

References

1. IS 10262-1981 (RA 1989) : Recommendation guidelines of concrete mix design
2. SP 23 (S&T)-1982 Hand book on concrete mixes
3. IS 456 – 2000 : code of practice for plain & reinforced concrete
4. IS 516-1959 (RA 1991) : Method of test for strength of concrete
5. IS 13311 (Part – 1) 1992 : Ultrasonic Pulse Velocity
6. IS 13311 (Part 2) 1992 : Rebound Hammer Test
7. N. Krishna Raju, **" Design of Concrete Mixes"**, CBS Publishers & distributors, Delhi 2010
8. Neville A. M., **"Properties of Concrete"**, Pitman Publishers-2009.

DETAILING OF STEEL STRUCTURES (1:0:2)

Sub Code : CV0213 **CIE : 50% Marks**

Hrs/Week: L+T+P - 1+0+2 **SEE: 50% Marks**

SEE Hrs : 03 Hrs **Max. Marks: 100**

*** Drawing**

Course Outcomes

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

1. Prepare detailed working drawings of different components of steel structures using the provided data for bolted connections, welded connections, framed connections, column bases, plate girder, gantry girder and roof trusses.

List of Drawings

1. **Connections:** Bolted and welded connections.
2. **Framed connections:** Beam to Beam, Beam to column (stiffened seated and unstiffened)
3. **Columns and splices:** Connections between columns of same and different sections, Built-up Columns with Lacings and Battens
4. **Column Bases:** Slab base, Gusseted base and Grillage foundation
5. **Girders:** Welded Plate girder, Gantry girder
6. **Truss:** Drawing of roof truss
7. Detailing of box sections

Text Book:

1. N. Krishna Raju, "**Structural Design and Drawing of Reinforced Concrete and Steel (Third edition)"**, University press, India 2013

Reference Books:

1. S Kanthimathinathan, "**Manual for detailing of steel structures"**, IK International publishing house, 2013.
2. MYH Bangash, "**Structural Detailing in Steel**", Thomas Telford Ltd, 2000
3. R B Shivagunde and R B Asthana, "**Structural Steel: Drafting and Detailing"**, Somaiya Publications Pvt. Limited, 1994, First edition
4. Bureau of Indian Standards, **IS 800-2007; IS 875 - 1987; SP- 6 (1)** or "**Steel Tables**"

STACKED PROJECT

Sub Code : CV0125 **CIE : 50%**

Hrs/Week : 0+0+12 **SEE : 50%**

Credits : 01 **Max. Marks : 50**

Course Outcomes

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

1. Plan, design and estimate simple residential/commercial/public buildings.

COURSE DETAILS

In this course, students undertake an individual self driven application activity in every semester based on his/her learning in the previous semester. This activity starts from 4^{th} semester and will culminate in 7^{th} semester. This independent activity spread over a period of three years will be monitored by a Faculty advisor once in every semester for the purpose of Continuous Internal Evaluation (CIE). In the final year, after preparing the report he/she will make an oral presentation for the Semester End Examination (SEE).

Elective-III

PAVEMENT EVALUATION AND MANAGEMENT (3:0:0)

Sub Code : CV0316 **CIE : 50% Marks**

Hrs/week : 3+0+0 **SEE : 50% Marks**

SEE Hrs : 3 Hrs **Max. Marks : 100**

Course Outcomes

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

1. Describe various pavement distresses and to evaluate the surface condition;
2. Describe pavement structure and to evaluate the structural condition;
3. Design and detail the pavement overlays and to apply the expert systems for pavement management.

Unit -I

Introduction

Structural and functional requirements of flexible and rigid pavements; pavement distress; different types of failures, causes and remedial measures. **3 Hrs**

Pavement Surface Condition

Various aspects of surface and their importance; factors affecting deterioration and measures to reduce: (i) Pavement slipperiness (ii) Unevenness (iii) Ruts, pot holes and cracks. **4 Hrs**

Self-Learning Exercise: *Maintenance measures to reduce pavement distresses*

Unit -II

Evaluation of Surface Condition

Methods of measurement of skid resistance using portable and dynamic methods, unevenness, ruts and cracks. Pavement surface condition evaluation by physical measurements by Profilograph, 5^{th} wheel Bump Integrator, ROMDAS and other methods and their applications; Micro paver and applications. **7 Hrs**

Self-Learning Exercise: *Standards for surface condition*

Unit -III

Pavement Structure

Factors affecting structural condition of flexible and rigid pavements; effects of subgrade soil, moisture, pavement layers, temperature, environment and traffic on structural stability, Pavement deterioration. **7 Hrs**

Self-Learning Exercise: *Basic Structural Response Models*

Unit -IV

Evaluation of Pavement Structural Condition

Evaluation by non-destructive tests such as FWD, Benkelman Beam rebound deflection, Plate load test, wave propagation and other methods. Evaluation by destructive test methods, and specimen testing. 7 **Hrs**

Self-Learning Exercise: *Structural Capacity Index Concepts*

Unit -V

Overlay Design

Design of Flexible overlay over flexible pavement by Benkelman beam deflection and other methods, flexible overlays and rigid overlays over rigid pavement. Use of geosynthetics in pavement overlays, fiber reinforced concrete overlays **7 Hrs**

Self-Learning Exercise: *Rigid overlays on deteriorated flexible pavements*

Unit -VI

Pavement Management

Components of pavement management systems, pavement maintenance measures, planning investment, research management, Pavement Preservation Programmes, Techniques and Tools. **3 Hrs**

Expert Systems and Pavement Management

Role of computers in pavement management, applications of expert systems for managing pavements, expert system for pavement evaluation and rehabilitation, knowledge-based expert systems, case studies. **4 Hrs**

Self-Learning Exercise: *Application of HDM and other pavement software*

Text Book

1. Ralph Haas and Ronald W. Hudson, **"Pavement Management System"**, McGraw Hill Book Co, 1978.

Reference Books

1. Yoder E.J. and Witczak, **"Principles of Pavement Design"**, II Edition, John Wiley and Sons, 1975.
2. Babkov, **"Road Conditions and Traffic Safety"**, Mir Publications, 2002.
3. David Croney, **"The Design and Performance of Road Pavements"**, HMSO Publications, 1977.
4. HRB/TRB/IRC/International Conference on "**Structural Design of Asphalt Pavements"**.
5. Ralph Haas, Ronald Hudson and Zanieswki, **"Modern Pavement Management**", Kreiger Publications, 1994.
6. Khanna and Justo, **"Highway Engineering"**, Nemchand and Bros., Civil Lines, Roorkee, India, 2001.
7. Khanna, Justo and Veeraragavan, "**Highway Materials and Pavement Testing"**, Nemchand and Bros., Civil Lines, Roorkee, India, 2000.

REPAIR AND REHABILITATION OF STRUCTURES (3:0:0)

Sub Code : CV0323 **CIE : 50% Marks**

Hrs/Week : 3+0+0 **SEE : 50% Marks**

SEE Hrs : 03 Hrs **Max. Marks : 100**

Course Outcomes

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

1. Asses existing conditions of buildings; Evaluate structures & suggest methods of repair and strengthening

Unit – I

The Challenge of Renovation / Rehabilitation

Terminology, When to Renovate, Beginning a Renovation Project, Typical Structural Challenges, Role of Building codes in Renovation, Renovation Provisions of Model Building Codes.

6 Hrs

Self-Learning Exercise: *Renovate or Rebuild*

Unit - II

Investigating Existing Conditions

Why Investigate?, Methods of investigations, Assessing Building Condition, Material Properties in Steel systems, Concrete Framing, Load Testing of Concrete Structures, Post-Tensioned Concrete Framing, Wood Framing, Masonry.

6 Hrs

Self-Learning Exercise: *Building Envelope*

Unit - III

Repairing Deteriorated Concrete

Overview, Repairing cracks, Corrosion of Reinforcement and its Effects on concrete, Patching spalls and Deteriorated Areas, Cathodic and Anodic – Protection and Electrochemical Chloride Extraction, Corrosion Inhibitors, Other types of Damage to concrete, Materials for concrete Repair, Durability of Repairs. **8 Hrs**

Self-Learning Exercise: *Systematic Maintenance Programs*

Unit - IV

Rehabilitation of Concrete Structures

Method of repair & restoration – patch repair, pressure grouting, guniting shotcreting, jacketing, replacement, fiber wrapping etc. Repair sequences, materials construction chemicals

6Hrs

Self-Learning Exercise: *Shear connectors & anchoring.*

Unit – V

Renovating Steel-Framed Buildings

Steel: The Venerable Material, Past Design Methods and Allowable Stresses for iron and steel Beams, Early Iron and Steel Columns, Properties of Early Fasteners, Open- Web Joists, Strengthening Floors, Reinforced Steel Members by Welding, Reinforced Beams by Composite Action with Concrete, Strengthening Beams Connections, Composite Steel-Concrete Columns, Openings in Existing Steel Beams, Thermal Prestressing of Steel Structures.

10 Hrs

Self-Learning Exercise: *Steel Corrosion: Evaluation and Protection.*

Unit - VI

Water Proofing

Types of water proofing in concrete structures. **6 Hrs**

Self-Learning Exercise: *Causes of leakage*

Text Book

1. Alexander Newman **"Structural Renovation of Buildings"**–McGraw Hill, 2009.

Reference Books

1. Allen RTL and Edwards, SC, "**The Repair of Concrete Structures"** Blakie and sons, 1993.
2. Raiker R.N, **"Learn for Failure from Deficiencies in design, Construction & service"**– R&D Center (SDCPL)

DISASTER MANAGEMENT (3:0:0)

Sub code: CV0328 **CIE: 50% Marks**

Hrs/weeks: 3+0+0 **SEE: 50% Marks**

SEE Hrs: 3 Hrs **Max. Marks: 100**

Course Outcomes

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

1. Identify the types of disaster and explain the concept behind the design of disaster resistant structures.
2. Explain the design philosophy for loads, material design.
3. Identify the materials used, damage assessment & techniques of damage assessment.

Unit-I

Behavior of Life Line Structures

Introduction - Disaster and types of disaster. Design philosophy to resist flood, cyclone, earthquake and fire disaster national and international codes of practice- by-laws of urban and semi urban areas, past history and lessons from disaster- approach to traditional and modern structures. **7 Hrs**

Self-Learning Exercise: *Concept of life period based design - case study.*

Unit-II

Community Structures

Safety analysis and rating – reliability assessment repairs and retrofitting techniques of community structures – Protection of Nuclear Structures – dams and bridges.

8 Hrs

Self-Learning Exercise: *Protection of buildings.*

Unit-III

Rehabilitation and Retrofitting

Testing and evaluation - methods and materials for strengthening for different disaster qualification test. **7 Hrs**

Self-Learning Exercise: *Classifications according to safety level*

Unit-IV

Materials Design and Detailing

Modern materials for disaster reduction – detailing aspects of structures subjected to probable disaster - analysis methodology – techniques for optimal performance – provision for artificial disaster – blast and impact.

8 Hrs

Self-Learning Exercise: *Construction techniques*

Unit-V

Techniques of Damage Assessment

Damage surveys – maintenance and modifications to improve hazard resistance – application of GIS in disaster management.

6 Hrs

Self-Learning Exercise: *foundation improvement techniques.*

Unit-VI

Disaster Preparedness

Concept and Nature, Disaster Preparedness Plan , Role and Responsibilities of Armed Forces, Police, Para-military Forces, National Service Scheme and Scouts , International Agencies, Non-governmental Organisations, Community Based Organisations, Community, and Media, Use and Application of Emerging Technologies in Disaster Preparedness.

6 Hrs

Self-Learning Exercise: *Disaster Response*

Reference Books

1. Raiker, R.N., **"Learning from Failures, Deficiencies in Design, Construction and Service"**, R & D Centre, Raiker Bhavan, 1987.
2. Allen R.T. & Edwards S.C, "**Repair of Concrete Structures**", Blakie and Sons, UK, 1987.
3. Moskvin V., **"Concrete and Reinforced Concrete"**, Deterioration and protection, MIR Publishers – Moscow, 1983.

FOUNDATION ENGINEERING (3:0:0)

Sub Code : CV0335 **CIE : 50% Marks**

Hrs/Week : 3+0+0 **SEE : 50% Marks**

SEE Hrs : 03 Hrs **Max. Marks : 100**

Course Outcomes

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

1. Analyze and design shallow and deep foundations
2. Identify and overcome problems of expansive soil
3. Sketch the flow nets and compute the seepage through earth dams & foundations.
4. Design sheet pile walls & bulkheads.

Unit-I

Shallow Foundations

Presumptive bearing capacity. Factors affecting bearing capacity and settlement. Basic principles of design of spread footings, combined footings & strap footings.

6 Hrs

Self-learning exercise: *Contact pressure under footings*

Unit-II

Pile Foundations

Introduction, Necessity for pile foundation, classification of piles, bearing capacity of piles – static and dynamic methods. Pile capacity from SPT. Pile load test. Group action of piles.

8 Hrs

Self-learning exercise: *Negative skin friction.*

Unit-III

Drilled Piers & Caissons

Introduction, Advantages and limitations of drilled piers. Construction of drilled piers. Bearing capacity of drilled piers. Types of caissons. Their advantages and limitations. Bearing capacity of caissons.

6 Hrs

Self-Learning Exercise: *Pneumatic Caissons.*

Unit-IV

Foundations on expansive soils

Introduction. Causes of moisture change and its effect. Methods of identifying expansive soils. Swell pressure test. Remedial measures and foundations on expansive soils. Basic problems on belled piers and under reamed piles. Construction of under –reamed piles. **8 Hrs**

Self-Learning Exercise: *Stabilization of expansive soils*

Unit-V

Earth Dams

Introduction. Types of earth dams. Criteria for fixing the c/s of an earth dam. Causes of failure of earth dams. Criteria for safe design. Laplace equation for 2-D flow. Sketching of flow net for simple cases. Location of top flow line in earth dams. Computation of seepage.

8 Hrs

Self-Learning Exercise: *Filters in earth dams.*

Unit-VI

Sheet pile walls & Bulkheads

Introduction. Cantilever sheet pile wall in cohesion less and cohesive soils. Anchored sheet pile wall – Free and fixed earth support methods. Design of anchors.

6 Hrs

Self-Learning Exercise: *Types of anchors.*

Text Books

1. K.R. Arora, "**Soil Mechanics & Foundation Engg"**, Standard Publishers, 2009.
2. B.C. Punmia, **"Soil Mechanics & Foundations"** , Lakshmi Publications Pvt. Ltd., 2005.

Reference Books

1. Bowles J.E, "**Foundation analysis & Design"**, Mc Graw Hill Int. Edition, 2001.
2. C. Venkataramaiah, **"Geotechnical Engg."**, New Age International Publishers Pvt. Ltd., 2006.
3. A.V. Narasimha Rao and C Venkatarmaiah, "**Numericals in Geotechnical Engg**." – University press , 1st Edition, 2000.

PIPE NETWORK ANALYSIS AND DESIGN (3:0:0)

Sub code : CV0336 **CIE : 50% Marks**

Hrs/weeks : 3+0+0 **SEE : 50% Marks**

SEE Hrs : 3 Hrs **Max. Marks : 100**

Course Outcomes

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

1. Describe and interpret an urban water distribution systems
2. Possess knowledge about Hydraulic concepts in the context of water transport in distribution networks
3. Analyse and design a branched or looped pipe network
4. Conduct simulation studies for a designed pipe network.

Unit-I

Urban Water Transport and Distribution Systems

System purpose, configuration and functions. System requirement (maximum and minimum pressures of supply); pumping and gravity systems; Intermittent and continuous supply; Layout of water distribution systems, pipes and Piping Materials; Water Demand and variations in demand; Operation and maintenance.

6 Hrs

Self-Learning Exercise: *Valves and Fire Hydrants; Instrumentation and Control.*

Unit-II

Head Loss in Pipes

Darcy-Weisbach Formula; Moody Diagram; Friction Coefficient Relationships; Hazen - Williams Formula; General Head Loss Formula; Simple Pipe Flow Problems - Determination of Head Loss, Discharge, Diameter. Minor losses due to- Sudden Enlargement; Gradual Enlargement; Sudden Contraction; Gradual Contraction; Entrance; Bends and Elbows; Tees; Obstructions; Flow Meters; valves. Introduction; Pipes in Series; Pipes in Parallel.

8 Hrs

Self-Learning Exercise: *Reduction of Carrying Capacity with Age; Pipes in Series-Parallel.*

Unit-III

Water Transmission Lines

Gravity Mains; Pumping Mains; Pumping in Stages-Long Pipeline on a Flat Topography, Pipeline on a Topography with Large Elevation Difference. RESERVOIRS: Reservoirs-Impounding Reservoirs, Service and Balancing Reservoirs, Determination of capacity of reservoir. PUMPS: Pumps - System Head-Discharge Curve, Pump Head-Discharge Curve, Head-Discharge Relationship, Characteristic Curves.

6 Hrs

Self-Learning Exercise: Pump in series and parallel and pump selection;

Unit-IV

Parameters, Parameter Inter-Relationships and Formulation of Equations

Types of Networks - Serial Network, Branching Network, Looped Network. Different parameters and their Configuration. Labelling Network Elements- Branching Networks, Looped Networks, Parameter Inter-relationships: Pipe head loss Relationship, Node flow continuity relationship, loop head loss relationship; Different combinations of known and unknown parameters; Formulation of Q and H equations of Single-Source branched and looped networks with Known Pipe Resistances;

9 Hrs

Self-Learning Exercise: Check Valves, Pressure Reducing Valves

Unit-V

Analysis of Looped Networks: Hardy Cross Method

Basic concept; Method of Balancing Heads and Method of Balancing Flows. Application to Single-Source Networks with Known Pipe Resistances.

8 Hrs

Self-Learning Exercise: Basics of Newton-Raphson Method and other methods of analysis.

Unit-VI

Steady State and Extended-Period Simulation and Hydraulic Calibration

Difference in Analysis and Design; Iterative Method; Direct Method; Introduction to steady state and extended-period simulation. Input Data for Hydraulic EPS Modeling; Introduction; Steady-State Calibration; EPS Calibration. Network skeletonisation.

5 Hrs

Self-Learning Exercise: **EPANET-** Background, Program, User, Solver Module, Programmer's Toolkit

Text Books

1. Pramod Bhave, R Gupta, **"Analysis of Water Distribution Networks"**, Narosa Publishing House, 2006.
2. Prabhata K. Swamee and Ashok K. Sharma, **"Design of Water Supply Pipe Networks"**, John Wiley & Sons, 2008.

Reference Books

1. Larry, W. Mays, **"Water Distribution Systems Handbook"** , McGraw-Hill, 1999.
2. Larry, W. Mays, **"Water Transmission and Distribution: Principles and Practices of Water Supply Operations"** , American Water Works Association, 2010.
3. Nemanja Trifunovic, **"Introduction to Urban Water Distribution"**, Taylor and Francis, 2009.
4. Bruce E. Larock, Roland W. Jeppson and Gary Z. Watters **"Hydraulics of Pipeline Systems",** CRC Press, 1999.

NPTEL – VALUE ADDED COURSES FOR 7TH SEMESTER CIVIL ENGINEERING STUDENTS

PROJECT PLANNING & CONTROL

COURSE LAYOUT

Week 1. Introduction, Course Context, Construction Project Management

Week 2. Time Management, Work Breakdown Structure (WBS), Gantt Charts

Week 3. Duration Estimation, Network Representation & Analysis -1

Week 4. Network Representation & Analysis -2; Two-Span Bridge: Scheduling, Network Analysis and Application

Week 5. Time-Cost Trade-off (Crashing)

Week 6. Resource Scheduling

Week 7. Precedence Diagramming Method (PDM), Project Monitoring & Control

Week 8. Project Monitoring & Control (Earned Value Concepts), Uncertainty in Project Schedules (PERT)

GLASS IN BUILDINGS: DESIGN AND APPLICATIONS

COURSE LAYOUT

Modern Architectural Requirements

- Requirements as per Standards – NBC – Fire & Structural

How to design a Sustainable Building

- Building Physics
- Green Buildings Requirements
- Codal Recommendations – ECBC/IS
- Segment Based Design

Manufacturing of glass

- Types of Glass
- Coating Technology – High Performance Glass
- Innovative Applications – Electro-chromic & Digital Printing

Processing

- Tempering/ Double glazing/ Lamination
- Printing on Glass

Glass as Building Envelope Material

- Glass Parameters
- Façade Fundamentals
- Façade Design & Testing
- How to Design Façade for Day lighting & Energy efficiency – Modeling
- Design Tools & Simulation Software's used for Design
- How to understand high performance glass
- Glass for Acoustics, Fire & Interior applications
- Glass for Safety & Security

Case Studies

- On Design & Detailing
- Application Impact
- Building Measurements & its Impact

EARTHQUAKE RESISTANT DESIGN OF FOUNDATIONS

COURSE LAYOUT

Week 1 : Introduction: General requirements, types of shallow and deep foundations and their use; performance of various types of foundations during past earthquakes. Shallow Foundations: IS codes for bearing capacity and settlement of foundations, foundation design, modes of soil failure.

Week 2 : Shallow Foundations: Safe bearing capacity, differential & total settlements, increase in permissible stress under earthquake loads. Methods of analysis, experimental investigations, Combined footings for earthquake loads

Week 3 : Shallow Foundations: Raft foundation, modulus of sub grade reaction, Winkler model, beam on elastic foundation. Dynamic Bearing Capacity under Transient & Earthquake Type Loads: Types of dynamic loads; Footing requirements to account for settlements and earthquake induced forces; Pseudo-Static analysis of footings with eccentric & inclined loads. Effect of horizontal load and moment. Dynamic Analysis of shallow foundations for various modes of vibrations

Week 4 :Pile Foundations: Types of piles based on usage, material, construction etc. pile load capacity in compression, Bearing capacity of piles, group action of piles, settlement of a pile group;

Week 5 : Pile Foundations: Laterally loaded piles, elastic analysis; Reese and Matlock approach, fixity of pile heads, dimensionless factors; Pile with dynamic loads.

Week 6 : Pile Foundations: soil-pile analysis with spring-mass & FEM idealisation, elements for slip and separation, soil-pile interaction, IS code of practice for design of pile foundations, piles through liquefiable soils

Week 7 : Well Foundations & Caissons: Types; components; scour depth, depth & bearing capacity of wells, static forces considered in stability of wells; Lateral stability of well

foundations. Pseudo-static analysis with earthquake induced loads, Lateral load resistance of well foundation; Terzahi's approach; IRC, IS and Indian Railway Codes, their limitations.

Week 8 : SSI for Deep Foundations: Soil-Structure Interaction, Modelling of Unbounded Soil Media for Dynamic Loads, Free Field Motion, Kinematic Interaction and Inertial Interaction.

INTRODUCTION TO MULTI MODAL URBAN TRANSPORTATION SYSTEMS (MUTS)

COURSE LAYOUT

Week 1:

Module 1: Overview of urban transportation

Lec. 1: Urbanization and Transport (0.5 hr.)
Lec. 2: Key issues in urban transportation (0.5 hr.)
Lec. 3: Challenges in urban transportation (0.5 hr.)
Lec. 4: Travel demand modelling overview (0.5 hr.)
Lec. 5: Vehicular Level of Service (LOS) overview (0.5 hr.)

Week 2:

Module 2: Public Transportation

Lec. 6: Introduction to public transportation (0.5 hr.)
Lec. 7: Basic operating elements of public transportation (0.5 hr.)
Lec. 8: Basic operating elements of public transportation (contd.) (0.5 hr.)
Lec. 9: Bus Transportation (0.5 hr.)
Lec. 10: Bus Transportation (contd.) (0.5 hr.)

Week 3:

Module 2: Public Transportation

Lec. 11: Financing public transportation (0.5 hr.)
Lec. 12: Transit marketing (0.5 hr.)
Lec. 13: Rail transportation (0.5 hr.)
Lec. 14: Intermediate Public Transportation (0.5 hr.)
Lec. 15: Measuring performance of transit systems (0.5 hr.)

Week 4:

Module 2: Public Transportation

Lec. 16: Advanced operation concepts of public transportation (0.5 hr.)
Lec. 17: Bus & Rail Transit Capacity (0.5 hr.)
Lec. 18: Bus & Rail Transit Capacity (contd.) (0.5 hr.)
Lec. 19: Station Capacity (0.5 hr.)
Lec. 20: Transit Stop Location (0.5 hr.)

Week 5:

Module 3: Non-Motorised Transportation (NMT) Planning

Lec. 21: Introduction to NMT Systems (0.5 hr.)
Lec. 22: Assessing existing NMT scenario (0.5 hr.)
Lec. 23: Data collection and analysis in NMT Planning (0.5 hr.)
Lec. 24: Complementarity and Selection of Interventions (0.5 hr.)
Lec. 25: Alternative Selection through Economic & Financial Analysis (0.5 hr.)

Week 6:

Module 3: Non-Motorised Transportation (NMT) Planning

Lec. 26: Introduction to NMT systems (0.5 hr.)
Lec. 27: Basic NMT Characteristics (0.5 hr.)
Lec. 28: Pedestrian Data Collection and Flow Characteristics (0.5 hr.)
Lec. 29: PTS Case Studies Pedestrian flow characteristics on facilities (0.5hr.)
Lec. 30: Pedestrian Level of Service (PLOS) based on Flow models (0.5hr.)

Week 7:

Module 3: Non-Motorised Transportation (NMT) Planning

Lec. 31: Other types of Pedestrian Level of Service (PLOS) (0.5 hr.)
Lec. 32: HCM 2010 Methodology for PLOS (0.5 hr.)
Lec. 33: HCM 2010 Methodology for PLOS (contd.) (0.5 hr.)
Lec. 34: Bicycle Facilities and Level of Service (BLOS) (0.5 hr.)
Lec. 35: BLOS and Bicycle Compatibility Index (BCI) (0.5 hr.)

Week 8:

Module 3: Non-Motorised Transportation (NMT) Planning

Lec. 36: NMT Design Principles (0.5 hr.)
Lec. 37: Design of Pedestrian Infrastructure (0.5 hr.)
Lec. 38: Design of Pedestrian Infrastructure (contd.) (0.5 hr.)
Lec. 39: Design of Cycling Infrastructure (0.5 hr.)
Lec. 40: Design of Cycling Infrastructure (contd.) (0.5 hr.)

Week 9:

Module 4: Urban Transport & Sustainability

Lec. 41: Travel Demand Management (TDM) overview (0.5 hr.)
Lec. 42: Push measures cases (0.5 hr.)
Lec. 43: Pull measure cases (0.5 hr.)
Lec. 44: Parking Studies (0.5 hr.)
Lec. 45: Transit Oriented Development (TOD) (0.5 hr.)

Week 10:

Module 4: Urban Transport & Sustainability

Lec. 46: Introduction to Intelligent Transportation Systems (ITS) (0.5 hr.)
Lec 47: ITS components, applications and communication (0.5 hr.)
Lec. 48: ITS Architecture (0.5 hr.)
Lec. 49: Electronic Toll Collection (ETC) (0.5 hr.)
Lec. 50: Public Bicycle Sharing (PBS) System with ITS (0.5 hr.)

Week 11:

Module 4: Urban Transport & Sustainability

Lec. 51: Multimodal transportation (MMT) environment (0.5 hr.)
Lec. 52: Multimodal Level of Service (MMLOS) (0.5 hr.)
Lec. 53: Multimodal Level of Service (MMLOS) (contd.) (0.5 hr.)

Lec. 54: Design of multimodal transfer facilities (0.5 hr.)
Lec. 55: Park & Ride (P&R) Facility Planning (0.5 hr.)

Week 12:

Module 4: Urban Transport & Sustainability

Lec. 56: An Introduction to Pedestrian Road Safety and associated Risk Factors (0.5 hr.)
Lec. 57: Road crash estimation and elements of predictive methods (0.5 hr.)
Lec. 58: Predicting Vehicle-Pedestrian and Vehicle-Bicycle conflicts (0.5 hr.)
Lec. 59: Environmental Concerns of Urban Transport (0.5 hr.)
Lec. 60: Sustainable strategies for Urban Transportation (0.5 hr.)

REMOTE SENSING AND GIS

COURSE LAYOUT

Week 1 : Remote Sensing Data and Corrections

Week 2 : Satellite Image Corrections

Week 3 : Digital Image Processing-I

Week 4 : Digital Image Processing-II

Week 5 : Thermal and Microwave

Week 6 : Imaging Spectroscopy-I

Week 7 : Imaging Spectroscopy-II & GIS-I

Week 8 : GIS-II and Application

SOFT SKILLS

COURSE LAYOUT

Week 1: Introduction to Soft Skills, Aspects of Soft Skills, Effective Communication Skills, Classification of Communication, Personality Development

Week 2: Positive Thinking, Telephonic Communication Skills, Communicating without Words, Paralanguage

Week 3: Proxemics, Haptics: The Language of Touch, Meta-communication, Listening Skills, Types of Listening

Week 4: Negotiation Skills, Culture as Communication, Organizational Communication

Week 5: Communication Breakdown, Advanced Writing Skills, Principles of Business Writing

Week 6: Business Letters, Business Letters: Format and Style, Types of Business Letter

Week 7: Writing Reports, Types of Report, Strategies for Report Writing, Evaluation and Organization of Data

Week 8: Structure of Report, Report Style, Group Communication Skills

Week 9: Leadership Skills, Group Discussion, Meeting Management, Adaptability & Work Ethics

Week 10: Advanced Speaking Skills, Oral Presentation, Speeches & Debates, Combating Nervousness, Patterns & Methods of Presentation, Oral Presentation: Planning & Preparation

Week 11: Making Effective Presentations, Speeches for Various Occasions, Interviews, Planning & Preparing: Effective Résumé,

Week 12: Facing Job Interviews, Emotional Intelligence & Critical Thinking, Applied Grammar

8th Sem.

Civil Engg.

CONSTRUCTION AND PROJECT MANAGEMENT (3:0:0)

Sub code: CV0342 **CIE : 50% marks**

Hrs/week: 3+0+0 **SEE : 50% marks**

SEE Hrs: 3 Hrs **Max. Marks: 100**

Course Outcomes

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

1. Implement various construction plans and work break down structure.
2. Identify construction equipment and cost controlling.
3. Implement project scheduling and cost controlling.
4. Apply available tools of total quality management for various Civil Engineering Projects.

Unit-I

Introduction

Needs, objectives and functions of construction management, organizational chart for the Construction Company, Duties and responsibilities of project manager, work safety series (OSHA - occupational safety and health administration), health, safety and environment management.

4 **Hrs**

Self-Learning Exercise: *Delegation of authority and accountability*

Unit-II

Construction planning

Necessity of planning and scheduling, various stages in planning, various construction schedule like material schedule, labour schedule , money schedule and machinery schedule, Bar chart, CPM, PERT, Formulation and time computation.

10 Hrs

Self-Learning Exercise: *Project monitoring and Evaluation*

Unit-III

Cost control

Different types of project cost, Total project cost and optimum duration, contracting network for cost optimization, Delay cost.

10 Hrs

Self-Learning Exercise: *Financial analysis.*

Unit-IV:

Construction equipment

Introduction, factors to be consider for selection, rent and lease of equipment, various earth moving equipment, cost of owning and operating construction equipment.

6 **Hrs**

Self-Learning Exercise: *Compaction equipment*

Unit-V

Introduction to departmental procedure

Different types of Procurement contract, control agreement tender, earnest money deposit, security deposit, tender form, comparative statements, Administrative approval, Technical

Sanction, Nominal Master roll, Measurement books, Method of recording Bills, Check measurement, Preparation of bills, types of contract.

6 Hrs

Self-Learning Exercise: *Swiss mode of contract, BOT, BOOT, PPP.*

Unit-VI

Introduction to Quality Management

Introduction, Definition, tools for quality control, Elements of quality management, requirement, Aims and ways of TQM. Quality circle, Quality system Standards.

6 **Hrs**

Self-Learning Exercise: *BIS certification of quality system, quality system requirement.*

Text Book

1. K.K. Chaitkara, **"Construction Project Management",** Tata McGraw-Hill, 2007.

Reference Books

1. Jack R. Merdith & Samual J.Mantel, **"Project Management-a managerial approach",** 7th edition, Wiley India, 2010.
2. P.P. Dharwadkar, **"Management in construction Industry**", Oxford IBH, 2008.
3. J.O Brien, **"Construction Management",** McGraw Hill, 2015.
4. J.M. Antill & R.W. Woodhead, **"Critical path method in construction",** Wiley, 1982.
5. B.C. Punmia & K.K. Khandelwal, **"Project Planning and construction Control with PERT and CPM PWD"** , **2015**.
6. Sathyanarayana B.J and Subash C. Saxena, **"Construction planning & Equipment", Standards** Publishers & Distributors, 2009.

ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT (4:0:0)

Sub Code : CV0435 **CIE : 50% Marks**

Hrs/week : 4+0+0 **SEE : 50% Marks**

SEE : 3 Hrs **Max. Marks : 100**

Course Outcomes

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

1. Identify several economic terms and apply economic laws for solving economic problems.
2. Execute and evaluate present worth, future worth and annual worth analyses on one or more economic alternatives and evaluate payback period and capitalized cost on one or more economic alternatives.
3. Carry out and evaluate benefit/cost, life cycle and break even analyses on one or more economic alternatives and an ability to calculate depreciations, describe the impact of inflation and to recognize the economic impact of engineering solutions.
4. Describe the basic concepts of financial management and to apply financial theory to tackle common financial problems in practice.

Unit -I

Introduction to Economics

Definitions, Micro and Macro Economics, Goods, Utility**,** Value, Asset, Liability, Capital, Revenue, Income, Wealth & Welfare, Economic Laws – Basics of Supply & Demand, Various forms & functions of market, Role of engineering economy in decision making.

8 Hrs

Self-Learning Exercise: *Price determination*

Unit -II

Value Engineering

An overview of Value Engineering concepts and approaches of value analysis and engineering - importance of value, value and value management, Life Cycle Costing, ISO 55000 and management of assets. Risk and risk management, Error management theory.

8 Hrs

Self-Learning Exercise: *Value engineering case studies and analysis*

Unit -III

Time Value of Money

Nominal and effective value of interest, simple interest, compound interest , present worth comparison, Present worth equivalence, Annual worth analysis, comparison of deferred investments, future worth comparison, pay back comparison, problems on rate of return method, Benefit cost analysis and Break even analysis

9 Hrs

Self-Learning Exercise: *Economic evaluation of public project.*

Unit -IV

Cost Estimation

Cost Concept and Classification of Cost, Cost output relationship, Activity based costing; Cost estimation techniques – Cost indices, Cost estimates – Cost saving areas, Variance analysis – Problems. **8 Hrs**

Self-Learning Exercise: *Effect of inflation on cost estimates.*

Unit -V

Economic Valuation of Properties

Definition, Purpose, Cost-Price-Value**,** Different forms of value, Gross income, Net income, outgoing, Types of outgoing, Years purchase, Capital Cost, Capitalized value, Sinking fund – Depreciation - Methods of depreciation, Mortgage, lease, Fixation of rent on buildings, Problems.

9 Hrs

Self-Learning Exercise: *Economic life of construction equipments*

Unit -VI

Financial Management

Introduction, the financial goal of a firm, taxation and policies, understanding financial statements, analyzing financial statements, profit planning and control, functions of financial management, types of capital, capital investment decisions, management of assets.

10 Hrs

Self-Learning Exercise: *Managing working capital*

Text Book

1. Banga & Sharma, **"Industrial Organization & Engineering Economics"**, Khanna Publishers, 2003.

Reference Books

1. James L. Riggs, David D. Bedworth, Sabah U. Randhawa, **"Engineering Economics"** Tata Mc Graw Hill Education Pvt. Ltd., New Delhi, 1996.
2. Tarachand**, "Engineering Economics"**, Nemchand and Brothers. Roorkee, 2000.
3. Yogesh Maheshwari, **"Managerial Economics"**, PHI Learning Pvt. Ltd. New Delhi, 2004.
4. Sengunthar, B and Guha, H. **"Construction Management and Planning"**, Tata MC Graw – Hill, 2002.
5. Kutchal H C, **"Financial Management"**, Chaitanya publishing house, 2000.
6. Parker, D.E., **"Value Engineering Theory"**, Sundaram publishers, 1990.

PRESTRESSED CONCRETE STRUCTURES (4:0:0)

Sub Code : CV0436 **CIE : 50% Marks**

Hrs/Week : 4+0+0 **SEE : 50% Marks**

SEE Hrs : 04 Hrs **Max. Marks : 100**

Course Outcomes

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

1. Characterize the materials to be used and identify the basic principles of Pre-stressed Concrete and Analyze the PSC sections for flexure.
2. Calculate loss of prestress and estimate the deflections of PSC Members.
3. Design PSC beams using concept of limit state.

Unit-I

Introduction

Basic concepts of Prestressing, Historical Development, Need for High Strength steel and Concrete, Terminology.

Material for Prestressed Concrete

High-Strength Concrete, High Tensile Steel.

10 Hrs

Self-Learning Exercise: *Advantages of Prestressed Concrete, Applications of Prestressed Concrete.*

Unit-II

Prestressing systems

Introduction, Tensioning Devices, Pretensioning Systems, Post-Tensioning Systems.

Analysis of Prestress and Bending Stresses

Basic Assumptions, Analysis of prestress, Resultant Stresses at a section, Pressure line or thrust line and internal resisting couple, concept of load balancing, stress in tendons, cracking moment.

10 Hrs

Self-Learning Exercise: *Thermo-Electric Prestressing, Chemical Prestressing.*

Unit-III

Losses of Prestress

Nature of losses of prestress, loss due to elastic deformation of concrete, loss due to shrinkage of concrete, loss due to creep of concrete, loss due to relaxation of stress in steel, loss of stress due to friction, loss due to anchorage slip

8 Hrs

Self-Learning Exercise: *Total losses allowed for in design.*

Unit-IV

Deflections of Prestressed concrete Members

Importance of control of Deflections, Factors Influencing deflections, Short-term deflections of uncracked members, Prediction of long time deflections, deflections of cracked members, Requirements of various codes of practice.

8 Hrs

Self-Learning Exercise: *Load verses deflection curve, methods of reducing deflection.*

Unit-V

Limit State Design Criteria for Prestressed concrete Members

Introduction, Inadequacies of the Elastic and ultimate Load methods, Philosophy of Limit-State design**,** Criteria for Limit States, Design loads and strengths, Strength and serviceability limit states, crack widths in prestressed members.

8 Hrs

Self-Learning Exercise: *Principles of dimensioning prestressed concrete members*

Unit-VI

Design of prestressed concrete sections

Design of sections for flexure, design of sections for axial tension, design of sections for compression and bending, design of prestressed sections for shear and torsion.

8 Hrs

Self-Learning Exercise: *Design of prestressed members for bond, design of prestressed members for bearing*

Text Book

1. N. Krishna Raju, **"Pre-stressed Concrete"**, Tata mc. Graw Hill Publishers.-4th edition.-2015

Reference Books

1. T.Y. Lin and Ned H. Burns, **"Design of pre-stressed concrete structures"**, John Wiley & Sons, NewYork.–3rd edition, 1981.
2. N.C. Sinha and S.K. Roy, **"Fundamental of pre-stressed concrete"**, S.Chand, 1994.
3. **IS -1343:2012**, Prestressed Concrete – code of practice.
4. N. Rajgopalan, **"Pre-stressed Concrete"**, Narosa Publishing House, 2008.
5. P. Dayarathnam, **"Pre-stressed Concrete"**, Oxford and IBH Publishing Co. 1996.

DESIGN AND DRAWING OF BRIDGES (1:0:2)

Sub Code: CV0210 **CIE: 50% Marks**

Hrs/Week: 1+0+2 **SEE: 50% Marks**

SEE Hrs: 03 Hrs **Max. Marks: 100**

Course Outcomes

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

1. Design basic types of bridges and prepare their drawings

Unit – I

a) Investigation to Bridges

Need for investigations, Selection of bridge site, Preliminary data to be collected, Determination of design discharge, Linear waterway, Economical span, Afflux, Scour depth, Vertical clearance above HFL, Choice of bridge type.

b) Standard Specifications for Road Bridges

General – Indian Road Congress Bridges Code – Width of Carriage way clearances – Loads to be considered: Dead loads, IRC Standard live loads –Application of live loads on deck slab

c) Design Principles of Bridge Sub-Structures

General – features, piers and abutments – materials, types, forces, design of piers.

12 Hrs

Self-Learning Exercise: Concept of moment envelopes for design of bridges

Unit – II

Design of Bridges

a) Reinforced cement concrete slab culvert
b) Reinforced cement concrete T-beam and slab bridge
c) Composite bridge (Steel-Concrete)

30 Hrs

Self-Learning Exercise: Principle of design of PSC bridges

Drawing Component

Preparation of drawings using the data given for

a) Reinforced cement concrete slab culvert

b) Reinforced cement concrete T-beam and slab bridge

c) Composite bridge (Steel-Concrete)

Text Book

1. N.Krishna Raju, **"Design of Bridges",**Oxford & IBH Publishing Ltd., 4th Edition, 2009.

Reference Book

1. S. Ponnuswamy,**"Bridges Engineering",**Tata McGrawHill, 2nd Edition, 2007.
2. D. Johnson Victor, **"Essentials of Bridge Engineering"**, Oxford & IBH Publishing Company Pvt. Ltd., New Delhi , 6th Edition, 2007.
3. T.R.Jagadeesh, and M.A.Jayaram, **"Design of Bridge Structures",** PHI Learning Private Limited, New Delhi, 2nd Edition, 2016.

Note: Design classes have to be conducted during 2 hr drawing classes

- Hence 6-8 drawing classes will be utilized for Design purpose only
- Other 6-8 classes are for drawings
- Drawings have to be evaluated after every submission –CIE for 25 marks
- MSE of Drawing 25 marks
- SEE of Drawing for 100 marks scaled down to 50 marks

MAJOR PROJECT (0:0:12)

Sub Code : CV0601 **CIE : 50% Marks**

Hrs/Week : 0+0+12 **SEE : 100% Marks**

Credits: 06

Course Outcomes

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

1. Plan and work out an action plan in a team for completion of a civil engineering problem.
2. Prepare documents in team and make individual presentations.

COURSE DETAILS

The project is offered to the students in order to inculcate research attitude and develop corresponding skills. A group of maximum four students work as a team for major project. Major project could be in the form of experimental investigation, computational work, data collection and its analysis etc. At the end of the major project, a report will be made wherein the details of the work undertaken, methodology adopted, conclusions drawn are provided. Evaluation of the major project is done as per the rubrics.

Elective-IV

ADVANCED R.C.C. STRUCTURES (3:0:0)

Sub Code : CV0314 **CIE : 50% Marks**

Hrs/Week : 3+0+0 **SEE : 50% Marks**

SEE Hrs : 03 Hrs **Max. Marks : 100**

Course Outcomes

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

1. Identify the failure mechanism of slabs under various conditions and analyze the same.
2. Design the various types of slabs.
3. Design shear wall.
4. Analyze the behavior of multistoried buildings under gravity and lateral loads.

Unit – I

Yield line Analysis of Slabs by Virtual Work Method

Introduction, assumption, locations of yield lines, method of analysis. Analysis of one-way slab, Analysis of two-way slabs (square and rectangular slabs) **5 Hrs**

Self-Learning Exercise: *Analysis of non-rectangular slabs*

Unit – II

Yield line Analysis of Slabs by Equilibrium Method.

Introduction, Method of analysis. Analysis of one-way slab, Analysis of two-way slabs (square and rectangular slabs) **5 Hrs**

Self-Learning Exercise: *Analysis of non-rectangular slabs*

Unit – III

Design of Grid Floors, Ribbed and Waffle Slabs

General features, proportioning of components, Analysis of grid floors, Design of grid floors, Design of ribbed slabs **10 Hrs**

Self-Learning Exercise: *Design of waffle slabs.*

Unit – IV

Design of Flat Slabs (With & Without Drops) by Direct Design Method

Introduction, Advantages and disadvantages, Column and middle strips, Proportioning of flat slab elements, Limitations of direct design method, Distribution of moments, Design for shear and moments, Design of interior panel, Design of exterior panel **10 Hrs**

Self-Learning Exercise: *Flat slab with column head.*

Unit – V

Design of Shear Walls

Introduction, classification of Shear walls, Loads in Shear Walls, Design considerations, Design of rectangular walls. **8 Hrs**

Self-Learning Exercise: *Flanged Shear Walls.*

Unit –VI

Multi-storey Buildings

Introduction to structural systems, tall buildings. **4 Hrs**

Self-Learning Exercise: *Gravity loads, lateral loads.*

Text Book

1. H. J. Shah, "**Reinforced Concrete Vol. -1 and Vol. -2",** Charotar Publication, 8th Edition, 2009 and 6th Edition, 2012.

Reference Books

1. S. UnnikrishnaPillai and DevdasMenon, **"Reinforced Concrete Design"**, TMH, 3rd Edition, 2009.
2. **IS 456:2000, SP16:1980, SP34:1987**.
3. B.C. **Punmia**, Ashok Kumar Jain, Arun Kumar Jain, **" Limit State design of Reinforced Concrete"**, Lakshmi Publications, 1st edition, 2007.
4. P.C.Varghese, **"Limit State Design of Reinforced Concrete"**, PHI, 2nd Edition, 2009.
5. J.N. Bandyopadhyay, **"Design of Concrete Structures"**, PHI, 1st Edition, 2008.
6. M. L. Gambhir, **"Design of Reinforced Concrete Structures"**, PHI,1st Edition, 2006.
7. Ram Chandra and VirendraGehlot, **"Elements of Limit State Design of Concrete Structures"**, Scientific Publishers, 1st Edition, 2004.
8. N.KrishnaRaju and R.N.Pranesh, **"Advanced Reinforced** ", CBS Publishers, 2nd Edition,
9. S.N.Sinha, "**Reinforced Concrete Design"**, TMC, 2nd Edition, 2002
10. Ashok. K. Jain : **"Reinforced Concrete Limit State Design", Nem Chand and Bros , 6th Edition, 2010**
11. Mark Fintel, "**Hand Book of Concrete Engineering",** 2ndedition, CBS publications, 2004.
12. Taranath, **"Reinforced ancient design of Tall Buildings"**, CRC press, 2010.

ENVIRONMENTAL SANITATION (3:0:0)

Sub Code : CV0333 **CIE:50% Marks**

Hrs/Week : 3+0+0 **SEE : 50% Marks**

SEE Hrs : 03 Hrs **Max. Marks: 100**

Course Outcomes

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

1. Identify the pollution in the environment and ability to explain its impact on human beings and society.
2. Manage solid waste generated in a town and ability for safe treatment and disposal.
3. Plan acoustically sound buildings.
4. Plan and manage sanitation in public buildings, swimming pools and rural areas.

Unit -I

Quality Factors for Environmental Protection

Quality Factors, Occupational Hazards, industrial poisons, threshold limit values, dust, noise, heat, light, radiation, compressed air, repeated motion,

Communicable Diseases

Terminology, classification, methods of communication, and general methods of control, vector control: Host-Vector Relationship, mechanism of transmission, Malaria and Filariasis management, Rodents and their control measures.

8 Hrs

Self-Learning Exercise: *Vibration, pressure & shock as a hazard.& Guinea Worm Disease and eradication.*

Unit -II

Refuse Collection and Disposal

Garbage, ash, rubbish, collection methods, transportation, disposal–salvaging, dumping, controlled tipping, incineration and composting.

8 Hrs

Self-Learning Exercise: *Disposal of hazarding waste*

Unit -III

Milk and Food Sanitation

Essentials, testing and sanitation measures, food protection from source to use, sanitizing food processing equipment, tests and inspection for food protection, cattle borne diseases, planning, dung disposal –biogas plant.

6 Hrs

Self-Learning Exercise: *Planning for a cow shed*

Unit -IV

Ventilators and Air conditioners Comfort standards of ventilation, physiological effects of heat, ventilation methods, natural and artificial ventilation, air-conditioning, insulation of buildings.

4 Hrs

Self-Learning Exercise: *Heating appliances and carbon monoxide.*

Unit -V

Noise Pollution and Mitigation

Noise and its effects – measurement of noise-transmission of noise-sound insulation - transmission loss -acceptable noise levels, Methods of sound insulation – materials used for sound insulation, conditions for good acoustics, methods of acoustical improvement for existing structures, acoustical design of an auditorium.

6 Hrs

Self-Learning Exercise: *Defects in an auditorium and their remedies.*

Unit -VI

Institutional Sanitation

School and College, Health Centre and Hospital, Sanitation in Markets, Shopping Areas and Bus Stand, Fair and Festival Sanitation,

Rural Sanitation

Soak pit, two pit latrine, Septic tank, public latrine, concept of Eco- sanitation, and DEWATS.

10 Hrs

Self-Learning Exercise: *Swimming Pool Sanitation.*

Text Book

1. E.W.Steel, **"Environmental Sanitation"**, McGraw-Hill Publications, New York, 2010.

Reference Books

1. Chanlett, **E.T. Environment Protection**. McGraw-Hill Publications, New York, 1997.
2. Joseph A Salvato, **"Environmental Sanitation",** John Willey Publishers, New York, 2009.

STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING (3:0:0)

Sub Code : CV0334 **CIE : 50% Marks**

Hrs/Week : 3+0+0 **SEE : 50% Marks**

SEE Hrs : 03 Hrs **Max. Marks : 100**

Course Outcomes

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

1. Apply the concepts of structural dynamics
2. Analyze simple vibration problems including dynamic loads
3. Apply the concepts of earthquake engineering
4. Design earthquake resistant structures

Unit - I

Introduction to Structural Dynamics: Basic Concepts, single degree of freedom system, un-damped and damped free vibrations of Single Degree of Freedom System, logarithmic decrement.

7 Hrs

Self-Learning Exercise: *Experimental determination of inherent damping*

Unit - II

Forced vibration of single degree of freedom systems, Response of un-damped and damped systems under harmonic loading, Rotation unbalance, reciprocating unbalance.

7 Hrs

Self-Learning Exercise: *Coulomb damping*

Unit - III

Duhamel's Integral, response due to general system of loading , dynamic load factor, response spectrum, response of single degree of freedom system to harmonic base excitation, vibration isolation.

7 Hrs

Self-Learning Exercise: Duhamel's Integral for rectangular pulse loading.

Unit – IV

Introduction to Earthquake Engineering: Causes of Earthquakes – Natural and their occurrence, their effects, damage. Measurement of Earthquakes, strong ground motion, Seismic zoning, Structural response to Earthquake, Seismic design principles.

7 Hrs

Self-Learning Exercise: *Geological concepts for earthquakes.*

Unit – V

Introduction to Earthquake resistant Design : Conceptual aspects– Functional planning, Continuous load path, overall form, simplicity and symmetry , Elongated shapes, Stiffness and strength, Horizontal and vertical members, Twisting of buildings, Ductility aspects, Flexible building, Framing systems, effect of Non Structural elements, Choice of construction materials.

7 Hrs

Self-Learning Exercise: *Concept of ductile detailing.*

Unit – VI

Earthquake resistant design - Seismic Design requirements, Basic assumptions, Seismic Methods of Analysis, Factors in Seismic analysis, Equivalent lateral force method for Analysis – examples. As per 1893 - 2002.

7 Hrs

Self-Learning Exercise: *Time history analysis for seismic effects.*

Text Books

1. Madhujit Mukhopadhyay, **"Vibrations, Dynamics and Structural Systems",** Oxford and IBH, 2000.
2. S.K.Duggal, **"Earthquake Resistant Design of Structures"**, Oxford University Press, 2007

Reference Books

1. Mario Paz **"Structural Dynamics"**, CBS Publications, 2000
2. Pankaj Agarwal, Manish Shrikande, **"Earthquake Resistant Design of structures"**, PHI India , 2007
3. **IS4326, IS13920, IS1893.**

EARTH AND EARTH RETAINING STRUCTURES (3:0:0)

Sub code : CV0339 **CIE : 50% Marks**

Hrs/weeks : 3+0+0 **SEE : 50% Marks**

SEE Hrs : 3 Hrs **Max. Marks : 100**

Course Outcomes

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

1. Design and analyze earthen dams
2. Design and analyze safety of Coffer dams and bulk heads
3. Design Bracing and Rockwell dams

Unit-I

Introduction to Earth retaining structures

Introduction about earthen dam and embankments - different types of earthen dam with sketches and their suitability. Types of failure of earthen dam –

3 Hrs

Self-learning Exercises: *Causes of failure of earthen dam*

Unit -II

Design of earthen Dams

Design criteria of earth dam –stability analysis of earthen dams-seepage control in earthen dams. Role of filter in earthen dam design.

7 Hrs

Self-learning Exercises: *Hydraulic filled and rolled fill method of construction-*

Unit-III

Coffer dams

Introduction – Types of coffer dams – design of cellular coffer dams on rock by Tennesse Valley Authority (TVA) Method –safety against sliding, slipping, overturning, vertical shear stability against bursting-design of cellular dams in soil.

10 Hrs

Self-learning Exercises: *Design of cellular dams in soil.*

Unit-IV

Bulk Heads

Cantilever sheet pile wall: Introduction – Types of sheet pile walls – Free cantilever sheet pile – cantilever sheet pile in cohesion-less soil- cantilever sheet pile penetrating in clay.Anchored sheet pile walls: Anchored sheet pile with free earth support in cohesionless soil, Anchored bulk heads with fixed earth support method- Types, Location and Design of anchors.

10 Hrs

Self-learning Exercises:*-Anchored sheet pile with free earth support in cohesive soil.*

Unit-V

Braced Cuts

Introduction, Lateral earth pressure on sheeting. Different types of sheeting and bracing system – design of various components of bracing.

6 Hrs

Self-learning Exercises: *Failures in bracing system.*

Unit-VI

Rock filled dams

Introduction, origin and usage of rock filled dams, types of rock filled dams and design of rock fill dams and construction of rock filled dams.

6 Hrs

Self-learning Exercises: *Failures of rock filled dams.*

Text Book

1. Arora, **"Soil mechanics and foundation Engineering"**, Standard Publishes and Distributors- 2009

References Books

1. B.C. Punmia, **"Soil mechanics and foundation Engineering"**,Lakshmi Publications Ltd, 2004.
2. B.L. Lasmalkar, **"Foundation Engineering"**, Pune VidyarthigrihaPrakashana, 2004.
3. A.V. Narisimha Rao & C. Venkataramaiah, **"Numerical in Geotechnical Engineering"**, University Press, 2000.
4. C.Venkataramaiah, **"Geotechnical Engineering"**, New Age Publication, 2009.
5. Purushotam Raj, **"Geotechnical Engineering"**, McGraw-Hill Education, 1995.

WATER RESOURCES ENGINEERING AND MANAGEMENT (3:0:0)

Sub Code: CV0338 **CIE : 50% Marks**

Hrs/Week : 3+0+0 **SEE : 50% Marks**

SEE Hrs : 03 Hrs **Max. Marks : 100**

Course Outcomes

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

1. Discuss the need for water resources development, and its benefits and ill-effects.
2. Estimate demand and provide solutions through planning.
3. Carry out preliminary hydrological design for a Water Resources project.
4. Carry out a basic Economic Analysis of a Water Resources project.

Unit-I
Introduction
Rainfall in India, Karnataka in particular - seasons and quantities; need for development of water resources. Surface and groundwater resources - basins, potentials; projects – classification, water resources development in India - present and future scenario.

6 Hrs

Self-Learning Exercise: *Basin-wise water potential of India*

Unit-II
Water Resources Planning
Demands for various uses - Industrial, Irrigation, and Hydropower, Water supply - rural and urban. Demand patterns. Benefits and ill effects; Multi-purposes projects – project formulation, resource allocation.

8 Hrs

Self-Learning Exercise: *Project classification, large v/s small projects*

Unit-III
Hydrological design
Catchment, water availability, estimation of yield - CN method; rainfall patters and regional models, Concepts of dependability; Environmental flows, D/s requirements; divertible yields in storage and diversion projects. Ground water potential and estimation of available yield.

6 Hrs

Self-Learning Exercise: *Flow duration curves and their use.*

Unit-IV
Design Flood
Probability and flood estimation, structures, – estimation of design flood. Concepts of frequency analysis – frequency, probability and return periods, Gumbel distribution for flood estimation; CWC hand books – UHG method.

6 Hrs

Self-Learning Exercise: *Rational Formula*

Unit-V

Water Rights

Water laws , water rights and policies. Interstate disputes – Indus and Ganga disputes; Interstate disputes – Cauveri and Krishna. Interlinking of rivers, India Water grid – the Himalayan and Peninsular components. Sustainable development, social repercussion – inclusive planning, micro projects -Rain Water harvesting; basin wise planning- issues & concerns.

8 Hrs

Self-Learning Exercise: *Mahadayi river dispute*

Unit-VI

Water Resources Economics

Basics of engineering economics: discount rates, amortization, sunk costs, planning horizons (economic-physical life, period of analysis, design period); demand and supply, aggregate demand curves; Methods of finance; Cost composition; benefit cost parameters; Determination of benefits; Selection of an alternative.

8 Hrs

Self-Learning Exercise: *Cost benefit scenario of a major water resources project*

Text Books

1. Linsley R.K and Franzine J.B, **"water Resources Engineering"**, McGraw Hill Book Co., 1972
2. Subramanya, K., **"Engineering Hydrology"**, Tata McGraw Hill, 2014.

Reference Books

1. Garg S.K, "**Hydrology & Water Resources Engineering"**, Khanna Publishers, 2010.
2. Bhave P, "**Water Resources Systems"**, Narosa Publications, 2011.
3. James D and Leo T, **"Economics of Water Resources Planning"** , Tata McGraw Hill, 2005.
4. Rao, K.L., **"Water Wealth of India"**, Orient Longman, 1979.
5. Putty, M.R.Y., **"Principles of Hydrology"**, IK International Pub., 2013.

AIRPORT ENGINEERING (3:0:0)

Sub. Code: CV0344 **CIE : 50% Marks**

Hrs/Week: 3+0+0 **SEE : 50% Marks**

SEE Hrs: 03 Hrs **Max. Marks: 100**

Course Outcomes:

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

1. Explain the impact of civil aviation, process of airport planning.
2. Describe national and international regulations on airport planning & design including geometric components of an airport.
3. Explain design of structural components of pavements and need of construction management& maintenance in airport engineering.

Unit- I

Introduction

History of aviation, Impact of civil aviation on society, Need for travel, Airport engineer's moral responsibilities, and Infrastructure development plan**:** National airport development plan, Regional airport development plan**,** State airport development plan**,** Traffic projection**,** Need for airport master plan .

7 Hrs

Self-Learning Exercise: *Recent developments of airports in India*

Unit- II

International regulations and economics of airport development

International regulations as per ICAO**,** National regulations as per DGCA**,** Airport development funds**,** Airport operation and maintenance funds.

7 Hrs

Self-Learning Exercise**:** *ICAO's safety initiatives*

Unit- III

Airport planning

Airport master plan, Airport components, Techno economic analysis, Possible phases of development, Site selection and investigations (including meteorological data).

7 Hrs

Self-Learning Exercise: *Air traffic control and management*

Unit- IV: Airport Design

Detailed site investigations, Geometric design (locations, types and numbers): Runways, Taxiways, Aprons, Separation distance.

7 Hrs

Self-Learning Exercise: *Airport cargo terminal building and aircraft maintenance hangars*

Unit- V: Structural design of pavements

Flexible and rigid, Drainage system, Utilities (power, water, sewage), Land side development (access roads, car parking), Visual aids.

7 Hrs

Self-Learning Exercise: *Airport pavement rehabilitation programmes*

Unit- VI

Construction management

Need for quality control, Project planning, Project management, Quality control and assurance, Airport operational issues and maintenance.

7 Hrs

Self-Learning Exercise: *Contract document preparation*

Text Books:

1. Horonjeff, "Planning & Design of Airport", McGraw Hill Publications New Delhi, 5th Edition.
2. S C Saxena, "Airport Engineering: Planning and Design", CBS Publishers, 2010.
3. Ashford, N. and Wright, P. H., "Airport Engineering", John Wiley & Sons, NY.,

Reference Books:

1. Annex 14, Volume I "Aerodrome Design and Operations", ICAO
2. Technical manuals related to Annex 14, ICAO
3. DGCA Civil Aviation Regulations – Section IV – Aerodrome Standards and Licensing

Elective-V

CONSTRUCTION SURVEYING (1:2:0)

Sub Code : CV0211	**CIE : 50% Marks**
Hrs/week : 1+2+0	**SEE : 50% Marks**
SEE Hrs : 2 Hrs	**Max. Marks: 50**

Course Outcomes

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

1. Describe and follow the procedures required for setting out works
2. Apply horizontal and vertical control techniques for setting out operations

Unit - I

Introduction

Construction surveying, role of surveying in civil engineering practice, typical responsibilities of a construction surveyor, skills required, Reading maps and drawings, Equipments for construction surveying; Levels, theodolite, total station, GPS, Laser levels

Horizontal control and vertical control, reference grids, base line, offsets, marking control stations, reference pillars, marking corners and lines.

4 Hrs

Self-Learning Exercise: *Use of laser level in construction*

Unit-II

Setting out works

Setting out buildings and structures, conventional and coordinate methods, measurement and setting out slopes and grades, pipe lines, controlling and checking verticality in tall structures.

6 Hrs

Self-Learning Exercise: *Care and adjustment/calibration of survey equipments, safety aspects*

Unit -III

Route and Tunnel surveys

Route surveys, alignments, procuring GTS bench marks/establishing DGPS control points. traversing and other surveys.

Tunnels, Surface and underground alignments, transferring surface alignment through vertical shafts, transferring levels, use of laser instruments and laser/total station guided tunnel boring machines.

4 Hrs

Self-Learning Exercise: *Documentation; project documents/drawings, certificates, survey records, photographs*

Text Book

1. A.M. Chandra. **"Higher Surveying"** New Age International Publishers, 2007.

Reference Books

1. James M Anderson, Edward M Mikhail. **" Introduction to Surveying"**, McGraw Hill Publications, 1984.
2. S.K. Roy, ***"Fundamentals of Surveying***", Prentice Hall of India New Delhi, 2009.