

Savitribai Phule Pune University



Board of Studies in Civil Engineering

Structure and Syllabus for B.E. Civil 2012 Course (w.e.f. June, 2015)



Savitribai Phule Pune University

Board of Studies in Civil Engineering

Structure for B.E. Civil 2012 Course (w.e.f. June 2015)

Subject code	Subject	Semester – I							
		Teaching Scheme Hrs/Week			Examination Scheme				
		Lect	Tu	Pr	In-Semester Assessment	TW	Or	End - Semester Exam	Total
401 001	Environmental Engineering II	3		2	30	--	50	70	150
401 002	Transportation Engineering	3		2	30	50	--	70	150
401 003	Structural Design and Drawing III	4		2	30	--	50	70	150
401 004	Elective I	3		2	30	50		70	150
401 005	Elective II	3			30			70	100
401 006	Project Phase I	--	2			50			50
	Total →	16	2	8	150	150	100	350	750

Subject code	Subject	Semester – II							
		Teaching Scheme Hrs/Week			Examination Scheme				
		Lect	Tu	Pr	In-Semester Assessment	TW	Or	End - Semester Exam	Total
401 007	Dams and Hydraulic Structures	3	--	2	30	---	50	70	150
401 008	Quantity Surveying, Contracts and Tenders	3	--	2	30	--	50	70	150
401 009	Elective III	3	--	2	30	50	--	70	150
401 010	Elective IV	3	--	2	30	50	--	70	150
401 006	Project	--	6		--	50	100	--	150
	Total →	12	6	8	120	150	200	280	750

Following will be the list of electives..

Semester I

Elective-I 401 004 1. Structural Design of Bridges 2. Systems Approach in Civil Engineering 3.. Advanced Concrete Technology 4. Architecture and Town Planning 5. Advanced Engineering Geology with Rock Mechanics	Elective-II 401 005 1. Matrix Methods of Structural Analysis 2. Integrated Water Resources and Planning 3. TQM & MIS in Civil Engineering 4. Earthquake Engineering 5. Advanced Geotechnical Engineering
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Semester II

Elective-III 401 009 1. Advanced Structural Design 2. Advanced Foundation Engineering 3. Hydropower Engineering 4. Air Pollution and control 5. Finite Element Method in Civil Engineering	Elective-IV 401 010 1 Construction Management 2. Advanced Transportation Engineering 3. Statistical Analysis and Computational Methods in Civil Engineering 4. Open Elective a). Plumbing Engineering b) Green Building Technology c) Ferrocement Technology d) Sub sea Engineering e) Wave Mechanics
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I Semester
401 001 Environmental Engineering – II

Teaching Scheme: Lectures: 3 Hrs / week
Practical: 2 Hrs/week

Examination Scheme:
Paper In-sem. 30 Marks (1 hr),
Paper End-sem : 70 Marks (2.5 hr)
Oral : 50 Marks

Unit I **(6Hrs)**

Sewage quantity: Collection and conveyance of sewage, sources of sewage, variations in sewage flow, Flow quantity estimation, Design of circular sanitary sewers. Pumping of sewage, necessity, location. Effect of change of life style on sewage quality.

Characteristics of sewage: Physical, chemical and biological characteristics, effluent discharge standards as per CPCB norms, interpretation and practical significance of test results.

Stream sanitation: Self purification of natural streams, river classification as per MoEF & CC,

Govt. of India; Oxygen Sag Curve, Streeter - Phelps equation and terminology (without derivation and numerical).

Unit II **(6Hrs)**

Sewage treatment: Introduction to sewage treatment, preliminary, primary, secondary and tertiary treatment, Process flow diagram for sewage treatment, Theory and design of screen chamber, Grit Chamber and Primary sedimentation tank as per the Manual of CPHEEO.

Unit III **(6Hrs)**

Theory & design of secondary treatment units: Introduction to unit operations and processes for secondary treatment. Principles of biological treatments, important microorganisms in waste water & their importance in waste water treatment systems, bacterial growth, general growth pattern, growth in terms of bacterial numbers and bacterial mass. Kinetics of biological growth, cell growth, substrate limited growth, cell growth and substrate utilization, effect of endogenous metabolism.

Activated sludge process: Theory and design of ASP, sludge volume index, sludge bulking & control, modifications in ASP.

Trickling filter: Biological principle, different T.F media & their characteristics, design of standard rate and high rate filters using NRC formula, single stage & two stage filters, recirculation, ventilation, operational problems, control measures, theory of rotating biological contractors.

Unit IV **(6Hrs)**

Low cost treatment methods:

Oxidation pond: Bacteria – algae symbiosis, design of oxidation pond as per the manual of CPHEEO, advantages & disadvantages of oxidation ponds.

Aerated lagoons: Principle, aeration method, advantages & disadvantages of aerated Lagoons, design of aerated lagoon.
Introduction and theory of Phytoremediation technology for wastewater treatment.
Introduction and theory of root zone cleaning system

Unit V

(6Hrs)

Onsite Sanitation and Introduction to Package Sewage Treatment Plant: Working principle, advantages and disadvantages

Anaerobic digester: Principle of anaerobic digestion, stages of digestion, bio – gas production its characteristics & application, factors governing anaerobic digestion,. Dewatering of sludge by gravity thickener, sludge drying bed, decanters. Methods of sludge treatment and disposal, advantages & disadvantages. Up-flow Anaerobic Sludge Blanket (UASB) Reactor– Principle, advantages & disadvantages.

Unit VI

(6 Hrs)

Industrial waste water treatment: Methods of sampling. Equalization and neutralization. Application of preliminary, primary and secondary treatment for industrial wastewater as per the CPCB norms.

Sources of waste water generation from manufacturing process, characteristics of effluent, different methods of treatment & disposal of effluent for the following industries: Sugar, dairy and distillery. Discharge standards as per CPCB norms.

Term Work

A. Compulsory Assignment

1. Brief report on Sewer materials, choice of materials, testing of sewer pipes, sewer appurtenances.
2. Design of septic tank

B. Experiments

The term work shall consist of a journal giving details of at least 8 out of 12 of the following experiments conducted in Environmental Engineering laboratory, of which, **Sr.No.12 is compulsory.**

1. Solids -Total solids, suspended solids, volatile solids, settleable solids & non settleable solids.
2. Sludge Volume Index.
3. Dissolved oxygen.
4. Bio-Chemical Oxygen Demand.
5. Chemical Oxygen Demand.
6. Electrical Conductivity.
7. Determination of Phosphates by spectrophotometer.
8. Determination of Nitrates by spectrophotometer.
9. Determination of heavy metals like Cr⁶⁺ or Zn or Ni or Cd.
10. Determination of total nitrogen by kjeldal method
11. Visit to domestic / Industrial wastewater treatment plant & its detailed reports.

12. Computer aided design of Sewage Treatment Plant (STP) OR Effluent Treatment Plant (ETP) of Sugar or Dairy Industry using suitable software (C programming or any other suitable software).

Note: - Term Work should include a detailed analysis of practical interpretation, significance and application of test results.

Text Books

1. Environmental studies by Rajgopalan- Oxford University Press.
2. Waste Water Treatment & Disposal – Metcalf & Eddy - TMH publication.
3. Environmental Engg. - Peavy, Rowe - McGraw Hill Publication.
4. Waste Water Treatment – Rao & Dutta.

Reference Books

5. Waste Water Engg. – B.C. Punmia & Ashok Jain - Arihant Publications.
6. Water Supply & Waste Water Engg.- B.S.N. Raju – TMH publication.
7. Sewage Disposal & Air Pollution Engg. – S. K. Garg – Khanna Publication.
8. Environmental Engg. – Davis - McGraw Hill Publication
9. Manual on sewerage and sewage treatment – Public Health Dept., Govt. of India.
10. Standard Methods by APHA.

I.S. Codes

I.S. 3025 (all parts)

e - Resources

- i) <http://nptel.iitm.ac.in/courses-contents/IIT Kanpur and IIT Madras>.
- ii) <http://cpcb.nic.in>
- iii) <http://moef.nic.in>

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401 002 Transportation Engineering

Teaching scheme

Lectures: 3 hours/week

Practical: 2 hrs

Examination scheme

In semester exam: 30 marks---1 hour

End semester exam: 70 marks—2.5 hours

Term Work: 50 marks

Highway Engineering

Unit I

(6

hrs)

Introduction:

Role of transportation, scope of road transportation, highway development in India, necessity of highway planning and development plans e.g. Bombay plan, Lucknow plan.

Classification of road:

Classification of roads, road patterns, planning surveys and preparation of master plan based on saturation system, determination of road length by 3rd road development plan.

Traffic engineering:

Traffic characteristics-road user characteristics, vehicular characteristics (only name and significance) Traffic studies –name of various studies and their uses, accident studies-objectives, causes of accident, condition and collision diagram, and measures for the reduction in accidents. Traffic regulation and control devices-traffic signs, traffic signals (types merits and demerits) road markings. Traffic islands, types of road intersections (sketch merits and demerits). Parking facilities.

Unit II

(6

hrs)

Highway alignment:

Basic requirements of an ideal alignment and factors controlling it, engineering survey for highway location, special requirements for hill roads,

Geometric design and traffic engineering:

Design controls and criteria for geometric design, cross sectional elements, sight distance requirements, stopping distance, overtaking sight distance, overtaking zones with IRC recommendations, attainment of super elevation, radius of curves, methods of introduction of extra widening, widening of pavement on horizontal curves, horizontal transition curves-objects, necessity, types of transition curves, length and shift of transition curves. Design of vertical alignment, gradient and its type, IRC recommendations, grade compensation on horizontal curve, vertical curves: - crest and sag curves, types of summit curves, length of summit curve for SSD and OSD. Requirements, types of valley curves, length of valley curve for comfort and head light sight distance criteria.

Highway drainage:

Importance of highway drainage, subsurface and surface drainage systems, scope of arboriculture for highway.

Unit III

(6

hrs)

Highway materials:

Importance and properties of sub-grade, pavement component materials. Tests on aggregates. Bitumen: Types--cut back, tar, emulsion and tests, modified binders, bitumen mix design by Marshall Stability test, viscosity based gradation of bitumen

Pavement design:

Objects and requirements, types of pavements structures, functions of pavement components factors affecting pavement design, Design of flexible pavement by C.B.R. Method, IRC 37- guidelines design of rigid pavements, factors affecting design & analysis of stress- wheel load stress & temp. Stress, critical combination of stress, IRC 58- design guidelines, types of joints, requirements of joints.

Construction:

Construction process of WBM, WMM, GSB (Mix design). Introduction to bituminous works such as prime coat, tack coat, seal coat, MPM, AC or BC, BM, DBM and premix carpet.

**Section II Airport Engineering:
Unit IV**

(6

hrs)

Introduction:

Advantages and limitations of air transportation. Aeroplane component parts and important technical terms.

Airport planning:

Aircraft characteristics, which influence judicious and scientific planning of airports, Selection of sites, survey and drawings to be prepared for airport planning.

Airport layout:

Characteristics of good layout, runway configuration, airport obstruction, location of terminal buildings, aprons and hangers. Zoning requirements regarding permissible heights of constructions and landing within the airport boundary.

Runways and taxiways:

Runway orientation, wind coverage, use of wind rose diagram, basic runway length, corrections for elevation, temperature and gradient as per ICAO and FAA recommendation. Airport classification by ICAO.

Unit V

(6

hrs)

Bridge engineering:

Introduction:

Classification of bridges, components of bridges, preliminary data to be collected during investigation of site for bridges, determination of discharge – empirical formula, direct methods, economical span, afflux, HFL, scour depth and clearance, locations of piers and abutments, factors influencing the choice of bridge super structure, approach roads.

Loads on bridges:

Brief specifications of different loads, forces, stresses coming on bridges, IRC load specification, requirements of traffic in the design of highway bridges

Substructure:

Abutment, Piers, and wing walls with their types based on requirement and suitability.

Types of bridges**Various types of bridges:**

- a. Culvert: Definition, waterway of culvert and types.
- b. Temporary bridges: Definition, materials used brief general ideas about timber, floating and pantoon bridges.
- c. Movable Bridges: Bascule, cut boat, flying, swing, lift, transporter and transverse bridges, their requirement and suitability.
- d. Fixed span bridges:
Simple, continuous, cantilever, arch, suspension, bowstring girder type and rigid frame and cable stayed bridges, materials for super structure.

Bearing:

Definition, purpose and importance. Types of bearings with their suitability.

Erection of bridge super structure and maintenance:

Introduction to different techniques of erection of bridge super structure and maintenance of bridges.

Term work:

Term work shall consist of the following:

A. Practicals:**I. Tests on Aggregate (Any Six) :**

1. Aggregate Impact Value Test
2. Aggregate Crushing Strength Test
3. Los Angeles Abrasion Test
4. Shape Test (Flakiness Index and Elongation Index)
5. Specific Gravity and Water Absorption Test by basket method
6. Stripping Value Test
7. Soundness Test

II. Tests on Bitumen (Any Five + No. 8 compulsory):

1. Penetration Test
2. Ductility Test
3. Viscosity Test
4. Softening Point Test
5. Flash Point & Fire Point Test
6. Specific Gravity Test
7. Bitumen Extraction Test
8. Marshall Stability Test

B. Technical visits to 1) Bridge site/Airport and 2) Hot mix Plant with detailed report

Text Books

1. Principles of Highway Engineering and Traffic Analysis (4th edition)
- F. L. Mannering, Scott S. Washburn, Wiley India
2. Highway engineering – S.K. Khanna and C.E.G. Justo, Nem Chand and Brothers, Roorkee
3. Principles and practices of Highway engineering –Dr. L.R. Kadiyali, Khanna Publishers Delhi.

- 4 .Essentials of Bridge Engineering – D. Johnson and Victor, Oxford and IBH publishing Co. Pvt. Ltd. , New Delhi.
- 5.Bridge engineering – S. Ponnuswamy, Tata Mc Graw – Hill publishing co. Ltd. New Delhi.
- 6.Airport planning and design – S.K. Khanna , M.G. Arora , S.S. Jain, Nem Chand and Brothers, Roorkee.
- 7.Airport Engineering - Rangawala, Charotar publishing House, Anand 388001 (Gujrat)

Reference Books:

1. A Course in Highway Engineering – S.P. Bindra, Dhanpat Rai and Sons, Delhi.
Principles of Transportation Engineering – G.V. Rao Tata MacGraw Hill Publication
2. Highway Engineering – Rangawala, Charotar publishing House, Anand 388001 (Gujrat)
3. Principles of Transportation Engineering – Partha Chakraborty ,Animesh Das, Prentice Hall of India Pvt. Ltd., New Delhi.
4. Highway and Bridge Engineering – B.L. Gupta, Amit Gupta Standard publishers Distributors, Delhi. 8) Principles and practice of Bridge Engineering – S.P. Bindra, Dhanpatrai and Sons, Delhi.
5. Bridge engineering – Rangawala, Charotar Publishing House, Anand –388 001.

Codes:

1. I.S. 1201 TO 1220-1978, IS 73, IS 2386 PART I toV
2. I.R.C. 58, IRC37
3. Specifications for Road and Bridge works (MORTH)-IRC, New Delhi.

Hand Books:

1. Handbook of Road Technology_Lay M.G., Gorden Breach Science Pub.Newyork
2. Civil Engineering Handbook-Khanna S.K.

e – Resources:

1. www.nptel.iitm.ac.in/courses/iitkanpur
2. www.cdeep.iitb.ac.in/nptel

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401 003 Structural Design III

Teaching Scheme:

Lectures: 4 Hrs / week
Practical: 2 Hrs/week

Examination Scheme:

In sem :30 + End sem : 70Marks
Oral : 50 Marks
Duration : Insem : 1.5 Hr
End sem : 3 Hrs

Unit 1

Prestressed concrete - Analysis

Introduction, Basic concepts, materials-various Pretensioning and post tensioning systems, concept of losses, Stress calculations, and concept of cable profile.

Unit 2

Prestressed concrete - Design

Design of post tensioned prestressed concrete simply supported rectangular and flanged sections for flexure and shear including end block.

Design of one way and two way post tensioned slabs (Single panel only)

Unit 3

Earthquake force calculation and analysis and design of frames

Review of methods of analysis for frames subjected to gravity and lateral loads. Earthquake loads by seismic coefficient method. Estimation of combined effect of lateral forces and vertical loading on multi storeyed frames. Design any intermediate continuous beam of the frames for combined effect of loadings

Unit 4

Earth retaining structures

Introduction, Functions and types of retaining walls. Analysis and design of RCC cantilever type of retaining wall for various types of backfill conditions.

Unit 5

Combined footings

Introduction, necessity and types of combined footings, design of slab type and slab-beam type of combined footing.

Unit 6

Liquid retaining structures

Introduction, types, function, codal provisions, methods of analysis and design of circular, square, and rectangular water tanks resting on ground.

Note: Design based on above unit shall conform to latest versions of IS 456, IS 875, IS 1343, IS 3370, IS 1893, IS 13920.

Term Work

Term work shall be based on the above syllabus. It consists of

- 1) Assignment on Loss calculation unit 1
- 2) Assignment on stress calculation unit 1
- 3) Design and detailing of design of prestressed girder from Unit 2
- 4) Assignment on Earthquake force calculation from unit 3
- 5) Design and detailing of frame (beam only) from Unit 3
- 6) Design and detailing of retaining wall for any type of loading from Unit 4

- 7) Design and detailing combined footing from Unit 5
- 8) Design and detailing of ground resting water tank from Unit 6
- 9) Minimum five full imperial sheets based on four projects of RCC and one project of pre-stressed concrete.
- 10) Report on analysis of assignment on unit 3 by software or computer program**
- 11) Two site visit reports one each of R.C.C. and another P.S.C. Oral Examination: Oral based on above term work
- 12) There should separate design data for a group size of maximum four students.**

Text Books

1. Limit state theory and design of reinforced - Dr. V. L. Shah and Dr S. R. Karve - Structures Publications,Pune
2. Fundamentals of Reinforced Concrete- N.C. Sinha, S.K. Roy – S. Chand & Co. Ltd
3. Advanced design of structures- Krishnaraju - Mc Graw Hill
4. Design of Prestressed concrete structures- T. Y. Lin.
5. Prestressed Concrete- N. Krishna Raju – Tata Mc Graw Hill Publication Co.

Reference Books

6. Comprehensive RCC Design - Punmia, Jain & Jain - Laxmi Publications.
7. Design of design of reinforced Concrete structures- M. L. Gambhir -PHI
8. Reinforced Concrete, Vol I- Dr.H J. Shah Charotar Publishing House
9. Prestressed Concrete – A Fundamental Approach- Edward Nawy – PHI.
10. Reinforced concrete design- Pillai and Menon TMH

I.S. Codes

1. IS: 456: Indian Standard code of practice for plain and reinforced concrete, BIS, New Delhi.
2. IS: 1343: Indian Standard code of practice for Prestressed concrete, BIS, New Delhi.
3. IS: 1893: Indian Standard Code of practice for criteria for Earthquake resistant design of structures, BIS, New Delhi.
4. IS: 3370-Indian Standard code of practice for concrete structures for storage of liquids, BIS, New Delhi.

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401 004 Elective I: (1) Structural Design of Bridges

Teaching Scheme:

Lecture: 3 hours per week

Practical : 2 hours per week

Examination scheme:

Term work: 50 marks

In-sem. Exam.: 30 marks (1 hrs)

End Sem. Exam.: 70 marks (2.5 hrs)

Unit 1

Introduction to RC highway bridges and steel railway bridges: Types of bridges, classification, IRC codal provisions for RC highway bridges, IRS codal provisions for railway steel bridges, loading standards.

Unit 2

RC highway bridges: T-beam deck slab bridges – Deck slab: Structural configuration, Piegaud's method, analysis and design of deck slab.

Unit 3

RC highway bridges: T-beam deck slab bridges – Post tensioned girders: Load distribution on longitudinal and cross girders, methods of analysis, analysis and design of longitudinal and cross girders.

Unit 4

Railway steel bridges – Truss bridges: Structural configurations, loads and load combinations, analysis and design of truss elements, longitudinal and cross-girders, bracing systems.

Unit 5

Bearings: Function of bearings, types of bearings, design of steel bearings and elastomeric bearings.

Unit 6

Sub-structure: Function, loads, analysis and design of RC abutments and piers.

Note: The designs should conform to the latest codal provisions.

Term Work

a) One project on RC highway bridges which shall include - the design of deck slab, longitudinal girder, cross-girder, bearings and abutment and pier.

The detailing shall be shown in at least three full imperial sheets.

b) One project on railway steel bridges which shall include – the design of truss elements, longitudinal girder, cross-girder, and bearings.

The detailing shall be shown in at least two full imperial sheets.

- c) The term work can be prepared in a group of not more than four students in a group.
- d) Report of at least two site visits covering the contents of the syllabus.
- e) One of the above projects can be done using any drafting software.

Reference Books

Design of Bridges, N. Krishna Raju, Oxford and IBH Publishing Company Pvt. Ltd.

Design of Bridge Structures, M.A. JayaramPrentice-Hall Of India Pvt. Limited

Prestressed Concrete, N. Krishna Raju, Tata-McGraw Hill

Design of Steel Structures, Ramachandra, Standard Publications New-Delhi

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401 004 Elective I (2)- Systems Approach in Civil Engineering

Teaching scheme

Lectures: 3 hours/week

Practical: 2 hrs/week

Examination scheme

In semester exam: 30 marks---1 hour

End semester exam: 70 marks—2.5 hours

Term Work: 50 marks

Unit 1: Introduction of systems approach

(6 Hrs)

Introduction to System approach, Operations Research and Optimization Techniques, Use of systems approach in Civil Engineering, Methods, Introduction to Linear and Non linear programming methods (with reference to objective function, constraints), Local & Global optima, unimodal function, convex and concave function

Unit 2: Non linear programming

(6 Hrs)

Single variable unconstrained optimization: Sequential Search Techniques-Dichotomous, Fibonacci, Golden section

Multivariable optimization without constraints-The gradient vector and Hessian Matrix, Gradient techniques, steepest ascent/decent technique, Newton's Method

Multivariable optimization with equality constraints - Lagrange Multiplier Technique

Unit 3: Stochastic Programming

(6 Hrs)

Sequencing– n jobs through 2, 3 and M machines

Queuing Theory : elements of Queuing system and it's operating characteristics, waiting time and ideal time costs, Kendall's notation, classification of Queuing models, single chanel

Queuing theory : Model I (Single channel Poisson Arrival with exponential services times, Infinite population (M/M/1) : (FCFS/ ∞ / ∞)

Simulation : Monte Carlo Simulation

Unit 4: Dynamic programming:

(6 Hrs)

Multi stage decision processes, Principle of optimality, recursive equation, Applications of D.P.

Unit 5: Linear programming (A)

(6 Hrs)

Formulation of Linear optimization models for Civil engineering applications. The simplex method, Method of Big M, Two phase method, duality

Unit6: Linear programming (B)

(6 Hrs)

The Transportation Model and its variants, Assignment Model, and its variants

Term Work

1. One exercise/assignment on each unit. Out of these any one exercise/assignment to be solved using Computer
2. One exercise on formulation of a problem applicable to any field of Civil Engineering, requiring use of LP/ NLP/ DP. Formulation of objective function and constraints (No solution)

Text Books

1. Engineering Optimization: Methods and Application-- A. Ravindran, K. M. Ragsdell—
Wiley India
2. Engineering Optimization by S.S.Rao
3. Operations Research by Hamdy A. Taha
4. Quantitative Techniques in Management by N.D. Vohra (Mc Graw Hill)
- 5 Operations Research by Premkumar Gupta and D.S.Hira, S. Chand Publications (2014).

Reference Books

- 6.Topics in Management Science by Robert E. Markland(Wiley Publication)
7. An Approach to Teaching Civil Engineering System by Paul J. Ossenbruggen
- 8 A System Approach to Civil Engineering Planning & Design by Thomas K. Jewell
(Harper Row Publishers)

e - Resources

1. Mathematical Model for Optimization (MMO Software)
2. nptel.iitm.ac.in/courses/webcourse-contents/IISc-Bang/OPTIMISATION

METHODS/New-index1.html

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401 004 Elective I (3)- Advanced Concrete Technology

Teaching scheme

Lectures: 3 hours/week

Practical: 2 hrs/week

Examination scheme

In semester exam: 30 marks---1 hour

End semester exam: 70 marks—2.5 hours

Term Work: 50 marks

Unit I

Cement and its types: general, hydration of cement, alkali aggregate reaction. Grading curves of aggregates, Manufactured sand as fine aggregate, copper slag as fine aggregate
Concrete: properties of concrete, w/b ratio, gel space ratio, Problems on maturity concept, aggregate cement bond strength, Green concrete, Guidelines for Quality control & Quality assurance of concrete, Effect of admixtures.

Unit II

Structural Light weight concrete, ultra light weight concrete, vacuum concrete, mass concrete, waste material based concrete, sulphur concrete and sulphur infiltrated concrete, Jet cement concrete (ultra rapid hardening), gap graded concrete, high strength concrete, high performance concrete, Self curing concrete, Pervious concrete.

Unit III

Design of high strength concrete mixes, design of light weight aggregate concrete mixes, design of flyash cement concrete mixes, design of high density concrete mixes, Design of pumpable concrete mixes, Design of self compacting concrete.

Advanced non-destructive testing methods: ground penetration radar, probe penetration, break off maturity method, stress wave propagation method, electrical/magnetic methods, nuclear methods and infrared thermographs.

Unit IV

Historical development of fibre reinforced concrete, properties of metallic fibre, polymeric fibres, carbon fibres, glass fibres and naturally occurring fibres. Interaction between fibres and matrix (uncracked and cracked matrix), basic concepts and mechanical properties: tension and bending.

Unit V

Properties of hardened frc, behaviour under compression, tension and flexure of steel fibres and polymeric fibres, GFRC, SFRC, SIFCON, -development, constituent materials, casting, quality control tests and physical properties.

Unit VI

Ferrocement: Properties & specifications of ferrocement materials, analysis and design of prefabricated concrete structural elements, manufacturing process of industrial concrete elements, precast construction, erection and assembly techniques.

Termwork / Labwork:

The Termwork / Labwork will be based on completion of assignments / practicals / reports of site visits, confined to the course in that semester.

1. Concrete mix design and production in lab of any one – Self compacting concrete, Fiber reinforced concrete, light-weight concrete, high strength or ultra-high strength concrete. Comparison with traditional concrete mix is to be clearly stated in the report.
2. Cost analysis (material, labour, equipment, others) of any type of concrete for lab, in-situ and RMC production.

401 004 Elective I (4)- Architecture and Town Planning

Teaching scheme

Lectures: 3 hours/week

Practical: 2 hrs/week

Examination scheme

In semester exam: 30 marks---1 hour

End semester exam: 70 marks—2.5 hours

Term Work: 50 marks

Unit I:

- Principles and elements of Architectural Composition,
- Qualities of Architecture: user friendly, contextual, ecofriendly, utility of spaces, future growth etc.
- Role of “Urban Planner and Architect” in planning and designing in relation with spatial organization, utility, demand of the area and supply

Unit II:

- Landscaping : importance, objectives, principles, elements, material (soft and hard),
- Urban renewal for quality of life and livability.
- Importance of sustainable architecture with case study

Unit III:

- Goals and Objectives of planning; components of planning; benefits of planning
- Levels of planning: Regional plan, Development Plan, Town Planning Scheme,
- Neighbourhood plan; Types of Development plans: Master Plan, City Development Plan, Structure Plan

Unit IV:

- Various types of civic surveys for DP : demographic, housing, land use, Water Supply & sanitation, etc.,
- Planning agencies for various levels of planning. Their organization and purpose (CIDCO-MHADA-MIDC, MMRDA/ PMRDA etc),
- Traffic transportation systems: urban road, hierarchy, traffic management, Intelligent Transport Systems.

Unit V:

- Legislative mechanism for preparation of DP: MRTP Act 1966
- UDPI guidelines (for land use, infrastructure etc), SEZ, CRZ, Smart City Guidelines

Unit VI :

- Special townships, Land Acquisition Rehabilitation and Resettlement Act 2013.
- Application of GIS, GPS, remote sensing in planning.

Term Work: - 50 Marks

Sr. no. 1 and 2 are compulsory and any four from remaining.

- 1 Study and analysis of Development Plan with respect to land use, services, infrastructure, street furniture, housing etc. (group work)
2. Neighborhood- planning (group work)
- 3 Report on contribution of Engineers, Planners and Architects in post independence India (individual work)
- 4 Report on any existing new towns and planned towns like new Mumbai, Gandhinagar, PCNTDA etc.(infrastructure, disaster management etc), (individual work)
- 5 Study of salient features of urban renewal schemes (group work)

- 6 Study of any existing town planning scheme (group work)
- 7 Smart City approaches (individual work)
- 8 Study of Special Townships: (site visit) (group work)
- 9 Study of urban housing and housing change (group work)

Text Books:

- Town Planning By G K Hiraskar
- Town Planning By S Rangwala
- Building Drawing and Built Environment- 5 Th Edition – Shah , Kale , Patki
- Planning Legislation By Koperdekar And Diwan.
- G. K. Bandopadhyaya , “Text Book of Town Planning”.
- Climate Responsive Architecture – Arvind Krishnan.
- Introduction To Landscape Architecture By Michael Laurie

Reference Books

- MRTTP Act 1966
- Manual Of Tropical Housing And Building By Koenigsbeger
- Sustainable Building Design Manual
- UDPFI Guidelines
- “The Urban Pattern: City planning and design” by Gallion and Eisner.
- Design of cities by Edmond bacon
- LARR Act 2013
- MoUD By GoI
- NRSA
- CIDCO, MHADA, MIDC, MMRDA, PMRDA
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401 004 Elective I-(5) Advanced Engineering Geology with Rock Mechanics

Teaching scheme

Lectures: 3 hours/week

Practical: 2 hrs/week

Examination scheme

In semester exam: 30 marks---1 hour

End semester exam: 70 marks—2.5 hours

Term Work: 50 marks

Unit I : Indian Stratigraphy, Geology applied to Civil Engineering Practices

1 *Indian Stratigraphy:* **4**

Distribution and Geological characters of Major rock formations of India, Geological Map of India with special reference to Maharashtra, Seismic Zones of India, Engineering characters of major rock formations of India.

2 *Geology applied to Civil Engineering Practices:* **2**

Importance of geological studies in engineering investigations, precautions necessary to avoid misleading conclusions likely to be drawn while interpreting drilling data, dependence of design on geological features of project site.

Unit II: Subsurface Explorations for Water Retaining Structures; Geological Foundation Treatments for various Civil Engineering Projects, Tail Channel Erosion.

3 *Subsurface Explorations for Water Retaining Structures:* **2**

Various Physical and Mechanical properties of rocks affecting strength & water tightness of them from foundation point of view. Effect of weathering, deterioration of rock masses on exposure to atmosphere & hydrothermal alteration of rocks on water retaining structures & suitable treatment for such rocks. Case studies illustrating economics made possible by proper geological studies & wasteful expenditure or difficulties resulting from their negligence.

4 *Geological Foundation Treatments for various Civil Engineering Projects:* **2**

Foundation investigations during construction for determining the foundation treatment for adverse geological features. Determination of foundation levels. Correction of adverse features by means of various techniques such as grouting etc. for improving strength of weak & fragmented rocks. Curtain grouting for preventing leakage through foundation rocks. Determining depths & zones of consolidation & curtain grouting. Foundation treatment for fractures having different manifestation, jointed rocks.

5 *Erosion of Tail Channels:* **2**

Erosion of tail channel as factor in selecting site for spillway. Causes of rapid erosion of tail channels of side spillways. Geological conditions leading to tail channel erosion. Case studies

Unit III: Geohydrological characters of major rock formations of India; Geological process of Soil formations

6 *Geohydrological characters of major rock formations of India:* **4**

Geohydrological characters and factors affecting the water bearing structures of various rocks in India. Introduction to morphometric analysis of river system. Various methods of water conservation techniques, adverse aspects of tube wells, bore wells and dug wells. Geological

	aspects of conservation of water, artificial recharge, rainwater harvesting and watershed development & necessity of geological studies for such schemes. Illustrative case studies.	
7	<i>Geological Process of Soil formations:</i> Rock weathering conditions favorable for decomposition & disintegration, Residual & transported soils. Effect of climate on formation of soil. Soil profile of various states in India.	2
	UNIT IV Rock Mechanics and Geophysical techniques.	
8	<i>Rock Mechanics:</i> General principles of rock mechanics. Dependence of physical and mechanical properties of rocks on geological characters. Various laboratory testing methods. Calculation of R.Q.D. Joint Frequency Index, Various Methods of Geomechanical classifications of rocks such as Terzahagi, U.S.B.M, R.M.R., R.S.R., Q. system, Deer and Miller, Bieniawski's Geomechanical classification etc. and computation of representative rock formation such as DTB.	4
9	<i>Geophysical techniques :</i> Various methods of Geophysical Exploration like Electrical Resistivity methods, Seismic method of exploration as applied to engineering investigations such as determination of thickness of overburden, locating ground water potential zones	2
	Unit V: Engineering Geological investigation for Tunnels and Bridges	
10	<i>Engineering Geological investigation for Tunnels:</i> Variations in methodology of investigation for different types of tunnels for different purposes, location, spacing, angles & depths of drill holes suitable for different types of tunnels. Difficulties introduced in various geological formation and their unfavourable field characters. Standup time of rock masses and limitations of it. Dependence of protective measures such as guniting, rock bolting, shotcreting, steel fiber shotcreting, permanent steel supports, lagging concreting & contact grouting above permanent steel supports on geological conditions. Illustrative case studies.	4
11	<i>Bridges:</i> Investigation for bridge foundation, difference in objectives of investigation of bridge foundation. Computing safe bearing capacity for bridge foundation based on nature & structure of rock. Foundation settlements. Case studies.	2
	UNIT VI : Resource Engineering ,Role of Geology in planning and development	
12	<i>Resource Engineering:</i> Deccan Trap basalts as construction material. Use of compact basalt & amygdaloidal basalts as rubble for masonry & metal for concrete & pavement quality concrete. Use of Basalt fibre during construction. Illustrative case studies.	2
13	<i>Role of Geology in planning and development:</i> Influence of geological factors upon urban development & planning ,locating non-renewable resources and geothermal energy.	2
14	<i>Earthquakes and tectonics:</i>	2

Seismicity of Indian sub continent. Earthquakes occurring in the areas of some dams & RIS theories.

Practical Work / Term Work

- I) Study of Geological map and seismic zonation map of India **(2 Practical)**
- II) Interpretation of drill hole data
Logging of drill core, preparation of Litho logs & interpretation of drill data. Preparing geological cross sections from drill hole data & using them for designing of civil engineering structures representing following case studies.
1. Dipping sedimentary formation
 2. Faulted region
 3. Folded region
 - 4 Locating spillway on Igneous rocks
 5. Tunnels in Tectonic areas
 6. Tunnels and open cuts in non-tectonic areas **(6 Practical)**
- III) Study of some parameters of Morphometric Analysis of some tributaries of river, (Toposheet will be made available by the college) **(1 Practical)**
- IV) Study of Soil Profile of any region. **(1 Practical)**
- V) Use of electrical resistivity method for determining depth of bedrock. **(1 Practical)**
- VI) Computation of RQD & Joint Frequency Index **(1 Practical)**
- VII) A compulsory guided tour to study geological aspects of an engineering projects & writing a report based on studies carried out during visits to civil engineering projects.

Note:

**** Class test will be held in the last week of every month**

**** Field visits will be made to different places around study area and one long study tour to important geological place.**

The practical journal will be examined as term work.

Reference Books and Text Books:

1. Jaeger – Rock Mechanics in Engineering, Cambridge Univ Press London, 1990.
2. Goodmann – Principles of Rock Mechanics.
3. Bieniawski Z. T. - Engineering Classification of jointed Rock Masses.
4. Dr. Dobbrin - Introduction to Geophysics.
5. Goodmann – Engg. Geology.
6. Megaw T. M.& Tunnels: Planning, Design, Construction
7. J. V. Bartlett - Int. ED, Ellis Horwood ltd. John Willey & Sons .
8. Skinner B. J: The Dynamic Earth, An Introduction to Phy & Porter S. C Geology John Willey & Sons. NY 1989
9. Introduction to Rock Mechanics by B. P. Verma-Khanna Pub New Delhi
10. Environmental Geology by Waldiya
11. Environmental Geology – Keller, Prentice – Hall Publication.

Handbooks

- a. Gupte R. B. (1980) – P. W. D. Handbook Chapter –6, Part-II ‘Engineering Geology Government of Maharashtra.
- b. Tunneling India '94, “Central Board of Irrigation and Power”, New Delhi

- c. Manual on Rock Mechanics, Central Board of Irrigation and Power, New Delhi, 1988.
- d. Handbook of Geological terms, geology and Physical Geology, David page, University of Michigan. USA.
- e. Handbook of Geology in Civil engineering, Robert Fergusson , Legget, Mc-Graw hill.
- f. Geotechnical Engineering handbook, Robert day, Mc- Graw hill, ISBN 0-07-137782-4

I. S. Codes

- i) IRC code of practice for Road Tunnels. IRC-78-2000; IS-12070; IS-1336 Part I and II.
- ii) I. S. 4453-1967 Code of practice for Exploration, pits, trenches, drifts & shaft.
- iii) I. S. 6926-1973 Code of practice for diamond drilling for site investigation river valley project.
- iv) I. S. 4078-1967 Code of practice for Logging and Storage of Drilling Core.
- v) I. S. 5313-1969 Guide for core drilling observation.

e- Resources

- 1. www.ebd.co.in/undergraduate/eng.
- 2. www.library.iisc.ernet.in
- 3. www.iitb.ac.in
- 4. www.nptel.iitm.ac.in

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401 005 Elective II (1)- Matrix Methods of Structural Analysis

Teaching scheme

Lectures: 3 hours/week

hours

Examination scheme

In semester exam: 30 marks---1 hour

End semester exam: 70 marks—2.5

Unit I: Computational Techniques

6 Hrs

Review of matrix algebra, computer oriented numerical methods-Gauss elimination, Gauss Jordan and Gauss Seidel. Computer algorithm and flowcharts of above methods

Unit II: Flexibility matrix method for trusses, beams and frame

6 Hrs

Degree of static indeterminacy, flexibility, selection of redundant, flexibility matrix, analysis of pin jointed indeterminate trusses, continuous beams and simple portal frames involving not more than three unknowns.

Unit III: Stiffness matrix method for bars and trusses

6

Hrs

a) Degree of kinematic indeterminacy (degrees of freedom), local and global coordinate systems, stiffness matrices of a axially loaded bar members, global stiffness matrix, structure approach, member approach, analysis of determinate/indeterminate bars involving not more than three unknowns

b) Stiffness matrices of a truss member with four DOF, transformation matrix, global stiffness matrix, analysis of determinate/indeterminate trusses involving not more than three unknowns

Unit IV: Stiffness matrix method for beams and frames

6

Hrs

a) Stiffness matrix for a beam member, member and structure approach problems involving not more than three unknowns

b) Stiffness matrix for a portal frame member, transformation matrix, member and structure approach problems involving not more than three unknowns

Unit V: Stiffness matrix method for grid structures

6

Hrs

Stiffness matrix method for analysis of orthogonal grid structure, member stiffness matrix, transformation matrix, member and structure approach, problems involving not more than three unknowns

Unit VI: Stiffness matrix method for 3D structures and FDM

6

Hrs

a) Stiffness matrix method for the analysis of space truss, member stiffness matrix, problems involving not more than three unknowns, Formation of stiffness matrix of space frame element (no numerical),

b) Applications of finite difference method (FDM): Determine deflection and moments in beams, critical buckling load of columns.

401 005 Elective II (2)- Integrated Water Resources Planning & Management

Teaching Scheme: Lectures: 3 Hrs / week

Examination Scheme:

Paper In-sem. 30 Marks (1 hr),

Paper End-sem : 70 Marks (2.5 hr)

Unit1:

(6 Hrs)

a) Introduction :World water resources, water resources in India, water as finite resource, variability of water in time & space, history of water resources development, water infrastructure-problems and perspectives, present institutional framework for water management.

b) Water laws: Constitutional provisions, National Water Policy, riparian rights / ground water owner ship, prior appropriation, permit systems, acquisition and use of rights, scope for privatization.

Unit2: Economics & Paradigm shift in water management

(6 Hrs)

a) Economics of water :Water as economic good, intrinsic value, principles of water pricing & water allocation, capital cost, opportunity cost, internal rate of return, benefit cost analysis, principles of planning and financing of water resources project : Discussion on any two case studies.

b) Paradigm shift in water management:

Global and national perspectives of water crisis, water scarcity, water availability and requirements for human and nature, concepts of 'blue water', 'Green water', and 'virtual water', and their roles in water management. Sustainability principles for water management, framework for planning a sustainable water future.

Unit3: Basin scale hydrology

(6 Hrs)

a) Estimation of surface water, estimation of ground water draft/recharge import/export of water (inter basin water transfer), recycling and reuse and storage, control of water logging, salinity, & siltation of storages.

b) Flood & Drought management: causes of floods, structural and non-structural measures, mitigation plan, flood damage assessment, use of geoinformatics for flood management. Types of droughts, severity index, drought forecasting, damage assessment, mitigation plan, use of geoinformatics for drought management

Unit 4: water demand and supply based management

(6 Hrs)

a) Consumptive & non consumptive demands, irrigation demand estimation, water utilization, irrigation efficiency, water management in irrigation sector,

b) demand estimation in hydro/thermal/nuclear power sector, estimation & forecasting of water demands of domestic & industrial sector, navigation and recreational water demands

Unit 5: Environmental and social aspects

(6 Hrs)

a) Environmental management: protection of vital ecosystem, water requirements for environmental management, aquaculture, minimum flows, water quality management for various uses.

b) Social impact of water resources development: direct/ indirect benefits, employment generation, industrial growth, agro-industry, enhanced living standards, education & health, co-operative movement, management of rehabilitation & resettlement.

401 005 Elective II –(3) TQM and MIS in Civil Engineering

Teaching scheme

Lectures: 3 hours/week
hour

hours

Examination scheme

In semester exam: 30 marks---1

End semester exam: 70 marks—2.5

Unit I: Quality in Construction (6 Hrs)

- a) Quality – Various definitions and interpretation. Importance of quality on a project in the context of global challenges.
- b) Factors affecting quality of construction, reasons for poor quality & measures to overcome.

Unit II: MIS (6 Hrs)

- a) Introduction to Management Information systems (MIS) Overview, Definition.
- b) MIS and decision support systems, Information resources, Management subsystems of MIS.

Unit III: TQM & Defects in Construction (6 Hrs)

- a) TQM – Necessity, advantages, Six sigma as a tool in TQM.
- b) Defects & its classification in construction. Measures to prevent and rectify defects.

Unit IV: TQM, ISO & Quality Manual (6 Hrs)

- a) Difference between, quality control, quality assurance, total quality control and total quality management (TQM).
- b) Process based approach for achieving TQM. Study of ISO 9001 principles.
- c) Quality manual – Importance, contents, documentation. Importance of check-lists in achieving quality. Typical checklist for concreting activity, formwork activity, steel reinforcement activity.

Unit V: Management Control (6 Hrs)

- a) Management information system structure based on management activity whether for Operational control, management control or strategic planning.
- b) Supply chain management as a tool in TQM, Benchmarking in TQM, Kaizen in TQM
- c) Categories of cost of Quality.

Unit VI: Modern tools in TQM Implementation (6 Hrs)

- a) Development of an MIS for a construction organization associated with building works, study and use of various modules of ERP software for construction.
- b) Introduction to smart phone technology & incorporating GIS, GPS, Android subsystems for documentation and monitoring of construction projects.

**** Units IV, V & VI to be supplemented with case studies**

Text Books:

- 1.Total Quality Management-- Dr. Gunmala Suri and Dr. Puja Chhabra Sharma—Biztantra
- 2.Quality Control and Total Quality Management by P.L.Jain- Tata McGraw Hill Publ.Company
- 3.Total Quality Management - Dr. S.Rajaram and Dr. M. Sivakumar-- Biztantra
- 4.Total Engineering Quality Management – Sunil Sharma – Macmillan India Ltd.

401 005 Elective II (4)- Earthquake Engineering

Teaching scheme

Lectures: 3 hours/week

Examination scheme

In semester exam: 30 marks---1 hour

End semester exam: 70 marks—2.5 hours

Unit I

Introduction to earthquakes:

Geology of earth, configuration of tectonic plates in a globe, influence of Geology on earthquake, behavior of plates, their motion and effects, causes of earthquake and their Characteristics, Earthquake parameters, magnitudes, intensity, scales, classification of earthquake seismic zoning of India, seismic coefficients for different zones, .Lessons from past earthquake: - Study of damages caused due to past, earthquakes in/ outside India and remedial measures.

Unit II

Theory of vibrations:

Vibrations - definition, causes, classifications. Single Degree of Freedom systems (SDOF) - Free, forced, damped, un-damped vibrations with basic examples. Introduction to Multi-degrees of Freedom systems (MDOF) - derivations of related equations and solutions to two degree and three degree of freedom systems.

Unit III

Seismic design of RC structure:

Introduction to IS1893 (Part-I): 2002, Seismic design Philosophy, provision, Seismic coefficient method. Response Spectra, Basic requirement, estimation of story shear, effect of unsymmetrical geometry and masses, mass center and stiffness center, estimation of story shear for symmetrical and torsion for unsymmetrical buildings. IS code provision to response spectrum.

Concept of ductile detailing, IS 13920 (1993) provisions for RC frame.

Unit IV

Seismic foundation design:

Type of forces generated due to earthquake, effects on different types of foundation, design of RCC isolated footing for earthquake loading, liquefaction, causes and its remedial measure.

Unit V

Introduction of different control systems: Passive control: base isolation and active control: bracing system, TMD etc and some latest invention.

Introduction to Disaster Management: Types of Disaster, Phases of disaster management, Disaster rescue, psychology and plan of rescue operations.

Unit VI

Strengthening and Retrofitting: Need of retrofitting, Evaluation of existing buildings, aging, weathering, development of cracks, improper load Path, asymmetry, materials and equipments for restoring and retrofitting, methodology of retrofitting for walls, slabs roofs columns, foundations etc. for buildings in stones, bricks, RCC.

Concept of shear wall,

Notes: Every design should confirm to latest versions of IS 1893, 4326, 13920, 13827, 13828, 13935

Text Books

1.Earthquake resistance design of structure by Duggal- Oxford University Press.

2. Earthquake – Resistant Design of Building Structures-Dr. Vinod Hosur-- Wiley India
- 3 Earthquake Tips NICEE, IIT, Kanpur
4. Elements of Earthquake Engineering by Jaikrishna and Chandarsekaran.

Reference Books

- 5 Dynamics of structure by Clough R.W. and Penzin J. McGraw Hill Civil Engineering Series
6. Dynamics of structure by Anil Chopra, Prentice Hall India Publication
7. Dynamics of structure by Mario Paz, CBSPD Publication
8. Geo-technical Earthquake Engineering by Kramer S. L. Prentice Hall India Publication
9. Introduction to Structural Dynamics by John M. Biggs
10. Mechanical Vibrations by V. P. Singh
11. Relevant Latest Revisions of IS codes.

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401 005 Elective II (5)- Advanced Geotechnical Engineering

Teaching scheme

Lectures: 3 hours/week

Examination scheme

In semester exam: 30 marks---1 hour

End semester exam: 70 marks—2.5 hours

Unit I

(a) Soil classification

Identification and classification, criteria for classifying soil - classification on the basis of grain size, plasticity, symbolic & graphic presentation. Classified soils and engineering properties.

(b) Soil structure & clay minerals

Clay minerals, clay water relations, clay particle interaction, soil structure & fabric, granular soil fabric.

Unit II

(a) Earth pressure theory

Earth pressure theories for calculation of active and passive pressure, Rankines and coulombs earth pressure theories, analytical and graphical methods.

(b) Design of earth retaining structures

Design of gravity and cantilever retaining walls, design - cantilever sheet pile walls, anchored sheet pile walls, timbering and bracing for open cuts.

Unit III

(a) Geosynthetics

Geosynthetics- types, functions, properties and functional requirements. Application of geosynthetics in geoenvironment.

(b) Reinforced soil

Mechanism, reinforcement soil – interaction. Applications – reinforcement soil structures with vertical faces, reinforced soil embankments. Reinforcement soil beneath unpaved roads, reinforcement of soil beneath foundations. Open excavation and slope stabilization using soil nails.

Unit IV

(a) Soil behavior under dynamic loads

Soil behavior under static and dynamic loads. Acceptable levels of strain under static and dynamic loading. Soil properties relevant for dynamic loading and its determination.

(b) Machine foundations:

Types of machine foundations, design criteria, methods of analysis – elastic half space method, linear elastic weightless spring method. Evaluation of soil parameters. Design procedure for a block foundation for cyclic loading and impact loading.

Unit V

Ground Improvement

In-situ ground improvement by compaction piles, dynamic loads, sand drains, grouting, deep mixing, inserting reinforcement elements, freezing soil, and vibroflotation.

Unit VI

Rheology

Rheological elements, basic and composite rheological models. Examples of compound models used to explain different soil phenomena; such as secondary consolidation, creep etc.

Term Work

(A) Experiments to be conducted (Any Three)

- 1) Plummet balance / Hydrometer Analysis.
- 2) Consolidation test.
- 3) Swelling Pressure Test.
- 4) Triaxial test with measurement of pore pressure.

(B) Assignments (Any Four)

- 1) Soil Classification.
- 2) Computation of Earth pressure behind Retaining Wall by Analytical method.
- 3) Computation of Earth pressure behind Retaining Wall by Graphical method.
- 4) Typical slope design with reinforced soil / Geosynthetics.
- 5) Design of machine foundation.

(C) Computer programme / Software package for solution of two topic covered in theory.

A) Reference Books

- 1. Physical and Geotechnical properties of soils- Joseph E. Bowels, Tata Mac-Grawhill
- 2. Advance Soil Mechanics – Braja Mohan Das- Tata Mc- Grawhill
- 3. Geotechnical Engineering by Shashi K. Gulati & Manoj Datta – Tata Mc-Grawhill
- 4. Basic and Applied Soil Mechanics- Gopal Ranjan & A.S. Rao- New Age Publication

B) I.S .Codes

- 1. IS: 1892-1979 – “Code of Practice for Subsurface Investigation for Foundation”.
- 2. IS: 2131-1981 (Reaffiemed 1997), “Method for Standard penetration Test for Soils”.

C) Handbooks

- 1. Bolt, Bruce A.(1999),”Earthquakes”, W.H.Freeman.
- 2. Baghi, A.,(1994)” Design, Construction and Monitoring of Landfills.”John Wiley & Sons.
- 3. Day.R.W.(2002),”Geotechnical Earthquake Engineering Handbook”,McGraw Hill.

D) e Resources

- 1. Website www.nptel.iitm.ac.in

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Savitribai Phule Pune University
Board of Studies in Civil Engineering
Structure for B.E. Civil 2012 Course (w.e.f. June 2015)
401006 Project Phase-I

Teaching Scheme:

Tutorial: 2Hrs/week

Examination Scheme:

TW: 50Marks

Project phase I Term Work will be evaluated for an individual student based on the seminar presented on the work done in first semester and submission of the report. If the student fails to present the seminar and submit the report, he / she will be marked absent in project examination.

The project work phase I shall be consisted of any one of the following nature in Civil Engineering related subjects.

1. Experimental investigation.
2. Software development.
3. Cost economic analysis.
4. Case study with own design.
5. Working model design and fabrication.
6. Case study with development of methodology using soft computing tools.

It is mandatory to present a seminar in presence of Internal and External Examiners and submit preliminary project report based on work done in first semester **for the grant of semester I**. The report shall contain finalization of topic, literature survey, planning schedule/ flow chart for completion of project. The report shall be typed or printed and hard/spiral bound. The project work to be taken up individually or in groups. The group shall not be of more than five-six students. The references shall be mentioned at the end as per universal standards as mentioned in any international journal of professional body

Format of project report:

Sequence of pages:

- i) Front Cover Page
- ii) Certificate
- iii) Acknowledgement
- iv.) Synopsis
- v) Contents
- vi) Notations
- vii) List of Tables
- viii) List of Figures
- ix) List of Graphs

Chapter 1 Introduction (This consists of: 1.1 Introduction of the Project Work; 1.2 Problem Statement, 1.3 Objectives and 1.4 Scope of the Project Work).

Chapter 2 Literature Review (It shall include theoretical support, details regarding work done by various persons, methods established, any new approach. It should preferably highlight the development in the field of research chronologically as reflected from books, journals etc.)

Chapter 3 Planning Schedule/ Flow Chart For Completion of Project

References and Bibliography (The references and bibliography shall include name of author/code/manual/book, title of paper/code/manual/book, name of the journal, month & year of publication, volume number/ISBN number, page number x-y. The references and bibliography shall be as per universal standards as mentioned in any international journal of professional body.)

Report Printing details:

1. Report shall be typed on A4 size Executive Bond paper with single spacing preferably on Both sides of paper.

2. Margins: Left Margin: 37.5 mm, Right Margin: 25 mm, Top Margin: 25 mm, Bottom Margin: 25 mm.
3. Give page number at bottom margin at center.
4. Size of Letters: Chapter Number: 12 font size in Capital Bold Letters, Chapter Name: 12 Font size in Capital Bold Letters, Main Titles (1.1, 2.5 etc): 12 Font size in Bold Letters-Sentence case, Sub Titles (1.1.5, 4.5.1 etc): 12 Font size in Bold Letters-Sentence case. All other matter: 12 Font size sentence case
5. No blank sheet be left in the report
6. Figure name: 12 Font size in sentence case Bold--Below the figure.
7. Table title -12 Font size in sentence case- Bold-Above the table.

Guidelines for the evaluation of B.E. (Civil) Project work (Project Phase I)

For Faculty, Guide and External Examiner

Sr. No.	Description	Marks
1.	Appropriate Introduction in the line of project title and area of project work	5
2.	Well defined problem statement, specific objectives and scope of the work	3+5+2=10
3.	Originality of the project work	5
4.	Literature Survey:	3+5+2=10
	i) International Papers (minimum 3 papers)	
	ii) National Papers (minimum 5 papers)	
	iii) Other relevant literature	
5.	Planning Schedule : Appropriate planning	5
6.	Quality of Term Work (as per given format)	10
7.	Individual contribution of students in the team work	5
	Total	50

Evaluation of Project phase I term work will be done by the pair of internal guide having minimum 3 years approved experience as teacher and external examiner with the equivalent / relevant experience .

Savitribai Phule Pune University
Board of Studies in Civil Engineering
Structure for B.E. Civil 2012 Course(w.e.f.June 2015)

Subject code	Subject	Semester – II							
		Teaching Scheme Hrs/Week			Examination Scheme				
		Lect	Tu	Pr	In-Semester Assessment	TW	Or	End - Semester Exam	Total
401 007	Dams and Hydraulic Structures	3	--	2	30	---	50	70	150
401 008	Quantity Surveying, Contracts and Tenders	3	--	2	30	--	50	70	150
401 009	Elective III	3	--	2	30	50	--	70	150
401 010	Elective IV	3	--	2	30	50	--	70	150
401 006	Project	--	6		--	50	100	--	150
	Total →	12	6	8	120	150	200	280	750

Following will be the list of electives..

Semester II

<p>Elective-III 401 009</p> <ol style="list-style-type: none"> 1. Advanced Structural Design 2. Advanced Foundation Engineering 3. Hydropower Engineering 4. Air Pollution and control 5. Finite Element Method in Civil Engg. 	<p>Elective-IV 401010</p> <ol style="list-style-type: none"> 1 Construction Management 2. Advanced Transportation Engineering 3. Statistical Analysis and Computational Methods in Civil Engg. <p>4.Open Elective</p> <ol style="list-style-type: none"> a). Plumbing Engineering b) Green Building Technology c) Ferrocement Technology d) Sub sea Engineering e)WaveMechanics
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II Semester

Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)
401 007 Dams and Hydraulic Structures

Teaching Scheme

Lectures: 3 hours/week
Practical: 2 hours/week

Examination Scheme

Theory Examination:
Insem : 30 marks (1Hour)
Endsem:70 marks (2.5.Hours)
Oral : 50 marks

Unit I

Chapter 1. Introduction to dams [2 Lectures]

Introduction, Historical development of dams, Different terms related to dams, Selection of site for dam, Factors governing selection of type of dam, Classification of dams, Classification based on purpose, Classification based on materials, Classification based on size of project, Classification based on hydraulic action, Classification based on structural action, Dams and earthquakes, Dams and social issues, Large dams verses small dams, Displacement and rehabilitation, Dams and climate change

Chapter 2. Dam Safety and Instrumentation [2 Lectures]

Introduction, Objectives of dam safety and instrumentation, Types of measurements, Instrumentation data system, Working principles of instruments, Selection of Equipments, Different Instruments, Piezometers, Porous tube piezometer (Determination of uplift pressure), Pneumatic piezometer (Determination of ground water pressure), Vibrating wire piezometer (Determination of pore water pressure) ,Settlement measurement system Vibrating wire settlement cell (Determination of settlement of earth dam embankments) Magnetic settlement system (Determination of settlement and lateral movements) Inclinator (Determination of shear plane and lateral movements) ,Jointmeter (Determination of movement of joints),Pendulums (Determination of tilt and rotation) ,Inverted Pendulum, Hanging Pendulum, Automatic pendulum coordinator ,Vibrating wire pressure cell (Determination of total pressure and stress distribution), Extensometer (Determination of internal deformation and cracking), Embedment strain gauge (Determination of internal strain), Temperature gauge (Determination of temperature),Distributed fiber optics temperature tool, Seismograph (Determination of earthquake shaking)

UNIT 2

Chapter 3. Gravity Dams [6 Lectures]

Introduction, Components of gravity dam, Conditions favoring gravity dams, Forces acting on gravity dam, Combinations of loading for design, Seismic analysis of dam, Terms related

to seismic analysis, Determination of Seismic forces, Effect of horizontal earthquake acceleration, Effect of vertical earthquake acceleration, Stress analysis in gravity dam (Only concept, no derivations), Vertical or normal stress, Principal stresses, Shear stress, Middle third rule, Modes of failure of gravity dam, Elementary profile of gravity dam, Concept of low and high gravity dams, Various Design methods of gravity dam (Introduction only)—Details of Gravity method or 2 D method, Construction of gravity dams, Colgrout masonry, Roller Compacted Concrete (R.C.C.), Temperature control in mass concreting, Crack formation in gravity dam, Control of crack formation in dams, Construction joints, Keys, Water seal, Retrofitting.

Chapter 4. Arch Dam and Other Dams (Introduction only) [2 Lectures]

Introduction, Concept of Arch Dam, Conditions favoring an arch dam, Classification of an arch dam, Constant angle arch dam, Constant radius arch dam, Variable radius arch dam, Arch gravity dam, Double curvature arch dam, Buttress dams, Advantages of Buttress dams, Limitations of Buttress dams, Types of buttress dams.

Unit III

Chapter 5. Spillway and Gates [6 Lectures]

Introduction, Location of Spillway, Different key levels and heads in spillway, Spillway Capacity, Components of spillway, Approach channel, Control structure, Discharge channel, Energy dissipation device, Tail channel, Classification of spillway, Classification based on operation, Main or service spillway, Auxiliary spillway, Emergency spillway, Classification based on gates, Gated spillway, Ungated spillway, Classification based on features, Straight drop spillway (Free overflow spillway), Saddle spillway, Side channel spillway, Overflow or ogee spillway, Chute or open channel or trough spillway, Shaft or morning glory spillway, Siphon spillway, Conduit or tunnel spillway, Stepped spillway, Design of Ogee spillway or overflow spillway, Shape of crest, Equations for spillway profile on upstream and downstream, Energy dissipation below spillway, Classification of energy dissipation devices, Energy dissipation in stilling basin, Stilling basin, Components of stilling basin, Types of stilling basins, Indian standard stilling basins, Energy dissipation through buckets, Solid roller bucket, Slotted roller bucket, Ski jump bucket, Correlation between jump height and tail water depth, Correlation 1-2-3-4-5 of TWD Vs Jump depth. Spillway gates, Classification of spillway crest gates, Classification based on function, Classification based on movement of gates, Classification based on special features, Requirements of spillway gates, Maintenance of gates, Inspection of gates,

Chapter 6 : Hydropower Structures [2 Lectures]

Introduction to hydropower, Advantages and limitations of hydropower, Assessment of hydropower potential, Definition and different terms related to hydropower, Features of layout of hydropower plant, Classification of hydropower plants based on storage, functions, head, plant capacity, location, nature of project.

Unit IV

Chapter 7. Earth Dam [6]

Introduction, Conditions favoring an earth dam, Limitations of earth dam, Classification of earth dam, Classification based on—materials, method of construction, height; Selection of type of earth dam, Components of an earth dam, Requirements for safe design of earth dam, Hydraulic (Seepage) Analysis, Plotting of seepage line, Case 1: Homogeneous earth dam with horizontal drainage blanket, Determination of seepage discharge using phreatic line.

Case II: Composite earth dam with casing and hearting, Properties of phreatic line, Determination of seepage discharge through earth dam using flownet, Structural stability analysis of homogeneous and zoned earth dam, Forces acting on earth dam, Method of stability analysis of an earth dam, Procedure of analysis by Swedish slip circle method, Fellenius Method of Locating Centre of Critical Slip circle, Stability analysis for foundation, Failure of earth dam, Classification of failure of earth dams, Hydraulic Failure, Seepage failure, Structural failure, Other failures, Seepage control in earth dams, causes of seepage, Seepage control measures, Construction of earth dam,

Chapter 8. Diversion head works [5 Lectures]

Introduction, Function of diversion headworks, Selection of site for diversion headworks, Layout of diversion headworks, Components of diversion headworks, Design of weir on permeable foundation, Criteria for safe design of weir floor, Brief introduction to Bligh and Lane's theory, Khosla's theory based on potential theory approach, Khosla's theory of independent variables, Design criteria of weirs on permeable foundations, Checks for stability and safety of weirs

Unit V

Chapter 9.-Canals [4 Lectures]

Introduction, Classification of canals, Classification based on alignment, Classification based on soil, Classification based on source of supply, Classification based on discharge, Classification based on lining, Classification based on excavation, Components of canal , Data required for canal design, Selection of canal alignment, Design of stable canal in alluvial beds, Kennedy's theory, Design of canal by Kennedy's theory, Limitations of Kennedy's theory, Lacey's regime theory, Design of canal by Lacey's theory, Canal lining, Need of canal lining, Requirements of lining material, Classification of canal lining, Hard surface lining including Ferrocement lining, Soft surface lining, Burried lining, Advantages of canal lining, Design of lined canal, Benefit – cost analysis for canal lining,

Chapter 10 –Canal Structures[2 Lectures]

Canal falls Introduction, Necessity of canal fall, Selection of site for canal fall, Classification of canal fall, Types of falls, Free fall or open fall, Notch fall, Ogee Fall, Rapid Stepped fall, Straight glacis fall, Sarda fall, Semi pressure fall, Baffle or Englis Fall, Montague fall Siphon well or cylinder fall, Pressure or closed conduit fall, Shaft or Pipe fall, Selection of type of fall, **Canal outlets-** Introduction of Canal outlet or module, **Canal escapes-** Introduction of Escapes, Significance of canal escape, **Canal regulators--**Canal regulators,

Unit VI

Chapter 11 C. D. Works [3 Lectures]

Introduction, Necessity of cross drainage works, Selection of site for Cross Drainage work, Data required for design of Cross Drainage work, Classification of Cross Drainage works, Drain over canal-Siphon,Super passage, Canal over drain—Aqueduct, Siphon aqueduct,Canal and drain water mixed in each other--Level crossing,Inlet and Outlet, Selection of suitable type of C. D. works, Design considerations for cross drainage works.

Chapter 12- River Training Structures [2 Lectures]

Introduction, Classification of rivers, Classification based on topography, regime, alignment, source, Behaviour of rivers, River training, Objectives of river training, Classification of river training, purpose, orientation, River training structures, Embankment or Levee, Guide banks, Groynes or spurs, Artificial cut off, Pitched island, Submerged sill or dykes, Closing dykes.

Term Work (A+B+C)

A) Analysis /Design Assignments

- 1) Stability analysis of gravity dam
- 2) Design of profile of spillway and energy dissipation device below the spillway
- 3) Stability analysis of zoned earthen dam
- 4) Analysis of weirs on permeable foundations.
- 5) Design of lined canal

B) Any 3 actual site visits and reports with photographs out of following 4 ---

- 6) Visit report on Gravity dam
- 7) Visit report on Earth dam
- 8) Visit report on C.D.work
- 9) Visit report on Canal structure(s)

C)) Review of any one case study of failure of hydraulic structure from the published literature

Note-Visit report should consist of Name of project, date of visit , need and practical significance of project, salient features of project, technical details of project, detailed description and figures of different components of project, special features of project, the technical, social, financial and environmental impact of project on downstream and upstream, photographs of technical details of visit, if allowed . If not allowed for technical details, the photograph near board of project or site as a proof of visit.

Reference Books :-----

1. Design of Small Dams- United States Department of the Interior, Bureau of Reclamation revised reprint 1974, Oxford and IBH Publishing Co.
2. Irrigation and Water Resources Engineering- Asawa G.L- New Age International (P) Ltd. Publishers, first ed, 2005.
3. Engineering for Dams- Creager W.P, Justin J.D, Hinds J -Wiley Eastern Pvt. Ltd., New Delhi, 1968
4. Irrigation Engineering and Hydraulic Structures- Garg S.K- Khanna Publishers N.D. 13th ed, 1998.
5. Hydraulic Structures, Vol. 1. & Vol. 2- Grishin M.M- Mir Publishers, Moscow, 1982.
6. Design Textbook in Civil Engineering: Volume Six: Dams- Leliavsky, Serge – Oxford and IBH Publishing Co. Pvt. Ltd., 1981.
7. Roller Compacted Concrete Dams- Mehrotra V.K- Standard Publishers Distributors, Delhi, 1st ed, 2004.
8. Irrigation, Water Resources and Water Power Engineering- Modi, P.N. - Standard Book House, New Delhi, 2nd ed, 1990.
9. Earth and Earth Rock Dams- Sherard J.L, Woodward R.J. - John Wiley and Sons, inc. 1963.

I.S. Codes

1. I.S. 8605 – 1977 (Reaffirmed 1998), Code of practice for construction of masonry in dams, third reprint, July 1999, B.I.S. New Delhi.
 2. I.S. 6512-1984 (Reaffirmed 1998), Criteria for design of solid gravity dams, first revision, first reprint, September, 1998, B.I.S. New Delhi.
 3. I.S. 457 – 1957 (Reaffirmed, 2005), Code of practice for general construction of plain and reinforced concrete for dam and other massive structures, sixth reprint, January 1987, B.I.S. New Delhi.
 4. I.S. 10135 – 1985, Code of practice for drainage system for gravity dams, their foundations and abutments, first revision, B.I.S. New Delhi.
 5. I.S. 14591 – 1999, Temperature control mass concrete for dams – guidelines, B.I.S. New Delhi.
 6. I.S. 11223 – 1985 (Reaffirmed 2004), Guidelines for fixing spillway capacity, edition 1.2 (1991-09), B.I.S. New Delhi.
 7. I.S. 6934 – 1998 (Reaffirmed 2003), Hydraulic design of high ogee overflow spillways – recommendations, first revision, B.I.S. New Delhi.
 8. I.S. 11155- 1994, Construction of spillways and similar overflow structures – Code of practice, B.I.S. New Delhi.
 9. I.S. 5186 – 1994, Design of chute and side channel spillway – criteria, first revision, B.I.S. New Delhi.
 10. I.S. 10137- 1982 (Reaffirmed 2004), Guidelines for selection of spillways and energy dissipaters, B.I.S. New Delhi.
 11. I.S. 4997 – 1968 (Reaffirmed 1995) Criteria for design of hydraulic jump type stilling basins with horizontal and sloping apron, sixth reprint, January, 1998, B.I.S. New Delhi.
 11. I.S. 7365-1985, Criteria for hydraulic design of bucket type energy dissipaters, first revision, B.I.S. New Delhi.
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Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)
401 008 Quantity Surveying, Contracts and Tenders

Teaching Scheme

Lectures: 3 hours/week
Practical: 2 hours/week

Examination Scheme

Theory Examination:
Insem : 30 marks (1Hour)
Endsem: 70 marks (2.5.Hours)
Oral : 50 marks

Unit I

Introduction and Approximate Estimates [6 Lectures]

a) Introduction to estimates and related terms: Definitions of estimation and valuation. Significance (application) of the Course. Purpose of estimation. Type of estimates, data required for estimation as a pre requisite. Meaning of an item of work, and enlisting the items of work for different Civil Engineering projects. Units of measurement. Mode of measurement of building items/ works. Introduction to components of estimates: face sheet, abstract sheet (BOQ), measurement sheet, Rate Analysis, lead statement. Provisional sum & prime cost items, contingencies, work charge establishment, centage charges. Introduction to D. S. R

b) Approximate Estimates: Meaning, purpose, methods of approximate estimation of building & other civil engineering projects like roads, irrigation/ water supply, sanitary engineering, electrical works.

Unit-II

Taking out quantities & Detailed estimate up to plinth [6 Lectures]

a) Methods of estimating-P.W.D. and center-line methods of working out quantities. Calculation of quantities for Load bearing and R.C.C framed structures up to plinth,

b) Detailed estimates, Factors to be considered while Preparing Detailed Estimate, Detailed estimates of Load bearing and R.C.C framed structures up to plinth only.

Unit-III

Detailed Estimation for super structure & Valuation [6 Lectures]

a) Calculation of quantities and detailed estimate for Load bearing and framed structures above plinth (super structure). Deduction rules for different items of work as per IS: 1200.

b) Valuation: Purpose of valuation. Meaning of price, cost and value. Factors affecting 'value'. Types of value: only Fair Market Value, Book Value, Salvage/ Scrap Value, Distressed Value and Sentimental Value. Concept of free hold and lease hold property. Estimation versus valuation. Meanings of depreciation & obsolescence.

Unit IV

Specifications and Rate Analysis [6 Lectures]

a) Specifications: Meaning & purpose, types. Drafting detailed specifications for materials, quality, workmanship, method of execution, mode of measurement and payment for major items like, excavation, stone/ brick masonry, plastering, ceramic tile flooring, R.C.C. work.

b) Rate Analysis: Meaning and factors affecting rate of an item of work, materials, sundries, labour, tools & plant, overheads & profit. Working out Rate Analysis for the items mentioned in specifications above. Task work or out turn, factors effecting task work.

Unit V

Tendering and Execution of Works [6 Lectures]

a) Tenders: Definition. Methods of inviting tenders, tender notice, tendering procedure, Pre and post qualification of contractors, tender documents. 3 bid/ 2 bid or single bid system. Qualitative and quantitative evaluation of tenders. Comparative statement, Pre-bid conference, acceptance/ rejection of tenders. Various forms of BOT & Global Tendering, E-tendering.

b) Methods of Executing Works: PWD procedure of work execution, administrative approval, budget provision, technical sanction. Methods of execution of minor works in PWD: Piecework, Rate List, Daily Labour. Introduction to registration as a contractor in PWD.

Unit V

Contracts and Arbitration [6 Lectures]

a) Contracts: Definition, objectives & essentials of a valid contract as per Indian Contract Act(1872), termination of contract. Types of contracts: only lump sum, item rate, cost plus. **Conditions of contract:** General and Specific conditions. Conditions regarding EM, SD, and time as an essence of contract, conditions for addition, alteration, extra items, testing of materials, defective work, subletting, etc. Defect liability period, liquidated damages, retention money, interim payment or running account bills, advance payment, secured advance, final bill.

b) Arbitration: Introduction to Arbitrations as per Indian Arbitration & Conciliation Act (1996) Meaning and need of arbitration, qualities and powers of an Arbitrator,

c) Brief introduction to laws related to professional liabilities

Term Work

The following exercises should be prepared and submitted:

1. Working out quantities using C-L and PWD method for a small single storied load bearing structure and working out cost of building using DSR(Regional)
2. Working out quantities of steel reinforcement for a column footing, a column, a beam and a slab by preparing bar bending schedule.
3. Detailed estimate of a single storied R. C. C. framed building using D.S.R.
4. Estimating quantities for any one of the following: a) A factory shed of steel frame
b) Underground Water Tank c) Pipe Culvert, d) Road/Railway track/Runway
5. Drafting detailed specifications of any 2 items of building & analyzing their rates based on prevailing market.
6. Drafting of tender notice and collecting minimum 3 tender notices of Civil Engineering works.

. Home assignment on the following is compulsory

7. Preparation of tender documents for the problem No.1 or 3
 - a) Tender Notice.
 - b) Schedule A and Schedule B
 - c) Conditions of contracts regarding time, labour payment, damages
8. Report on contents and use of current DSR.

Note: Any one of the above to be completed using a suitable (relevant) software.

Oral Examination: Based on the Term Work Written Examinations:

Question Paper shall be based on the portions completed in theory lectures as well as in the Practical Sessions.

Reference Books

1. Estimating and Costing in Civil Engineering: Theory and Practice: B.N Dutta - S. Dutta&Company, Lucknow.
 2. Estimating, Costing Specifications & valuation in Civil Engineering: M. Chakraborty.
 3. Estimating and Costing: R. C. Rangwala - Charotar Publ. House, Anand
 4. Theory and Practice of Valuation: Dr. RoshanNamavati, Lakhani Publications
 5. Valuation Principles and Procedures: Ashok Nain, Dewpoint Publ.
 6. Laws for Engineers : Dr. Vandana Bhat and PriyankaVyas –Published by PRO-CARE,5/B,/Sagarika Society,Juhu Tara Road,Juhu,Santacruz(W),Mumbai-400049 (procure@technolegal.org)
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Handbooks

1. Standard Contract Clauses for Domestic Bidding Contracts: Ministry of Statistics and Programme Implementation, Government of India.
 2. FIDIC Document: Federation International Des IngenieursConseils i.e. International Federation of Consulting Civil Engineers, Geneva, Switzerland.
 3. Indian Practical Civil Engineers' Handbook: P. N. Khanna, UBS Publi. Distri. Pvt. Ltd. (UBSDP)
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Codes

1. IS 1200 (Part 1 to 25): Methods of Measurement of Building & Civil Engg.Works.
2. IS 3861-1966: Method of Measurement of Areas and Cubical Contents of buildings.
3. D. S. R. (District Schedule of Rates) for current year.
4. PWD Redbooks, Vol 1 & 2.

e – Resources: nptel.iitm.ac.in

Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)
401 009 Elective III (1) Advanced Structural Design

Teaching Scheme

Lectures: 3 hours/week

Practical: 2 hours/week

Examination Scheme

Theory Examination:

In-sem : 30 marks (1 Hour)

End-sem: 70 marks (2.5.Hours)

Term work: 50 Mark

Unit 1

Cold-formed light gauge steel structural members: Design of axially loaded compression members, tension members and beams (not more than two spans).

Unit 2

Frames: Uniqueness theorem, lower bound and upper bound theorems, mechanisms, analysis and design of frames (single story), design of connections.

Unit 3

Chimneys: Function, types, loads, analysis and design of self-supporting and guyed chimneys.

Unit 4

Yield line analysis and design of slabs: Yield line theory, yield lines, ultimate moment along a yield line, principle of virtual work, analysis and design of slabs of different geometry, support conditions and loading conditions.

Unit 5

Elevated water tanks: Analysis and design for gravity and earthquake loads (static analysis) for square, rectangular and circular water tanks (excluding Intze tank) supported on staging, design of staging and foundation system.

Unit 6

Shear walls: Function, types, analysis and design of cantilever type shear walls

Note: The designs should conform to the latest codal provisions.

Term Work

a) At least three plates showing the details of cold-formed light gauge steel sections used in compression, tension and flexural members

b) At least three plates showing the details based on yield line analysis and design of slabs

- c) Sheet 1: Detailing of any one design problem from Unit 2 or Unit 3
- d) Sheet 2: Detailing of any one design problem from Unit 5 or Unit 6
- e) Report of two site visits covering the contents of the syllabus mentioned above.

References

- 1). Design of Steel Structures, Ramachandra, Standard Publications New-Delhi
 - 2). Structural and Stress Analysis, T.H.G. Megson, Butterworth-Heinemann
 - 3). Design of Concrete Structures, J. N. Bandyopadhyay, PHI
 - 4). Punmia, Reinforced Concrete Structures Vol. 1 and 2, Standard Book House NewDelhi.
 - 5). Sinha and Roy., RCC Analysis and Design . S. Chand and Co. New-Delhi
 - 6). Ramachandra, Design of Steel Structures Vol.-II Standard Publications New-Delhi.
 - 7). Punmia,B. C. and Jain and Jain, Comprehensive Design of Steel Structures, Standard Book House
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Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)
401 009 Elective III (2): Advanced Foundation Engineering

Teaching Scheme

Lectures: 3 hours/week
Practical: 2 hours/week

Examination Scheme

Theory Examination:
In-sem : 30 marks (1 Hour)
End-sem: 70 marks (2.5.Hours)
Term work: 50 Mark

Unit I

IS code provision in respect of subsoil exploration for dams, canals, tunnels, off shore structure, air ports and bridges. IRC, provisions for exploration in respect of roads. Case studies of failures of foundation,

Unit II

Design of pile based on cyclic load test. Study of provision made in different IS codes related to deep foundation, various types of pile. Design of Racer piles & piles subjected to lateral load. Testing and Design of piles subjected to tensile loads.

Unit III

Design of under reamed pile foundation subjected to tensile loads. Design of sand drains and stone columns.

Unit IV

Design of shallow foundations subjected to inclined loads. Design of Raft foundation on different types of soil. Design of combined and isolated footing based on field test including calculation of settlement. Introduction to software available for geotechnical foundation design.

Unit V

Study of various provisions made as per IRC and as per IS in respect of design of well foundation. Case studies of failure of well foundation. Design of Rock fill coffer Dams.

Unit VI

Stress distribution in the shaft, tunnels, underground conduits, classification, load on ditch conduits, positive and negative projecting conduits, and Imperfect ditch conduits.

Term Work

Term work will consist of

A) Any Four of following 6 assignments

- 1) Comparative study of provisions made for the extent of exploration in IS, IRC codes adapted by Indian railways, and PWD
- 2) Detailed study of any two Geophysical methods of exploration
- 3) Computations of Bearing capacity and Settlement of a Shallow Foundation involving inclined loads.
- 4) Design of Pile foundations subjected to inclined load and tensile load.
- 5) Design of Sand Drains.
- 6) Comparative study of provisions for well Foundation as per IS, IRC and code adapted by Indian railways.

B) Computer Modeling

Design of any one type of Deep foundation using computer software

C) Site visit and Case study

- 1) One site visit to any important deep foundation and submission of report on the same giving details of design and construction.
- 2) Any one case study of failure of foundation from the published literature

A) Reference Books

1. Foundation Analysis and Design- Joseph E. Bowels, TATA Mc-Graw hill
2. Design Aids in Soil Mechanics and Foundation Engineering-Shenbaga R Kaniraj, TATA Mc-Grawhill
3. Foundation Design & Construction (4th Ed.)- M.J.Tamlinson, ELBS publication
4. G. A. Leonards, Foundation Engineering, McGraw-Hill, 1962.
5. R.B. Peck, W.E. Hanson and T.H. Thornburn, Foundation Engineering, 2nd Edition, John Wiley and Sons, 1974.
6. “Principles of Foundation Engineering” by B.M. Das
7. Theory and Practice of Pile Foundations Wei Dong Guo CRC Press

B) I.S .Codes

IS: 1892-1979 – “Code of Practice for Subsurface Investigation for Foundation”.

IS: 2131-1981 (Reaffirmed 1997), “Method for Standard penetration Test for Soils”.

IS: 6403-1981 – “Code of Practice for Determination of B.C. of Shallow Foundation”.

IS: 8009 (Part-1) 1976, “Code of Practice for Calculation of settlements of foundations”.

IS: 1904-1986, “Code of Practice for Design and Construction of Foundations in Soils, general Requirements”.

IS: 2911-1979, “Code of Practice for Design and Construction of Pile Foundation,”.

C) Handbooks

1. Fang , H.Y.,(1991),” Foundation Engineering Handbook”, Chapman & Hall,NY.
 2. Teng .W.C.(1962), Foundation Design , Prentice Hall International.
 3. Foundation Design Manual by Narayan V. Nayak, Dhanpat Rai & Sons.
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Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)
401 009 Elective III (3): Hydropower Engineering

Teaching Scheme

Lectures: 3 hours/week

Practical: 2 hours/week

Examination Scheme

Theory Examination:

In-sem : 30 marks (1 Hour)

End-sem: 70 marks (2.5.Hours)

Term work: 50 Mark

Unit I

Energy Resources – Planning and Potential

Power resources – Conventional and Nonconventional, Need and advantages, Overview of World Energy Scenario, energy and development linkage, Environmental Impacts of energy use, Green House Effect, Trends in energy use patterns in India, Hydropower development in India, Hydropower potential.

Unit II

Hydropower Plants

Hydrological Analysis, Classification of hydropower plants - Run of river plants, Storage or Valley dam plants, Pumped storage plants, Introduction to micro hydro, Base load and Peak load plants, advantages and disadvantages, Components of hydropower plants.

Unit III

Load Assessment

Estimation of electrical load on turbines. Load factor, Plant factor, peak demand and utilization factor, load curve, load duration curve, Prediction of load, Tariffs, Hydro-Thermal Mix, Combined Efficiency of Hydro-Thermal-Nuclear Power Plants.

Unit IV

Water Conductor System and Powerhouse

Water Conductor System – Alignment, Intake Structures- Location and Types, Trash Rack. Penstock and pressure shaft, Types of Powerhouses, Typical layout of powerhouse, Components, Power plant equipments, Instrumentation and control.

Unit V

Turbines

Classification, Principles and design of impulse and reaction turbines, Selection of Turbine, Specific Speed, Governing of turbines, Water hammer, Hydraulic Transients and Surge tanks, Draft tubes, Cavitation.

Unit VI

Economics of Hydroelectric Power

Hydropower - Economic Value and Cost and Total Annual Cost. Economic considerations – pricing of electricity, laws and regulatory aspects, Policies, Electricity act – 2003, Investment in the power sector, Carbon credits, Participation of private sector.

Term Work

Minimum eight assignments as per the list given below. **Assignments 1 and 10 are compulsory.**

1. Calculating the electricity bill of upper middle class family that uses various electrical appliances.
2. Determination of power output for a run of river plant with and without pondage.
3. Justification of economics of Pumped storage plants.
4. Design of Kaplan / Francis / Pelton turbine.
5. Determination of economic diameter of penstock using different methods.
6. Design of surge tank.
7. Design of straight conical draft tube.
8. Use of any software to calculate water hammer pressure.
9. Study of any hydropower project.
10. Report based on visit to any micro/small/mega hydropower project

Reference Books

1. Water Power Engineering – M. M. Dandekar and K. N. Sharma
 2. Water Power Engineering – R. K. Sharma and T. K. Sharma, S. Chand and Co. Ltd.
 3. Handbook of Hydroelectric Engineering – P.S. Nigam
 4. Modern Power System Planning – Wang.
 5. Hydropower Resources in India – CBIP
 6. Hydro Power Structures – R. S. Varshney.
 7. Water Power Development – E. Mosonvi, Vol. I & II.
 8. Hydro-electric Engineering Practice – G. Brown, Vol. I, II & III.
 9. Hydro – Electric Hand Book – Creager and Justin.
 10. Water Power Engineering – P. K. Bhattacharya, Khanna Pub., Delhi.
 11. Water Power Engineering – M. M. Deshmukh, Dhanpat Rai Pub.
 12. Manual of “Energy Group” of ‘PRAYAS’, an NGO
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Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)
401 009 Elective III (4): Air Pollution and Control

Teaching Scheme

Lectures: 3 hours/week
Practical: 2 hours/week

Examination Scheme

Theory Examination:
In-sem : 30 marks (1 Hour)
End-sem: 70 marks (2.5.Hours)
Term work: 50 Mark

Unit I

(6 hrs)

Meteorological aspects: Zones of atmosphere, Scales of meteorology, Meteorological parameters, Temperature lapse rate, Plume behavior. Gaussian diffusion model for finding ground level concentration. Plume rise. Types of fuels, Emission Inventory and stack height determination per CPCB norms.

Unit II

(6 hrs)

Ambient Air sampling and analysis: Air pollution survey, basis and statistical considerations of sampling sites, devices and methods used for sampling gases and particulates. Stack emission monitoring for particulate and gaseous matter, isokinetic sampling. Analysis of air samples chemical and instrumental methods. Ambient air quality monitoring as per the procedure laid down by CPCB. National Ambient Air Quality Standards (NAAQS) 2009.

Unit III

(6 hrs)

Indoor air pollution: Causes of air pollution, sources and effects of indoor air pollutants, changes in indoor air quality, control of indoor air pollutants and air cleaning systems. Odour pollution: Theory, sources, measurement and methods of control of odour pollution.

Unit IV

(6 hrs)

Control of air pollution: By process modification, change of raw materials, fuels, process equipment and process operation. Control of particulate matters. Working principle and design of control equipment as Settling chamber, Cyclone, Fabric filter and Electro static precipitator. Control of gaseous pollutants. Control of air pollution from automobiles.

Unit V

(6 hrs)

Land use planning: As a method of control. Economics of air pollution control: Cost/benefit ratio and optimization. Legislation and regulation: Air (Prevention and Control) Pollution Act, 1981. The Environment (Protection) Act 1986. Emission standards for stationary and mobile sources.

Unit VI

(6 hrs)

Environmental impact assessment and management: Methodology for preparing environmental impact assessment (Identifying the sources of air pollution, calculating the incremental values, prediction of impacts and mitigation measures). Role of regulatory agencies and control boards in obtaining environmental clearance for project. Public hearing. Environmental impacts of thermal power plants sugar and cement industry. Environmental management plan.

Term Work:

Term work shall consist of A) One assignments on each unit

B) Detailed industrial visit report. (Min.1)

Reference Books:

- 1) Air Pollution – H. V. N. Rao and M. N. Rao, TMH, Pub.
- 2) Air pollution – KVSG Murali krishna.
- 3) Air Pollution – Perkins.
- 4) Environmental Engineering – Davis, McGraw Hill- Pub.
- 5) Environmental Engineering – Peavy and Rowe, McGraw Hill- Pub.
- 6) Air Pollution – Stern.
- 7) Air Pollution Control – Martin Crawford.

I.S. Codes :

- 1) I.S. 5182 (all parts), and
- 2) I.S. 15442 (2004)

e – Resources:

- 1) <http://nptel.iitm.ac.in/courses-contents/IIT Kanpur and IIT Madras>.
- 2) <http://cpcb.nic.in> 3) <http://moef.nic.in>

Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)
401 009 Elective III (5): Finite Element Method in Civil Engineering

Teaching Scheme

Lectures: 3 hours/week

Practical: 2 hours/week

Examination Scheme

Theory Examination:

In-sem : 30 marks (1 Hour)

End-sem: 70 marks (2.5.Hours)

Term work: 50 Mark

Unit I

Theory of elasticity: Strain-displacement relations, compatibility conditions in terms of strain, plane stress and plane strain problems, differential equations of equilibrium, compatibility condition in terms of stresses, stress-strain relations in 2D and 3D problems. General steps of the finite element method, Applications and advantages of FEM, concept of finite element for continuum problems, discretisation of continuum, use of polynomial displacement function, Pascal's triangle, convergence criteria.

Unit II

Formulation of stiffness matrix, analysis of spring assemblage, member approach for truss and beam element, node numbering, assembly of element equations, formation of overall banded matrix equation, boundary conditions and solution for primary unknowns, applications to truss and beam not involving unknowns more than three.

Unit III

Formulation of stiffness matrix using member approach for portal frame and grid elements, transformation matrix, applications to frame and grid not involving unknowns more than three.

Unit IV

Principle of minimum potential energy, formulation of stiffness matrix for truss element using variational principles. Displacement function for 2D triangular (CST and LST) and rectangular elements, Introduction to 3D elements such as tetrahedron and hexahedron.

Unit V

Use of shape functions, Area co-ordinates for CST element, Shape functions in cartesian and natural coordinate systems, shape functions for one dimensional element such as truss and beam, shape functions of 2D Lagrange and serendipity elements.

Unit VI

Iso-parametric elements in 1D, 2D and 3D analysis, Jacobian matrix, Formulation of stiffness matrix for 1D and 2D Iso-parametric elements in plane elasticity problem.

Termwork

The Termwork shall be based on completion of assignments as given below.

1. At least one assignment on each unit.

2. One assignment based on FEM by using coding tools for
 - a) Formulation of stiffness matrix for any 1-D element
 - b) Formulation of stiffness matrix for any 2-D element
3. Finite Element Method -Software applications of any one of following cases using any standard available software.
 - a) Truss/ grid problem
 - b) Plane stress / plane strain problem

Reference Books

- 1) A first course in the finite element method-Daryl L. Logon, Thomson Publication.
 - 2) Nonlinear finite element analysis by Reddy- Oxford University Press.
 - 3) Introduction to the Finite Element Method – Desai & Abel, CBS Publishers & Distributors, Delhi
 - 4) Introduction to Finite Elements in Engineering – T.R. Chandrupatla & A.D. Belegundu Prentice Hall of India Pvt. Ltd.
 - 5) Matrix, Finite Element, Computer & Structural Analysis – M. Mukhopadhyay, Oxford & IBH Publishing Co. Pvt. Ltd.
 - 6) Finite Element Analysis – Theory & Programming – C.S. Krishnmoorthy, TATA McGraw Hill Publishing Co. Ltd.
 - 7) An Introduction to the Finite Element Method – J.N. Reddy, TATA Mc Graw Hil Publishing Co. Ltd.
 - 8) Theory & Problems – Finite Element Analysis – Gorge R. Buchanan, Schaum’s Outline series. TATA Mc Graw Hill Publishing Co. Ltd.
 - 9) The Finite Element Method – O.C. Zien kiewicz, TATA Mc Graw Hill Publishing Co. Ltd.
 - 10)Finite Element Analysis – S.S. Bhavikatti, New Age International (P) Ltd.
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Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)
401 010 Elective IV (1): Construction Management

Teaching Scheme

Lectures: 3 hours/week

Practical: 2 hours/week

Examination Scheme

Theory Examination:

In-sem : 30 marks (1 Hour)

End-sem: 70 marks (2.5 Hours)

Term work: 50 Mark

Unit - I

Overview of construction sector

(6 Hrs.)

Role of construction industry in infrastructure development, components of infrastructure sector, construction industry nature, characteristics, size, structure, role in economic development, construction management – necessity, applications, project management consultants – role, types, selection and appointment process, project overruns and means to combat them, project monitoring and reporting systems, managerial correspondence and communications, generation and identification of project investment opportunities.

(*At least 2 expert lectures by experts from field are to be conducted on above topics)

Unit - II

Construction scheduling, work study and work measurement

(6 Hrs.)

Construction scheduling

(3 Hrs.)

Construction project scheduling – purpose, factors affecting scheduling, time as a control tool, work breakdown structure, project work breakdown levels, line of balance technique, repetitive project management

Work study and work measurement

(3 Hrs.)

Definition, objectives, basic procedure of work study, symbols, activity charts, string diagrams, time and motion studies.

Unit - III

Labour laws and financial aspects of construction projects

Labour laws

(3 Hrs.)

Need and importance of labour laws, study of some important labour laws associated with construction sector- workmans compensation act 1923, Building and other construction workers act 1996, child labour act, interstate migrant workers act

Financial aspects of construction projects

(4 Hrs.)

Capital investments: importance and difficulties, means of finance, working capital requirements, project cash flow projections and statements, project balance sheet, profit loss account statements

Unit - IV

Elements of risk management and value engineering

(6 Hrs.)

Risk management

(3 Hrs.)

Introduction, principles, types, origin, risk control, use of mathematical models: sensitivity analysis, break even analysis, simulation analysis, decision tree analysis, risk identification,

analysis and mitigation of project risks, role of insurance in risk management.

Value engineering

(3 Hrs.)

Meaning of value, value analysis, value engineering and value management, energy resources, consumption patterns, energy cost escalation and its impact.

Unit - V

Materials management and human resource management

(6 Hrs.)

Materials management

(3 Hrs.)

Materials flow system, role of materials management in construction management and its linkage with other functional areas, vendor networking, buyer-seller relationships, eoq model and its variations, material codification and classification, concept of logistics and supply chain management, role of ERP in materials management – material resource information systems

Human resource management

(3 Hrs.)

Human Resource in Construction Sector, Staffing policy and patterns, Human Resource Management Process, Human Resource Development Process, Performance Appraisal and Job Evaluation, Training and Career planning, Role of ERP in Human Resource Management – Human Resource Information

System (HRIS)

Unit - VI

Introduction to artificial intelligence technique

(6 Hrs.)

Basic terminologies and applications in civil engineering

- (a) Artificial neural network
- (b) Fuzzi logic
- (c) Genetic algorithm

Term Work

1. Site Visit to a Construction project to study following documents and preparing a report –

- a. Project Cash Flow Analysis.
- b. Project Balance Sheet.
- c. Work Break Down Structure.
- d. Materials Flow System in the Project.

2. Scheduling of a Construction Project using Line of Balance Technique.

3. Assignment on Work Study on any two Construction Trades.

4. Assignment on EOQ Model and its variation.

5. Assignment on application of AI techniques in Civil Engineering

6. **Seminar on any one topic from above syllabus.**

Reference Books

- 1. Projects – Planning, Analysis, Selection, Implementation and Review, Prasanna Chandra, Tata McGraw Hill Publications.
- 2. Construction Management and Planning – B. Sengupta and H. Guha, Tata McGraw Hill Publications
- 3. Civil Engineering Project Management – C. Alan Twort and J. Gordon Rees, Elsevier Publications
- 4. Total Project Management – The Indian Context – P. K. Joy, MacMillian Publications
- 5. Materials Management–Gopalkrishnan & Sunderasan,Prentice Hall Publications.
- 6. Human Resource Management – Biswajeet Pattanayak, Prentice Hall Publishers

7. Laws for Engineers : Dr. Vandana Bhat and PriyankaVyas –Published by PRO-CARE,5/B,/Sagarika Society,Juhu Tara Road,Juhu,Santacruz(W),Mumbai-400049 (procure@technolegal.org)

8. Labour and Industrial Laws – S. N. Mishra, Central Law Publications.

9. Artificial Neural Network – Venganarayanan – Prentice Hall

10. Genetic Algorithm – David & Goldberg

11. Fuzzi Logic & Engg Applications – Ross

12. Principles of Construction Management by Roy Pilcher (McGraw Hill)

e-Resources

1. ERP Software-Builders Management Software

2. Project mates Construction Software

Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)
401 0010 Elective IV (2): Advanced Transportation Engineering

Teaching Scheme

Lectures: 3 hours/week

Practical: 2 hours/week

Examination Scheme

Theory Examination:

In-sem : 30 marks (1 Hour)

End-sem: 70 marks (2.5 Hours)

Term work: 50 Mark

Unit I

Transport System Planning: Transport policy, process, and types of surveys. OD matrix. Travel demand forecasting trip generation, modal split analysis, trip distribution, route assignment analysis, Transport Networks, network flow analysis.

Unit II

Urban Transport Technology: Classification, mass and rapid transit system, Introduction to Intelligent Transportation System (ITS), Public Transport policy, intermediate. Introduction to BRT, Mono rail, sky bus, metro projects, grade separated interchanges such as flyovers, underpasses, overpasses, concept of Integrated Inter Model transit system.

Unit III

A. Transport Economics & Financing: Vehicle operations cost, running cost, pollution cost, value of travel time, road damage cost, congestion cost, accident cost economic evaluation, various economic studies. Transportation plans – Benefit cost method, Net present value method, First year rate of return method, Internal rate of return method & comparison of various methods. Pavement management systems.

B. Highway Financing: Pay as you go method, credit financing, private financing, BOT, BOOT, dedicated road funds, road pricing, tolls, private provisions, advantages & limitations.

Unit IV

Traffic Systems: Traffic impacts, traffic studies, level of service, traffic analysis process, basic traffic theory, intersection studies, turning movements, flow, delays, and queuing, signal design, grade separated intersection, parking studies, Traffic generation and parking, parking demand surveys and requirements, parking facilities, instrumentation of traffic monitoring,

Unit V

Study of flexible pavement: Highway pavements and airport pavements, Flexible pavements studies, performance studies, surface, surface characteristics of pavements, profile measurements, pavement unevenness, skid resistance, its measurements, IRC, AASHTO

guide to design of pavement, pavements failure, maintenance strategy Freezing of soil, B.C. soil, desert soil etc. Strengthening of pavement – Benkelmen beam method. Distresses in Pavements.

Unit VI

a) Study of rigid pavement: Concept of rigid pavement, comparison of rigid pavement over flexible pavement , Stress distribution in layered media, one and two layered system, joints in rigid pavement, longitudinal construction joints, design as per IRC guidelines, design of joints, dowel bars, temperature reinforcement, pavement failure, maintenance strategy strengthening of rigid pavement, types of overlays, flexible over rigid, rigid over rigid, mechanization in pavement construction.

b) Overlay types and their design as per IRC.

Term work :

1. Traffic counts using
 - a. Manual Methods
 - b. Moving vehicle survey method
2. Design of a flexible pavement using IRC-37.
3. Design of rigid pavement using IRC-58.
4. Road deflections measurement using Benkelmen Beam's method.
5. Design of an overlay using IRC-81.
6. Conduct of distress surveys on a flexible pavement or a rigid pavement and determining its condition index (PCI).
7. Study of any expert system or a pavement management system.
8. Study of format of household survey and recording sample measurements.

Reference Books:

1. Highway Engineering - Laurence I Hewes & Clarkson H Oglesby
2. Traffic Engineering and Transport Planning - L R Kadiyali.
3. The Design and Performance of Road Pavements - David Croney, Paul Croney.
4. Understanding Traffic System -Michel A Taylor, William Young, PeterW Bonsall.
5. Principles of Urban Transport Systems Planning - B. G.Hutchinson.
6. Introduction to transport planning - M. J. Bruton.
7. Transport Networks - Potts Oliver (Academic Press).
8. Modern Construction Equipments's and methods- Frank Harries.

9. Principles of Pavement Design - E.F. Yoder (John Wiley & Sons, Inc USA).
10. Fundamentals of Transportation Engineering - C. S. Papacostas.
11. Pavement analysis and Design – Huang Y H, Prentice Hall, Englewood Cliff, New Jersey.
12. Introduction to Transportation Engg. and Planning – Morlok E K, McGraw-Hill company.
13. Fundamentals of Traffic flow Theory – Drew, McGraw-Hill book co
- 14 A course in Traffic Planning and design-Saxena Subhash,Dhanpat Rai & sons,Delhi
- 15 Traffic analysis (New technologies new solutions)-Taylor M P ,Hargreen Pub.Co. New Delhi

Hand Books:

Handbook of Road Technology _Lay M. G.Gorden Breach Science Pub.Newyork.

e-Resources:

- 1) www.nptel.iitm.ac.in/courses/iitkanpur
 - 2) www.cdeep.iitb.ac.in/nptel
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Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)
401 010 Elective IV (3): Statistical Analysis and Computational
Methods in Civil Engineering

Teaching Scheme

Lectures: 3 hours/week
Practical: 2 hours/week

Examination Scheme

Theory Examination:
In-sem : 30 marks (1 Hour)
End-sem: 70 marks (2.5 Hours)
Term work: 50 Mark

Unit I: Numerical methods: Bisection method, False Position method, Newton Raphson, Secant method.

Unit II: Numerical Integration Need and scope, trapezoidal rule, Simpsons 1/3rd rule, Simpsons 3/8th rule, Gauss Quadrature method.

Unit III: Optimization techniques: Introduction to optimization techniques-concepts and applications, direct solution of linear equations-Gauss elimination and Gauss Jordan method. Iterative solution of linear equations- Gauss Seidel method.

Unit IV: Statistical methods: Introduction, collection, classification and representation of data, measures of central value (mean, median, mode), measures of dispersion, sampling.

Unit V: Probability and Probability distributions including Binomial, Poisson, Normal, test of hypothesis, chi-square test

Unit VI: Correlation analysis, regression analysis. Coefficient of correlation, probable error, single and multiple regression, curve fitting, Interpolation and extrapolation

Term Work

1. One exercise on each unit.
2. Any two problems to be solved using c, c++, excel or using softwares like SPSS, minitab, etc.
3. One exercise on formulation and solution of an optimization problem applicable to any field of Civil Engineering.

Reference Books

1. Statistical methods – S.P.Gupta
2. Probability and Statistics for Engineers – Richard A Johnson
3. Probability and Statistics for Science and Engineering – G Shankar Rao
4. Numerical Methods – E Balagurusamy
5. Numerical methods for Engineers – S.Chapra, R.P.Canale
6. Higher Engg. Mathematics – B.S. Grewal

Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)
401 010 Elective IV : Open Elective : 4(a): Plumbing Engineering

Teaching Scheme

Lectures: 3 hours/week

Practical: 2 hours/week

Examination Scheme

Theory Examination:

In-sem : 30 marks (1 Hour)

End-sem:70 marks (2.5.Hours)

Term work: 50 Mark

Unit I

Introduction to plumbing engineering:

(4 Lectures)

Definition- plumbing engineering/public health engineering, Indian plumbing industry, Roles of plumbing contractor, plumber, plumbing consultant, plumbing terminology, Principles of plumbing, head and pressure, plumbing hydraulics and pneumatics, Effect of frictional loss in pipes, Properties of water, Norms for water quality as per CPCB, Alternate water sources, Green plumbing code supplement-India (GPCS-I)

Introduction to codes and standards:

(4 Lectures)

Introduction to UPC-I and ITM, other codes applicable in plumbing, Approvals of authority having jurisdiction, General regulations, Testing and labeling, Alternative materials, workmanship and minimum standards, Prohibited fittings and practices, Local laws related to plumbing, Architectural and structural coordination, plumbing shafts, Sunken toilet floors, Ledge walls.

Unit II

Rain (Storm) water drainage:

(3 Lectures)

Introduction, Measurement of rainfall, rainfall intensity, Primary and secondary drains, Conductors and leaders, Runoff coefficients, Primary and tributary catchment areas, Piping system, Sizing of gutters, Channels and pipes, Traps required, Rainwater harvesting, Design components of RWH, Surface and subsurface storage and recharge system, Subsoil drains.

Solar water heater:

(3 Lectures)

Introduction to USEC-I, Open and closed loop system, Capacity, Sizing, Space requirement for solar systems, Flat plate collectors, evacuated tubes, Hot water tanks, Hot water distribution, Safety, water and energy conservation.

Unit III

Plumbing fixtures and fittings:

(4 Lectures)

Plumbing fixtures, Water conserving fixtures, Rating system for water efficient products, (WEP-I), Water closets, Bidets, Urinals, Flushing devices, Lavatory and bath units, Kitchen sinks, Water coolers, Purifiers, Drinking water fountain, Cloth washers, Mop sinks, Dish washers, Receptors,

Overflows, Strainers, Prohibited fixtures, Floor slopes, Minimum spacing, Standard heights.

Water Supply: (4 Lectures)

Types of water supply pipes Fittings and joints, Galvanized iron, Copper, Stainless steel, HDPE, MDPE, Rigid PVC, CPVC, PPR, Composite pipes, (PE-AL-PE), PEX, Joints, Jointing methods and materials, Tools etc. Pipe protection, Velocity, pressure, temperature limitations, Water Supply Fixture Unit (WSFU), Sizing, testing, Valves and regulators, Backflow prevention, Commissioning, Water tanks.

Unit IV

Traps and Interceptors (4 Lectures)

Traps-Purpose, Fixture traps and floor traps, Prohibited traps, Trap arm, Developed length, Trap seal, Trap seal protection, Venting of traps, Trap primers, Building traps, Clarifiers, Grease interceptors, Sizing, oil and sand interceptors.

Vents: (4 Lectures)

Vent requirement, Parts of vent system. Parts of vent system, Materials, Sizing, Vent connections, Flood rim level, Island sink venting, Venting of interceptors, Water curtain and hydraulic jump, Termination of vent stacks, Stack venting, Yoke vent, Wet venting.

Unit V

Sanitary system: (3 Lectures)

Fixtures, Appliances and appurtenance, Classification of fixtures, Soil and waste Vs black and grey water, Soil fixtures, Bathroom fixtures, Accessories, Indirect waste connections, Food handling establishments, Fixtures below invert level.

Building Drains: (6 Lectures)

Introduction, Four systems of plumbing, One pipe and two pipe system, Air admittance valves and sovents, Comparison of systems, Vent pipe, Symphonic action, Antisiphon and vent pipes, Loop, Circuits, Types of building drainage pipes, Fittings and jointing methods, Clean outs, Drainage fixture units (DFU), Sizing, Testing, Case study.

Unit VI

Building Sewers: (3 Lectures)

DFU, Change in direction of flow, Hydraulic jump, Sudsing stack, Cleanouts, Pipe grading, pipes and fittings suitable for building sewers, RCC, PVC, Nu-Drain, Stoneware., Sizing, testing, Types of traps, Gully, Chambers and manholes, Materials, Venting, Sizing, Testing, Sumps, Pumps, Sewage disposal, Septic tanks.

Plumbing in high rise buildings: (6 Lectures)

Definition of high rise building, Multiple storage tanks, Plumbing shafts, Break pressure tanks, Water supply, Hydro pneumatic system, Pressure reducing valves, Building drainage system, Rain water system, Sizing,

Testing, Case study, Introduction to centralized hot water supply, Principles of design,

Term work

Term work will consist of any 8 assignments with necessary plans / sketches

1. Introduction of available codes in plumbing
2. Introduction of associations in plumbing in India and outside India
3. Detailed hydraulic design for high rise structure
4. Detailed hydraulic design for plumbing of G+1 Bungalow
5. Compilation of rules and regulations of local governing bodies
6. A brief on smart plumbing for smart cities
7. Roles of plumbing contractor and plumbing consultants
8. Report on Plumbing fixtures and fittings and explain any ten
9. Report on materials for water supply and drainage
10. Report on necessity of traps, intercepts and vents
11. Tabulate WSU and DFU
12. Design solar water piping for G+1 Bungalow

Books:

- 1 “ Plumbing Engineering” by Deolalikar
- 2“Plumbing, Sanitation and Domestic Engineering” Volume – 1to 4 by G. S. Williams, Mc Graw Hill
- 3 “Plumbing, Sanitation and Domestic Engineering, Data Sheets & Wall Charts” by G. S. Williams, Mc Graw Hill
- 4“Plumbing Engineering, Theory and Practice” by Subhsh Patil. SEEMA Publishers Mumbai

Codes -- Uniform Plumbing Code-India—

Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)
401 010 Elective IV : Open Elective : 4(b): Green Building Technology

Teaching Scheme

Lectures: 3 hours/week
2 hours/week

Examination Scheme

Theory Examination: Practical:
In-sem : 30 marks (1 Hour)
End-sem: 70 marks (2.5.Hours)
Term work: 50 Mark

Unit I:

Materials And Its Applicability , Indoor Environmental Quality, Reuse And Recycle of Construction Waste

- A) Eco Friendly/ Green Building Materials: To understand Environmental impact of building materials. Eco Friendly building materials, their composition, availability, production, physical properties etc. Application of the Eco Friendly/ Green Building materials for different components of the buildings at different level, both internally and externally.
- B) Indoor environmental quality , Low VOC materials : Adhesives - Sealants, Paints- Coatings etc
- C) Construction Waste as a Resource- Resource Economics, Disposable Materials, Recovery, Recycling, Collection, Processing, Governmental Role in Waste Management, Potential for Reuse.

Unit II

Site / Building Planning

- A) Sustainable Site planning: wind / sun path, water management , material use, landscape, topography
- B) Climate Responsive Architecture: orientation, solar- wind, Building envelope
- C) Thermal comfort indices. Heat flow through building materials. Thermal properties of common building materials available in India. Thermal performance of building envelope. Air movement and buildings. Ventilation and buildings. Wind an Stack effect. Mechanical ventilation. HVAC System, Day lighting. Passive and sustainable architecture. Passive and active systems.

Unit III

Embodied Energy, Life Cycle Assessment, Environmental Impact Assessment, Energy Audit and Energy Management

- A) Embodied energy of various construction materials. Introduction to the Concept: “Life Cycle assessment of materials”
- B) EIA : Introduction to EIA., Process of EIA and its application through a case study., EIA as a strategic tool for sustainable development.
- C) Energy Management

Unit IV

Appropriate Technologies / Approaches for :

- A) Water conservation / efficiency
- B) Sanitation (Grey water, black water management, SWM)
- C) Treatments
- D) Biogas
- E) Composting
- F) Solar energy and its applicability through panels, photovoltaic cells etc
- G) Use of “ LED, CFL, Fresnel Lens” etc
- H) Wind energy and its use....
- D) Orientation aspects in site planning to achieve maximum daylight and natural ventilation

UNIT V:

- A) Clean Development Mechanism
- B) Kyoto Protocol
- C) Energy Conservation Building Code

UNIT VI

Rating Systems: - Leadership in Energy and Environmental Design (**LEED**), **Green Globes**,

National Association for Home Builders (**NAHB**) – For Homes, Building Research Establishment Environmental Assessment Method (**BREEAM**), Green Star by Green Building Council Australia (**GBCA**), **LEED India**, Comprehensive Assessment System for Built Environment Efficiency (**CASBEE**), **Estimada** -Abu Dhabi Urban Planning Council (UPC) etc.

Term work: 50 Marks

Any Eight of the following

- A) To study: Innovative Materials Developed by CBRI, SERC,
- B) To study : Environmental Audit of any existing building and prepare a report
- C) To study , analyze present scenario of organic waste collection and management of any of the premise; preferably hotels
- D) To compare the benefits under different rating systems
- E) To prepare detailed plan for a hypothetical site indicating utility of solar path, wind direction, rainfall intensity etc to make it sustainable
- F) To prepare a report on carbon credit.
- G) To prepare a report on energy efficient buildings in India
- H) To study sustainable planning aspects for urban housing
- I) Study of Design of On Site Sanitation Systems for Indian conditions developed by Appasaheb Patwardhan Safai V Paryavaran Tantraniketan, Dehugaon .
- J) To study the benefits given by Municipal Corporations to Green Buildings

Reference Books and Additional Reading material:

- Manual of Tropical housing and climate by Koenisberger
- Climate responsive architecture by Arvind Krishnan
- Manual of solar passive architecture - by Nayak J.K. R. Hazra J. Prajapati.
- Energy Efficient Buildings in India by Milli Mujumdar
- Green Building Materials by Ross Spiegel and Dru Meadows
- Publications from - CBRI – Roorkee, - IDC – Mumbai, NID - Ahmedabad
- Solar Energy in Architecture and Urban Planning by Herzog Thomas
- Solar Heating, Design Process by Kreider Jan F
- Energy - Manual for college teachers (CEE publications)
- Renewable Energy & Environment - A policy analysis for India (CEE publications)
- Sustainable Building Design Manual-Volume I and II –TERI Publication
- Mechanical and Electrical Systems in Construction and Architecture-by Frank R Dagostino

- Principles of Air conditioning-By V.Paul Lang
 - Heating, Cooling and lighting design methods for architecture. By Lechor Worbert
 - LEED
 - Green Globes
 - Florida Green Building Coalition
 - The green building process
 - Design and construction relationships
 - Site and landscape strategies
 - Building energy system strategies
 - Water cycle strategies
 - Materials selection strategies
 - Indoor Environmental Quality (IEQ) analysis and strategies
 - Construction team responsibilities and controls
 - Building commissioning strategies
 - Economic issues and analysis
 - Use of the Green Strategies cost estimating tool
 - Future directions in green high performance building technologies
 - Green building codes and standards
 - International Green Construction Code
 - ASHRAE 189P
 - ANSI/GG 01 , TERI, BREEAM etc
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Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)
401 010 Elective IV : Open Elective : 4(c): Ferrocement Technology

Teaching Scheme

Lectures: 3 hours/week

Practical: 2 hours/week

Examination Scheme

Theory Examination:

In-sem : 30 marks (1 Hour)

End-sem:70 marks (2.5.Hours)

Term work: 50 Mark

Unit 1 :

What is ferrocement ?

- a) Definition, Basic concept like bond increase. Comparison with concretes like RCC, Prestressed, Asbestos cement, Fiber reinforced, Polymer concretes. Composition of ferrocement. Special types of ferrocement. Ferrocement as substitute for conventional building materials. Typical characteristics and their applications.
- b) Raw materials, skills, tools and plants. Ferrocement as material of construction. Forming a ferrocement structure. Properties and specifications of raw materials. Proportioning of cement mortar. Job requirements of required skills. Tools and plants.

Unit 2 :

Mechanical properties and construction methods:

- a) Mechanical properties and typical features affecting design. Properties under static and dynamic loading. Shrinkage and creep. Testing of ferrocement.
- b) Methods of constructing ferrocement structures. Standardizing method of construction. Planning the work. Fabricating skeleton, tying meshes and mortaring. Curing. Maintenance. Protective surface treatments. Damage to ferrocement structures.

Unit 3:

Strength through shape and design:

- a) Strength through shape. Design of structure based on form and shape. Forms in nature, various structural forma and their behavior. Typical strengths of different materials. Comparative study of various forms.
- b) Design of ferrocement structures. Design, analysis and optimization. Special design considerations for ferrocement. Typical features of ferrocement affecting design. Conventional design methods like working stress, load factor, applied to ferrocement. Design based on equivalent area method for compression, tension and flexural members. Specific surface method and crack control method, Design of structures subjected to membrane stresses. Design of shaped structures in ferrocement like stiffened plates, arch faced walls, stiffened cavity walls and hollow floors and beams, Design of forms like 'T' 'U' 'T' '+' 'L'

Unit 4:

Cost analysis and ferrocement in Building construction.

- a) Cost analysis : Factors governing cost analysis. Special considerations for ferrocement structures. Cost comparison with conventional construction. Specifications for ferrocement structures. Quantity analysis of material and labour for ferrocement items. Cost and value of ferrocement construction.
- b) Ferrocement in building construction. Ferrocement in foundations, walls, floors roofs. Ferrocement single wall construction. Design and construction of houses with cavity walls, hollow floors and hollow beams. Staircases and other building accessories. Earthquake resisting structures. Special characteristics of ferrocement to resist shock loading design and construction of quake proof structures.

Unit 5 :

Hydraulic and soil retaining structures in ferrocement :

- a) Hydraulic structures. Why ferrocement? Water retaining structures, Storage tanks of various types. Structures across streams. Ferrocement in layered form used for lining, water proofing and surface coating.
- b) Soil retaining structures. Types of retaining walls and their comparison with ferrocement arch faced wall. Design and method of fabrication and casting. Ferrocement counterfort retaining wall. Ferrocement containers for storing granular materials.

Unit 6:

Space structures and precast products :

- a) Ferrocement large size special purpose structures. Space structures like shells, pyramids, domes corrugated catenaries.
- b) Precast ferrocement products : Why ferrocement for precasting? Methods of precasting. Design of precast elements. Ferrocement precast walling and flooring panels. Joints in precast ferrocement elements.

Term work : Minimum 02 site visits with detailed reports and one assignment based on each unit (Journal consisting of total 6 assignments + 2 visit reports)

Books Recommended :

- 1) Ferrocement Technology- A Construction Manual. -- Dr. B. N. Divekar
Published by the Author.
- 2) Ferrocement --- : B. R. Paul and R. P. Pama. Published by International Ferrocement Information Centre. A.I.T. Bangkok, Thailand.
- 3) Ferrocement and laminated cementitious composites --: A.E. Naaman. Publisher : Techno-press, Ann Arbor, Michigan, USA.
- 4) Ferrocement - Materials and applications; Publication SP 61, A C I Detroit. USA
- 5) State of the art report and guide for design, Construction and repairs of Ferrocement; ACI Committee Report. No. ACI 549R-88 and ACI 549.1R.88. Published by American Concrete Institute, Detroit, USA.
- 6) Chapter 1 titled 'Ferrocement' by S. P. Shah and P. N. Balaguru in book

- ‘Concrete Technology and Design Vol. II, Editor; R. N. Swamy.
- 7) Proceedings of International Symposiums on ‘Ferrocement and thin reinforced composites – Ferro 1 to Ferro 10. Available with International Ferrocement Information Centre, A I T Bangkok, Thailand.
 - 8) Ferrocement Conference Proceedings of Ferrocement Society, India---FS-2011, F.S.2013 ,F.S.2015

Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)
401 010 Elective IV : Open Elective : 4(d): Subsea Engineering

Teaching Scheme

Lectures: 3 hours/week

Practical: 2 hours/week

Examination Scheme

Theory Examination:

In-sem : 30 marks (1 Hour)

End-sem: 70 marks (2.5.Hours)

Term work: 50 Mark

Unit1

Introduction to oil and gas industry: general view of oil and gas industry, technological challenges and future developments. Overview of deepwater developments: introduction, deepwater areas and potential, challenges, route for development. Metocean and environmental conditions: Overview of the determination of Metocean conditions (meteorological and oceanographic) and the influence of wave, wind, tide and current on marine operations. Introduction to marine ecology and its impact on marine operations.

Unit 2:

Introduction to subsea infrastructure development: Summarizes the current state of the art and highlights the design challenges. Outlines the way in which water depth influences the architecture and technology of Oil and Gas infrastructure.

Flow assurance: overview of flow assurance and the fundamentals of flow management for subsea production systems, analysis of flow assurance issues like paraffin deposition; hydrate formation and blockage; Asphaltene precipitation; emulsions; experimental methods, flow assurance assessment methods; prevention, mitigation and remediation tools for flow assurance issues; thermal management and insulation materials.

Unit 3:

Subsea installation and intervention: Overview of the installation of subsea plant, risers and pipelines and the main intervention methods including AUVs, ROVs and divers.

Subsea operations and control: An overview of the principle methods of subsea control including electrical, acoustic and hydraulic systems.

Subsea processing and artificial lift: introduction the analytical and numerical models used to design subsea processing systems for sustained recovery of hydrocarbons

Unit 4:

Reliability and integrity management: Introduction to Risk Assessment, FMECA and HAZOPS, Monitoring, Intervention and Inspection Methods, Data Management
Field economics and future challenges: An overview of economic decision making in field development and a view of future challenges such as deep water, high temperature, remote fields.

Unit5:

Subsea field equipment, structures and architectures: scale of operations, environmental factors, A description of each of the pieces of the subsea

infrastructure, their use and interconnection including subsea trees, flow lines, umbilicals, risers, moorings and pipelines

Materials and corrosion: material selection and analysis, structure property relationship and harsh environment. Types of corrosion found in the oilfield with emphasis on the effects of acid gases (CO₂ and H₂S).

Unit 6:

Pipelines and design: Introduction to pipeline engineering, the main pipeline design challenge in deepwater. Analysis and design methods of pipelines that address stress analysis, buckling and collapse of deepwater pipelines. Limit state based strength design methods. Geotechnical aspects of pipeline design and its installation.

Deepwater risers: different design options available for deepwater risers, and defines the key design drivers for each. General principles of stress analysis: An introduction to the principles of stress analysis and the principles of reliability based design, finite element analysis.

Reference books:

- Introduction of Pipe Stress Analysis-Sam Kannappan P.E.-John Wiley and Sons Publication
- Handbook of Subsea Structural Engineering-Yong Bai and Qiang Bai –Gulf Professional Publication
- Dynamic Analysis and Design of Offshore Structures – Srinivasan Chandrasekaran-Springer link
- Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms-Working Stress Design-American Petroleum Institute
- Deepwater Foundations and Pipeline Geomechanics-William O. Mccarron

Termwork-

One assignments on each unit + report(s) of site visits (Min .1), confined to the course

Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)
401 010 Elective IV : Open Elective : 4(e): Wave Mechanics

Teaching Scheme

Lectures: 3 hours/week
Practical: 2 hours/week

Examination Scheme

Theory Examination:
In-sem : 30 marks (1 Hour)
End-sem: 70 marks (2.5.Hours)
Term work: 50 Mark

Unit 1: Introduction to Wave mechanics

6 lectures

Introduction, Generation, Decay, Classification, Measurement, Basic hydrodynamic equations, Wave Forecasting: The Significant Wave, Simplified versus Elaborate Technique, Numerical Wave Modelling (introduction only, no mathematical treatment): Phase resolving models, Phase averaging models, Introduction to Wave watch III, SWAN, MIKE

Unit 2: Wave Theories

6 lectures

wave theories - Linear wave theory , Bottom boundary condition, Kinematic free surface boundary conditions, Dynamic free surface boundary conditions, Solution to linear water wave problem, wave length, wave celerity, classification of waves , wave particle velocities, water particle acceleration, water particle displacement, Wave energy: potential and kinetic energy.

Unit 3: Wave propagation

6 lectures

Wave shoaling, wave refraction, wave diffraction, wave reflection, combined effects using numerical solutions, wave breaking, wave set up and set down, wave runup, radiation stresses.

Unit 4: Wave statistics

6 lectures

Wave statistics: Short term wave statistics, Tucker method, Long term wave statistics- Gumbel distribution, Weibull Distribution, Log Normal Distribution
Wave spectrum analysis, wave spectra and statistics, Theoretical spectra: Pierson-Muskowitz Spectrum, Bretschneider Spectrum, JONSWAP Spectrum, Scott Spectrum, Scott-Wiegel Spectrum

Unit 5: Coastal area and processes

6 lectures

Overview of Coastal Engineering, The Coastal Area, The Beach and Nearshore System, Dynamic Beach Response to the Sea, Causes of Shoreline Erosion, Coastal Protection Methods and Navigation Works

Unit 6: Littoral processes

6 lectures

Introduction of Littoral process, Littoral Materials, Littoral Wave Conditions, Nearshore Currents, Littoral Transport, Role of Foredunes in Shore Processes, Sediment Budget, Engineering Study of Littoral Processes

Term Work

One exercise/assignment on each unit

Books:

Sarpkaya, T., Issacson, M. (1981). "Mechanics of Wave Induced Forces on Offshore Structures", Van Nostrand Reinhold.
U.S. Army Corps of Engineers. (2002). "Coastal Engineering Manual", U.S. Army Corps of Engineers, Washington, D.C

WMO. (1988), "Guide to Wave Analysis and Forecasting", Pub. NO. 702, World Meteorological Organization, Secretariat of WMO, Geneva
Dean, R. G., Darlymple R. A. (1991). "Water Wave mechanics for Engineers and Scientists", World Scientific
Sorensen, R. M. (1997). "Basic Coastal Engineering", Springer
Mani, J.S., (2012), "Coastal Hydrodynamics", PHI Learning Pvt. Ltd, New Delhi

Savitribai Phule Pune University
Board of Studies in Civil Engineering
Structure for B.E. Civil 2012 Course (w.e.f. June 2015)
401006 Project work

Teaching Scheme:

Tutorial: 6 Hrs/week

Examination Scheme:

TW: 50Marks Oral 100 marks

Project Work will be evaluated for an individual student based on the presentation of the work done in a year(I Sem +II Sem) and submission of the report .The student may work in a group during project work ,if any.

The project work shall be consisted of any one of the following nature in Civil Engineering related subjects.

- 1.Experimental investigation.
- 2.Software development.
- 3.Cost economic analysis.
- 4.Case study with own design.
- 5.Working model design and fabrication.
- 6.Case study with development of methodology using soft computing tools.

The details of report writing and preparation of report will be similar to that of as mentioned in syllabus of Project Phase I in first semester.

Evaluation of Project work in final exam. will be done by the pair of internal guide having minimum 3 years approved experience as teacher and external guide .

It is recommended to promote the students to present a paper based on project work in appropriate conference / journal.