

4. Dynamics of Structures by Humar, J.L., Prentice Hall, 1990.
5. Structural Dynamics by Mario, Paz, CBS Publ. New-Delhi, 1995.
6. Advanced Dynamics by Timoshenko, S., McGraw Hill Book Co, NY, 1948.
7. Elements of Vibration Analysis by Meirovitch, L., 2nd Edi. McGraw Hill Intr. Edi.,Singapore, 1986.
8. Introduction of Structural Dynamics, Biggs, J.M., McGraw Hill, NY, 1964
9. Principles and techniques of vibrations by L Meirovich, 1997, Prentice Hall, NJ.
10. Analytical methods in vibrations by L Meirovich, 1967, Macmillan, NY.
11. Theory of vibrations by W T Thompson, 1983, Prentice hall, New Delhi
12. Vibration: fundamentals and practice by C W de Silva, 1999, CRC Press, Boca Raton.
13. Mechanical Vibrations by S S Rao, 2004, 4th Edition, Pearson Education, New Delhi.
14. Probabilistic theory of structural dynamics by Y K Lin, 1967, Mc-GrawHill.
15. Introduction to random vibrations, N C Nigam, 1983, The MIT press, Massachussets.

Course Outcomes:

On the completion of this course, the student will be able to

- 1) Convert a physical structure into SDOF system/model
- 2) Find response of free and force vibration (harmonic, periodic and transient) of SDOF system
- 3) Calculate natural frequency and mode shapes of MDOF system
- 4) Carry out modal analysis of MDOF system
- 5) Get the Response of structures by performing experiments and/or by computer simulation.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-I	CT-II	TOTAL			
<i>Subject Code:</i>	CE07TPE04C							70	100	3
<i>Subject:</i>	Foundation Engineering	3	0	0	15	15	30			

Course Learning Objectives:

- To introduction of different methods of soil exploration.
- To provide comprehensive studies of shallow foundation and calculate settlements.
- To analyze various types of footings & rafts.
- To introduction of various types of piles foundations and to calculate bearing capacity.
- To introduce Comprehensive studies of Retaining walls and determine stability.

Course Content:

UNIT-1 SITE INVESTIGATION AND SELECTION OF FOUNDATION

Scope and Objectives, Methods of Exploration , Auguring and Boring ,Wash Boring and Rotary Drilling ,Depth and Spacing of Bore Holes ,Soil Samples ,Representative and Undisturbed, Sampling Methods Split Spoon Sampler, Thin Wall Sampler, Stationary Piston Sampler ,Penetration Tests (SPT and SCPT) ,Data Interpretation ,Strength Parameters ,Bore Log Report and Selection of Foundation.

UNIT-2 SHALLOW FOUNDATION

Location and Depth of foundation, Codal Provisions, Bearing Capacity of Shallow Foundation on Homogeneous Deposits ,Terzaghi's Formula and BIS formula ,Factors Affecting Bearing Capacity Bearing Capacity from In-Situ Tests (SPT, SCPT and Plate Load) ,Allowable Bearing Pressure , Seismic Considerations in Bearing Capacity Evaluation, Determination of Settlement of Foundations

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on Granular and Clay Deposits ,Total and Differential Settlement , Allowable Settlements , Codal Provision , Methods of Minimizing Total and Differential Settlements.

UNIT-3 FOOTINGS AND RAFTS

Types of Isolated Footing, Combined Footing, Mat Foundation, Contact Pressure and Settlement Distribution, Proportioning of Foundations for Conventional Rigid Behavior, Minimum Thickness for Rigid Behavior, Applications, Compensated Foundation, Codal Provisions.

UNIT- 4 PILE FOUNDATION

Types of Piles and Functions ,Factors Influencing the Selection of Pile , Carrying Capacity of Single Pile in Granular and Cohesive Soil , Static Formula ,Dynamic Formulae (Engineering News and Hileys) ,Capacity from In-Situ Tests (SPT and SCPT) , Negative Skin Friction , Uplift Capacity, Group Capacity by Different Methods (Feld's rule, Converse — La-Barrae formula and Block Failure Criterion) ,Settlement of Pile Groups , Interpretation of Pile Load Test (Routine Test Only), Under Reamed Piles, Capacity under Compression and Uplift , Cohesive -Expansive ,Non Expansive — Cohesionless Soils , Codal Provisions.

UNIT- 5 RETAINING WALLS

Plastic Equilibrium in Soils ,Active and Passive States , Rankine's Theory for Cohesionless and Cohesive Soil ,Coulomb's Wedge Theory , Condition for Critical Failure Plane ,Earth Pressure on Retaining Walls of Simple Configurations , Culmann's Graphical method ,Pressure on the Wall due to Line Load ,Stability Analysis of Retaining Walls ,Codal Provisions.

Text Books:

- 1) Foundation Analysis and Design by J. E. Bowels, McGraw Hill. Companies, Inc. 6th Ed. 2001.
- 2) Principles of Foundation Engineering by B. M. Das, CENGAGE Learning. Seventh Edition.
- 3) Foundation Engineering Handbook by R. W. Day, McGraw Hill. ConstructionASCE Press. Ed. 2006.

Reference Books:

- 1) Basic and Applied Soil Mechanics by Gopal Ranjan & A.S. R. Rao, New Age International (P) Limited Publishers, New Delhi-110002.
- 2) Textbook of Soil Mechanics and Foundation Engineering –Geotechnical Engineering Series (PB 2018) by V.N. S. Murthy, CBS Publications, New Delhi
- 3) Soil Mechanics by Robert V. Whitman & T. William Lambe, Wiley India Pvt Ltd., New Delhi.
- 4) Soil Mechanics and Foundation Engineering (Geotechnical Engineering) by Dr. P.N. Modi, Standard Book House(Rajsons Publications Pvt Ltd), New Delhi-110002

Course Outcomes-At the end of the course completion, the students shall be able to:

- CO1 Understand different methods of soil exploration.
- CO2 Analyze various shallow foundations and calculate different types of settlements.
- CO3 Understand various types of footings & rafts.
- CO4 Analyze bearing capacity of piles with different methods
- CO5 Design stability of Retaining walls.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-I	CT-II	TOTAL			
<i>Subject Code:</i>	CE07TPE04D							70	100	3
<i>Subject:</i>	Rock Mechanics	3	0	0	15	15	30			

Course Learning Objectives:

- To understand the basics of rock mechanics and able to analysis stress.
- To calculate strain and determine physical properties of rocks.
- To determine mechanical properties of rocks by different methods.
- To analyse different models of stress-strain in rocks.
- To determine the static & dynamic elastic constants of rocks.

Course Content:

UNIT – 1: INTRODUCTION TO ROCK MECHANICS

Definition, Scope, Importance & Development, Application in Mining, Discontinuities; Description of Discontinuities, Introduction to Mapping and Hemispherical Projection of Discontinuities, Barton's Shear Strength of Joints.

Analysis of Stress: Introduction, Definition and Basic Concepts, Stress in a Plane(2-D), Mohr's Circle of Stress, Secondary Principal Stress, Equations of Equilibrium, Plane Stress Equations.

UNIT – 2: ANALYSIS OF STRAIN

Introduction, Definition and Basic Concepts, Strain in a Pane (2-D), Mohr's Circle of Strain, Equations of Compatibility, Stress-Strain Relationship, Basic Equations in Elastic Theory, Pain Strain Equations, Elasto Plastic Behaviour of Rocks, Stress – Strain Curves of Various Rocks.

Physical Properties: Definition and Determination of Density, Hardness, Porosity, Permeability, Moisture Content, Degree of Saturation. Electrical and Thermal Properties of Rocks.

UNIT – 3: MECHANICAL PROPERTIES

Definition and Determination of Compressive Strength, Tensile Strength, Shear Strength, Triaxial Testing. Time Dependent Properties, Scaling of Laboratory Data to In-Situ Values.

Rock Indices: Protodyakanov Strength Index, Point Load Strength Index, RQD, In-Situ Strength Properties of Rocks, Necessity and Requirement, Methods of In-Situ Stress Measurements, Plate Load Test, Cable Jack Test, Bore Hole Test, Dilatometer Test, Flat Jack Test, Hydraulic Fracture and Velocity Propagation.

UNIT – 4: RHEOLOGICAL MODELS

Relationship and Rate of Change of Stress-Strain for Idealizing Materials – Models Representing Elastic, Plastic, Viscous, Elasto-Plastic, Non-Elastic and Brittle Rock Properties.

UNIT – 5: STATIC AND DYNAMIC ELASTIC CONSTANTS OF ROCKS

Static Elastic Constants of Rocks: Introduction, Definition, Instrument, Measurement of Deformation, Mechanical, Optical, Electrical Gauges, LVDT, Calculation of Elastic Constants of Rocks.

Dynamic Elastic Constants of Rocks: Introduction, Elastic Wave, Calculation of Modulus of Elasticity.

TEXT BOOKS:

- 1) Rock Mechanics for Engineers - B. P. Verma, 2nd edition, Khanna Publishers, 1989.

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- 2) Strata Mechanics in Coal Mining - Jeremic, K. L. Jeremic, Rotterdam, Balkema, 1985.
- 3) Fundamentals of Rock Mechanics - Jager & Cook, Methuen andco. London, 1969.

REFERENCE BOOKS:

- 1) Hand Book on Mechanical Properties of rocks - R.D. Lama, V. S. Vutukuri, Vol. I to IV, Transtech Publications, 1978.
- 2) Mechanics and Engineering - Charles Jaeger, Cambridge University Press, 1979.
- 3) Rock Mechanics for Underground Mining - 2nd edition, Brady and Brown, Kluwer Academic Publishers, 1993.
- 4) Ground Mechanics in Hard rock Mining - M. L. Jeremic, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.
- 5) Rock Mechanics and Design of Structures in Rock - L. Obert & W.I. Duvall, John wiley and Sons, 1966.
- 6) Introduction to Rock Mechanics - R. E. Goodman, 2nd edition, John wiley and Sons, 1989.
- 7) The elements of Mechanics of Mining Ground - B. S. Verma Vol. I. Julin & Co. Lucknow 1981.
- 8) Engineering Rock Mechanics, An Introduction to the Principles - John A. Hudson and John. P. Harrison Pergamon Press 1997.

Course Outcomes: At the end of the course completion, the students shall be able to:

- CO1 Learn basics of rock mechanics and calculate stresses.
- CO2 Determine physical properties of rocks and strain.
- CO3 Evaluate mechanical properties of rocks.
- CO4 Compare stress strain in rocks by different methods.
- CO5 Determine the static & dynamic elastic constants of rocks.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-I	CT-II	TOTAL			
<i>Subject Code:</i>	CE07TPE04E									
<i>Subject:</i>	Water Resources Planning & Management	3	0	0	15	15	30	70	100	3

Course Learning Objectives:

1. To learn how to assess water resources
2. To study how to develop suitable plans for water resources development and management
3. To understand various types of water resources systems.
4. To learn managing the water resources quality and quantity
5. To understand water quantity and quality modelling.

Course Content:

UNIT 1: Introduction: Role of water in national development, assessment of water resources of country, scope of water resources development vis-a-vis environment, Irrigation development in India, utilisation of Irrigation potential.

UNIT 2: Planning: Water resources planning process; planning for single purpose and multipurpose projects, estimation of different water needs and project formulations, comparison of alternatives, cost-benefit analysis.

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UNIT 3: Water Resources Systems: Definition, types of system, optimization techniques, system approach, system analysis, linear programming, and formulation of a linear programming problem, formulation with different types of constraints, graphical analysis, graphical solution, simplex method, optimization techniques and systems approach.

UNIT 4: Management: Evaluation and monitoring of water quantity and quality, managing water distribution networks for irrigation, flood control and power generation, inter-basin transfer of water, conjunctive use of surface and ground water.

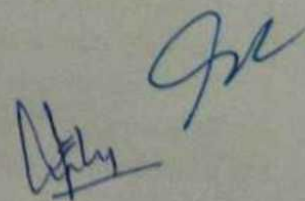
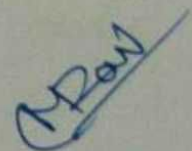
UNIT 5: Modelling: Water quantity and quality modelling, evaluation of impacts of water resources projects on river regimes and environment, reservoir sedimentation and watershed management.

Text Books:

1. Principles of Water Resources Planning – Good Man, A.S., (Prentice Hall, Inc., Englewood Cliffs, N.J. 1984.)
2. Water Resources Systems -S Vedula and P P Mujumdar, Tata McGraw-Hill Education, 2005
3. James, L. Douglas, and Robert R. Lee, Economics of Water resources Planning, McGraw-Hill Book Company, 1971.
4. Quentin Grafton, R. and Karen Hussey, Water Resources Planning and Management, Cambridge University Press, 2011.
5. Water Resources System, Planning and Management – M.C. Chaturvedy (Tata McGraw Hill)
6. Water Resources System, Planning and Management – Helweg O.J. (John and Wiley & Sons)

Course Outcomes- after completion of the course the students shall be able to

1. Describe the potential of assessing water resources
2. Prepare master and strategic water resources planning
3. Apply the optimization techniques for water resources systems.
4. Exercise the management of water resources in different real life situations
5. Solve various water resources problems using modelling.



**SYLLABUS
(SEMESTER-VII)**

Subject Code:	CE7TPE5X	CREDITS:3			Internal Assessment (IA)			ESE
Subject:	Professional Elective - 5X	L	T	P	CT 1	CT 2	TOTAL	70
		3	-	-	15	15	30	
Professional Elective-5A or Professional Elective-5B or Professional Elective-5C or Professional Elective-5D or Professional Elective-5E		Any one subject to be Selected from the Professional Electives						
Professional Elective-5 (PE Group-5)								
CE07TPE05A	Industrial Structures							
CE07TPE05B	Airport Planning and Design							
CE07TPE05C	Highway Construction and Management							
CE07TPE05D	Contracts Management							
CE07TPE05E	Construction Projects Planning & Systems							

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-I	CT-II	TOTAL			
<i>Subject Code:</i>	CE07TPE05A							70	100	3
<i>Subject:</i>	Industrial Structures	3	0	0	15	15	30			

Course Learning Objectives:

The purpose of this course is to develop an in-depth knowledge in the area of design of industrial structure with the latest code of practice as per the Indian Standard.

Course Content:

UNIT: I Planning and functional requirements- classification of industries and industrial structures- planning for layout- requirements regarding lighting ventilation and fire safety- protection against noise and vibrations

UNIT: II Industrial buildings- roofs for industrial buildings (Steel) - design of gantry girder- design of corbels and ribs- machine foundations

UNIT: III Design of Pre-Engineered Buildings

UNIT: IV Power plant structures- Bunkers and silos- chimney and cooling towers- nuclear containment structures.

UNIT: V Power transmission structures- transmission line towers- tower foundations- testing towers

TEXT BOOKS

1. Handbook on Machine Foundations by P. Srinivasulu and C. V. Vaidyanathan, Structural Engineering Research Center
2. Tall Chimneys- Design and Construction by S. N. Manohar Tata Mc Grawhill Publishing Company

REFERENCES:

1. Transmission Line Structures by S. S. Murthy and A. R. Santakumar McGraw Hill
2. SP 32: 1986, Handbook on functional requirements of Industrial buildings
3. Design of steel structures by N. Subramanian

Course Outcomes-

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

CO1 Plan the functional requirements of structural systems for various industries.

CO2 Get an idea about the materials used and design of industrial structural elements.

CO3 Realize the basic concepts and design of power plant structures.

CO4 Design power transmission structures.

CO5 Possess the ability to understand the design concepts of Chimneys, bunkers and silos

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SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-I	CT-II	TOTAL			
<i>Subject Code:</i>	CE07TPE05B							70	100	3
<i>Subject:</i>	Airport Planning and Design	3	0	0	15	15	30			

Course Learning Objectives:

1. To familiarize students with of airport planning.
2. To develop the knowledge for design and analysis of airport runway, taxiway and airport pavement crust.
3. To understand air traffic control system.

Course Content:

UNIT-1 Airport Planning: Significance of transport, Different modes of transportation, Airport master plan- FAA recommendation. Regional planning, airport site selection, survey for site selection, Estimation of future air traffic, Characteristics of aircraft, Environmental consideration.

UNIT-2 Runway Design: Orientation of runway , Basic runway length, Corrections for basic runway length, Runway geometric design

UNIT-3 Taxiway Design: Controlling factors of taxiway, Geometric design for taxiway, Design for exit taxiways.

UNIT- 4 Airport Pavement Design: Design factors, Design of flexible pavement, Design of rigid pavement, design of overlay pavements

UNIT- 5 Air Traffic Control and Visual Aids: Air traffic control objectives, control system. Visual aids-airport markings and lighting

Text Books:

1. Dr. S. K. Khanna, M.G. Arora and S.S. Jain, Airport Planning & Design, Nem Chand & Bros.,Roorkee
2. G.V. Rao Airport Engineering, Tata McGraw Hill Pub. Co., New Delhi
3. S.C. Rangwala and K.S, Rangwala, Airport Engineering, Charotar Publishing House Pvt. Ltd, Anand

Course Outcomes-

After learning the course the students should be able to:

1. Understand the fundamentals of airport planning.
2. Familiarize with design of runway.
3. Recognize design of taxiway
4. Understand airport pavement design
5. Analyse air traffic control system.

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-I	CT-II	TOTAL			
Subject Code:	CE07TPE05C									
Subject:	Highway Construction and Management	3	0	0	15	15	30	70	100	3

Course Learning Objectives:

1. To familiarize students with highway construction materials.
2. To develop ability to pavement design.
3. To instruct students to concept of evaluation and strengthening of pavement.
4. To interpret students to concept of highway drainage.
5. To develop knowledge on concept of highway maintenance.

UNIT 1: Highway Materials: Soil, Desirable Properties, Classification, CBR, G. I., Modulus of Subgrade Reaction, Aggregates and their Characterisations, Bituminous materials, Bituminous mixes, Concept of Superpave.

UNIT 2: Construction of Pavement: Highway Constructions - Earth Roads, Gravel roads, Soil Stabilized Roads, WBM Roads, Bituminous roads. Surface dressing, Seal Coat, Tack, Coat, Prime Coat, Grouted Macadam, Premix Methods and their Construction Procedures Construction of Cement Concrete Pavement Slab.

UNIT 3: Evaluation And Strengthening: Flexible And Rigid Pavement Evaluation, Strengthening of Pavements, Design of Overlays

UNIT 4: Highway Drainage: Significance of highway drainage, requirements of highway drainage, Design of surface drainage system, Design of sub-surface drainage system, Road construction in water-logged areas.

UNIT 5: Highway Maintenance: Types of defects in Flexible and Rigid pavement, Causes and Treatment, Special repairs. Pavement Evaluation- Pavement surface conditions and Structural Evaluation.

Text Books:

1. S.K. Khanna and C.E.J. Justo, "Highway Engineering", Nem Chand Publication.
2. Partha chakrobarty & Animesh Das "Principles of Transportation Engineering", PHI.
3. Subhash C Saxena "textbook of Highway and traffic engineering" CBS publishers and distributions pvt. Ltd.
4. L.R.Kadiyali&N.B.Lal, "Principles & Practices of Highway Engg, Khanna Publishers.
5. Specification for Road and Bridge Works (Ministry of Surface Transport - Published by Indian Roads Congress.

Course Outcomes:

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

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1. identify the highway materials.
2. design and analysis of pavement design.
3. conduct and analysis of evaluation and strengthening of pavement.
4. design and analysis of surface and sub-surface drainage system.
5. use various repair techniques for highway maintenance.

SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-I	CT-II	TOTAL			
<i>Subject Code:</i>	CE07TPE05D							70	100	3
<i>Subject:</i>	Contracts Management	3	0	0	15	15	30			

Course Learning Objectives:

- To introduce about various Authorities, indulge in construction contract management.
- To impart knowledge on municipal bye-laws related to construction.
- To elaborate about construction contracts, arbitration, and litigation procedures

Course Content:

UNIT-1 Introduction and concepts of Construction law-public law-government departments and local authorities.

UNIT-2 Private law-contracts-torts-property law and building law-concepts-salient features sections

UNIT-3 Construction contracts-contracts specifications-types of contract documents used for construction.

UNIT- 4 Contract procurement- selection of contractor-contract procedure-salient features.

UNIT- 5 Arbitration and litigation procedure-preparation, settlement, evidence, price adjustment-need for the formulae-civil engineering and building formulae- practical implications.

Text Books:

1. Gajaria G. T., laws relating to building and engineering contracts in India, M. M Tripathi Private Ltd., Bombay, 1982.
2. Jimmie Hinze, construction contracts, 2nd edition. McGraw hill, 2001.
3. Joseph T. Bockrath, contracts and the legal environment for engineers and architects, 6th edition, McGraw Hill, 2000.

Course Outcomes-

1. To remember about various Authorities, indulge in construction contract management.
2. To understand about municipal bye-laws related to construction.
3. To remember & understand about various classifications of construction contracts.
4. To review about various steps of contract procurement in construction industry.
5. To evaluate the role of Arbitration and litigation procedure in settlement of contract related disputes.

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