Material Science

Material Science

COURSE OBJECTIVE

The aim of the course is to give knowledge and proficiency in construction as regards to material technology.

COURSE CONTENTS

UNIT I

Introduction:

Introduction to Material Science and Engineering:

Type of Materials- Metallic Materials, Polymeric Materials, Ceramic Materials, Composite Materials, Electronic Materials, Magnetic Materials, Photonic/Optical Materials, Construction Materials, Recent advances in Materials Science- Smart Materials, Nano Materials, Selection of Materials

Atomic Structure and Bonding:

Structure of Atoms, Atomic Numbers and Atomic Masses, Electronic structure of Atoms, Quantum Numbers of Electrons of Atoms, Crystal and Amorphous Structure in Materials –Crystalline and Amorphous Materials. Type of Atomic Bonds- Metallic Bonds, Covalent Bonds, Ionic Bonds, Vander Walls Bond, Primary and Secondary Bonds.

UNIT II

Properties and Failure of Materials:-

Mechanical Properties of Materials, Thermal properties of Materials, Electrical and Magnetic Properties of Materials, Failure of Materials –Fracture, Fatigue and Creep , Corrosion and Wear

UNIT III

Construction Materials I- Masonry and Concrete

Stones, Bricks, Their properties, Mortar-Cement and Lime mortar, Proporation, Mixing and Properties of Mortar, Properties of Masonry, Concrete Proportioning, Properties of Fresh & Hardened Concrete

UNIT IV

Construction Materials II- Steel , Wood & Polymers

Structural Steel, Reinforcing Steel –Grades and Types, Properties of Reinforcing Steel ,Structural Wood, Physical Properties of Wood, Wood Products- Plywood, Particle Board, Fibre Board, Polymers-Thermoplastics, Thermosets, Elastomers, General Properties of Polymers, Common Polymers and their Properties, Modified Polymers, Uses of Polymers.

UNIT V

Construction Materials III- Bituminous Materials and Mixtures

Bitumen, Tar, Pitch and Asphalt, Asphalt Cement, Cut back Asphalt, Emulsified and Blown Asphalt, Properties of Asphalts, Consistency, Rate of Curing, Resistance to Action of Water, Ductility and Adhesion etc., Grades of Asphalt, Viscosity and Penetration Grading, Performance based Grading, Cut back Asphalt Grades, Asphalts Concrete, Asphalt Pavement, Applications of Asphalt.

COURSE OUTCOME

The student will be able to identify the use of different materials used in civil engineering.

REFERENCES

1. *DR Askeland, K Balani, The science and Engineering of Materials, Cengage Learning*
2. *Somayaji S., Civil Engineering Materials, 2nd ed Pearson*
3. *Sahu G.C, Jena J.; Building materials and Construction, Mc Graw hills, new Delhi.*
4. *Smith William,Hashmi J, Prakash R; Material Science & Engineering; 5ed Mc-Graw Hill.*
5. *S K Duggal, Building Materials, New Age International.*
6. *P C Vaghese, Building Materials, PHI Learning.*
7. *S.C. Rangwala, Engineering Materials, Charotar.*
8. *R. Balasubramaniam, Material Science & Engineering, Wiley India*
9. *Purushattam Raj, Building materials and Techniques, Pearson*
10. *Mamlouk MS, Building materials and Construction Engineering 3rd, pearsons.*
11. *Gambhir & Jamwal, Building Materials, Mc Graw Hill.*

Fluid Mechanics

Fluid Mechanics

COURSE OBJECTIVE

To understand the basic concepts of fluid mechanics for undergraduate students in Civil Engineering. The course will begin with the fundamental concepts of fluid flow and proceed to cover various flow phenomena and approaches to analyse the flow phenomena. Some important applications shall also be covered.

COURSE CONTENT

UNIT I

Fundamental Fluid Properties: Engineering units of measurement, mass, density, specific weight, specific volume, specific gravity, surface tension, capillarity, viscosity, bulk modulus of elasticity, pressure and vapour pressure. **Fluid Statics**: Pressure at a point, pressure variation in static fluid, Absolute and gauge pressure, manometers, Forces on plane and curved surfaces (Problems on Gravity Dams and Tainter Gates), buoyant force, stability of floating and submerged bodies, relative equilibrium.

UNIT II

Kinematics and Dynamics of Flow: Introduction to basic lines - Streamlines, Streaklines, Pathlines. Various types of fluid flow. Velocity potential function, Stream function, Vorticity and Circulation, Flow net. Basic equations of fluid flow like Energy equation, continuity equation and momentum equation. Bernoulli's equation and its applications.

UNIT III

Laminar Flow and Turbulent Flow: Introduction to laminar & turbulent flow, Reynolds experiment & Reynolds number. Velocity distribution, Laminar and turbulent boundary layers and laminar sublayer, boundary layer concept, aging of pipes. Losses due to sudden expansion and contraction, losses in pipe fittings andvalves, concepts of equivalent length, hydraulic and energy gradient lines, siphon, pipes in series, pipes in parallel, branching of pipes. Concept of Water Hammer transmission of power.

UNIT IV

Open channels: Channel geometry and elements of channel section, velocity distribution, energy in open channel flow, specific energy, types of flow, critical flow and its computations, uniform flow and its computations, Chezy's and Manning's formulae, determination of normal depth and velocity, Normal and critical slopes, Economical

sections. Basic assumptions and dynamic equations of gradually varied flow, characteristics analysis and computations of flow profiles, rapidly varied flow hydraulic jump in rectangular channels and its basic characteristics, surges in open channels & channel flow routing.

UNIT V

Forces on immersed bodies: Types of drag, drag on a sphere, a flat plate, a cylinder and anaerofoil development of lift, lifting vanes, Magnus effect.

Fluid Machines: Turbines: Classifications, definitions, similarity laws, specific speed and unit quantities, Pelton-wheel turbine-their construction and settings, speed regulation, dimensions of various elements, Action of jet, torque, power and efficiency for ideal case, characteristic curves. Reaction turbines: construction & setting, draft tube theory, runaway speed, simple theory of design and characteristic curves, cavitation.

COURSE OUTCOME:-

- Knowledge of the basic concepts and principles of fluid mechanics.
- Ability to analyze fluid flow problems with the application of momentum and energy equations.
- Ability to distinguish between various types of fluid flow.
- Ability to find solutions to typical pipe flow problems
- Basic knowledge of hydraulic machines.

REFERENCES

- *Modi & Seth , Hydraulics & Fluid Mechanics ,Rajson's Publication Pvt Ltd*
- *A K Jain, Fluid Mechanics: Including Hydraulic Machines, Khanna Publisher.*
- *Subramanyam,Fluid Mechanics & hydraulic machines - - Tata McGraw-Hill*
- *R.J.Garde , Engg Fluid Mechanics , SCITECH Publishers Pvt Ltd*
- *Merle C. Potter, David C. Wiggert, Bassam H. Ramadan, Mechanics of Fluid, Cengage Learning.*
- *John F. Douglas, J.M. Gasoriek, John Swaffield, Lynne Jack, Fluid Mechanics, Pearson Education.*
- *K.R. Arora, Fluid Mechanics, Hydraulics and Hydraulic Machines, Standard Publishers Distributors..*
- *Balchandran, Engg Fluid Mechanics, PHI Learning Pvt Ltd*
- *Ojha & Chandramouli , Fluid Mechanics & Machinery , Oxford University Press*
- *Fox, Mc Donald, Pritchard Fluid Mechanicas– Wiley India, New Delhi.*
- *Narsimhan S Fluid Mechanics –. – University Press, Mumbai.*
- *Ratnam Chanamala kothapalli A.V. Fluid Mechanics & Machniery — I.K. International, New Delhi.*
- *Flow Through Open Channel -- Tata McGraw-Hill*
- *S K Som, G Biswas, Suman Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill Education.*

LIST OF EXPERIMENTS:-

1. To Verify Bernoull's equation.
2. To verify Impulse Imomentum equation.
3. To find out the terminal velocity of a spherical body in water.
4. Calibration and study of Venturimeter.
5. Determination of Cc, Cv, Cd of Orifices
6. Draw characteristics Curves of Pelton Wheel Turbine.
7. Draw characteristics Curves of Francis Turbine.
8. Draw characteristics Curves of Kaplan Turbine.
9. Calibration of Nozzle meter and Mouth Piece
10. Reynolds experiment for demonstration of stream lines & turbulent flow
11. Determination of metacentric height
12. Determination of Friction Factor of a pipe
13. Determination of coefficient of discharge for a broad crested weir & to plot water surface profile over weir

Strength of Materials

COURSE OBJECTIVE

To familiarize the student with the various stresses that may act on a material such as compressive stress, tensile stress, tangential stress, etc and the response of a material to each of these types. The course will define basic concepts and calculations that will come handy in long-term to civil engineering students.

COURSE CONTENT

UNIT I

Simple Stress and Strains: Concept of Elastic body stress and Strain, Hooke's law, Various types of stress and strains, Elastic constants, Stresses in compound bars, composite and tapering bars, Temperature stresses. Complex Stress and Strains- Two dimensional and three dimensional stress system. Normal and tangential stresses, Principal Planes, Principal Stresses and Strains, Mohr's circle of stresses.

UNIT II

Bending and Shearing Stresses: Theory of simple bending, Concept of pure bending and bending stress, Equation of bending, Neutral axis, Section-Modulus, Differential equation of the elastic curve, Determination of bending stresses in simply supported, Cantilever and Overhanging beams subjected to point load and uniformly distributed loading, Bending stress distribution across a section of beam, Shearing Stress and shear stress distribution across a section in Beams.

UNIT III

Determination of Slope and Deflection of beams by Double Integration Method, Macaulay's Method, Area Moment Method, Conjugate Beam Method, and Strain Energy Method, Castiglione's Method, and Unit Load Method.

UNIT IV

Columns and Struts: Theory of columns, Slenderness ratio**,** Direct and bending stresses in short columns, Kern of a section. Buckling and stability, Euler's buckling/crippling load for columns with different end conditions, Rankin's formula, Eccentric loads and the Secant formula-Imperfections in columns. Thin Pressure Vessels: cylinders and spheres. Stress due to internal pressure, Change in diameter and volume. Theories of failure.

UNIT V

Torsion of Shafts: Concept of pure torsion, Torsion equation, Determination of shear stress and angle of twist of shafts of circular section, Torsion of solid and hollow circular shafts, Analyses of problems based on combined Bending and Torsion. Unsymmetrical Bending: Principal moment of Inertia, Product of Inertia, Bending of a beam in a plane which is not a plane of, symmetry. Shear center; Curved beams: Pure bending of curved beams of rectangular, circular and trapezoidal sections, Stress distribution and position of neutral axis.

COURSE OUTCOME

An ability to identify and compute various mechanical stresses in material and the material's response to each. An ability to apply this knowledge in science and engineering models.

REFERENCE

1. *Punmia B.C., Mechanics of Materials, , Laxmi Publications (P) Ltd.*
2. *S.S Bhavikaati, Strength of Materials, Vikas Publisher, new Delhi*
3. *Rajput R. K., Strength of Materials, S. Chand.*
4. *S. Ramamrutham, R. Narayanan, Strength of Materials, Dhanpat Rai Publications.*
5. *R. Subramaniam, Strength of Materials, Oxford University Press.*
6. *Sadhu Singh , Strength of Material , Khanna Publishers*
7. *Mubeen A , Mechanics of solids , Pearsons*
8. *D.S Prakash Rao, Strength of Material , University Press , Hyderabad*
9. *Debrath Nag, Strength of Material , Wiley*
10. *Jindal , Strength of Material , Pearsons.*
11. *Bansal R.K, Strength of Materials, Laxmi Publisher, New Delhi.*
12. *Nash, W.A., Strength of Materials, Mcgraw hills, New Delhi.*
13. *Chandramouli, Strength of Materials, PHI learning*
14. *Dongre A.P., Strength of Materials, Scitech, Chennai*
15. *Negi L. S ,Strength of Materials, McGraw Hill Professional.*
16. *Raj Puroshattam, Strength of Material , Pearsons*
17. *J.M. Gere,.J. G. Barry Mechanics of Material, Cengage Learning*

LIST OF PRACTICALS

1. Study of Universal testing Machine
2. To determine the Compressive and Tensile Strength of Materials.
3. To determine the Brinell Hardness of Materials.
4. To determine the Rockwell Hardness of Materials
5. To determine the Toughness of the materials.
6. To determine the stiffness of the spring.
7. To determine the deflection of Beam by the use of deflection-beam apparatus.

DC Advance Surveying, & Remote Sensing

Advance Surveying, & Remote Sensing

COURSE OBJECTIVE

To introduce the student to the importance and objectives of surveying. The course would begin with the basic concepts of surveying and move on to discuss advancements such as GID and Remote Sensing.

COURSE CONTENTS

UNIT I

Introduction :Basic Definitions of Surveying and Levelling , Principles , Classification of surveying ,Methods of Linear Measurement Ranging , Accessories for linear measurement ,Chain Surveying , Compass Surveying , Plane Table Surveying , Computation of Area and Volumes

UNIT II

Theodolite Traversing & Types:Digital levels and theodolites, Electronic Distance measurement (EDM), Total Station and Global Positioning Systems (GPS), Digital Planimeter.

UNIT III

Control Surveys:Providing frame work of control points, triangulation principle, co naissance, selection and marking of stations, angle measurements and corrections, baseline measurement and corrections, computation of sides, precise traversing

UNIT IV

GPS Surveying: Introduction & components of GPS, Space segment, control segment and user segment, Elements of Satellite based surveys-Map datums, GPS receivers, GPS observation methods and their advantages over conventional methods.

UNIT V

Remote Sensing & GIS : Principle, components, classification, remote sensing data acquisition process, different types of remote sensing satellite imagery with special relevance to Indian Remote Sensing Satellites (IRS) and applications. GIS-Definition, components and advantages.

COURSE OUTCOME

- The student will be able to understand the basic principles of surveying and how they are implemented in practice.
- The student will be able to adjust for errors that occur in practising of various surveying methods.
- The student will be able to plan a survey for applications such as road alignment and height of the building.

Surveying Project - Student will go for a week-long Surveying Camp and carry out a Project Work.

REFERENCES

1. *B.C Punmia , Surveying Vol-II & III ,Laxmi Publication.*
2. *S.K. Duggal, Surveying Vol. II McGraw Hill Publishing Company Ltd.*
3. *Saikia MD, Das BM, Das MM, Surveying, McGraw hill*
4. *T.P. Kanetkar and S.V. Kulkarini Surveying and Leveling-Part-I & II , Pune Vidyarthi Griha Prakashan, Pune.*
5. *Gopi A, Satikumar R- Advance surveying, Pearson*
6. *Remote Sensing and image interpretation by Lillesand T.M. and Kiefer R.W.*
7. *R.Agor, Advance Surveying ,Khanna Publisher*
8. *Chandra AM, Higher Surveying, New Age International, new Dwlhi*
9. *Bhavikatti SS, Surveying and Levelling Vol. II, I.K International*
10. *Venkatramaiah, Surveying, University Press, Mumbai*
11. *Bhatta Basudeb, , Remote Sensing and GIS, Oxford, New Delhi.*
12. *Subramanaian, Surveying & levelling, Oxford, New Delhi.*
13. *Joseph George Fundamentals of Remote Sensing*

List of Practical

1. Measurement of Distance by Chaining and Ranging.
2. Locating Various Objects by Chain or Cross-Staff Surveying.
3. Measurement of bearings of sides of traverse with prismatic compass and computation of correct included angle.
4. Determination of elevation of various points with dumpy level by collimation plane method and rise & fall method.
5. Fixing bench mark with respect to temporary bench mark with dumpy level by fly levelling and check levelling.
6. Measurement of vertical angles with theodolite.
7. Determination of horizontal distance between two inaccessible points with theodolite.
8. Locating given building by theodolite traversing.

DC Geology

Geology

COURSE OBJECTIVE

To study geological science and apply the same in the field of civil engineering. The course begins with history of earth's formation. It moves on to the different types of soil found on earth and finally describes the various applications of geological science in civil engineering. Also to make the students familiar with remote sensing and geographical information system.

COURSE CONTENT

UNIT I

Introduction and Physical Geology- Objects and scope of geology. The crust and the interior of the earth, origin and age of the earth, sub-aerial land, sub-terrain weathering, denudation and deposition, wind, river, glacial and marine erosion, volcanoes, soil, formation of soil profile ,geological classification of soil and concept of earthquake, Plate- tectonics.

Mineralogy and Crystallography- Fundamentals of mineralogy, study of common rock forming minerals, ores and minerals of economic importance to civil engineering. elements of crystallography and introduction to crystal systems.

Petrology: Composition of earth's crust, study of igneous, sedimentary and

Metamorphic rocks and their formation, characteristics classification, Rocks of civil engineering importance.

Geology of India: Physical features of India, Brief geological history of India, occurrence of important ores and minerals in India.

UNIT II

Structural Geology: Structures related to rocks, Dip, Strike and outcrops, Classification and detailed studies of geological structures i.e. folds, Faults, Joints, Unconformity and their importance in Civil Engineering.

UNIT III

Applied Geology: Introduction to applied geology and its use in civil engineering, properties of rocks, selection of sites for roads, bridges, dams, reservoirs and tunnels. Prevention of Engineering structures from seismic shocks, stability of hill sides, water bearing strata, artesian wells, Use of remote-sensing techniques in selection of above sites.

UNIT IV

Remote Sensing: Basic principles, roll of remote sensing in civil engineering, components, classification, remote sensing data acquisition process, various interpretation techniques in remote sensing, different types of remote sensing satellite imagery with special relevance to Indian Remote Sensing Satellites (IRS) and applications.

UNIT V

Geographic Information Systems (GIS): Definition, components and advantages, application of geological knowledge in civil engineering projects like dams, bridges, roads, tunnels and multistory buildings, geological factors in the design of buildings.

COURSE OUTCOME

1. Understanding of the role of geology in design and construction processes.
2. Ability to apply geological concepts and approaches to rock engineering projects.
3. Ability to identify and classify rocks using basic geological classifications and understand the formation and properties of each category.
4. Ability to use the geological literature to establish the Geo-technical framework needed to properly design and construct heavy civil engineering projects.
5. Understanding the application of remote sensing and geographical information system in civil engineering projects.

REFERENCE

1. *Parbin Singh – "Engineering and General Geology"*
2. *S.K. Garg – " A text Book of Physical and Engineering Geology"*
3. *Varghese P.C., Engineering Geology for civil engineering, PHI*
4. *A. Parthasarthy- Engineering Geology, Wiley*
5. *Duggal, Pandey and Rawal- Engineering Geology, Macgra Hill*
6. *Duggal SK, pandey, Rawal, Engineering Geology, Mc Graw Hills*
7. *Kamith Vasudev, Engineering Geology, University Press*
8. *Alam MM. Engineering Geology and Geo- Engineering, Axiom Books*
9. *Gangopadhay S., Engineering Geology, Oxford*
10. *Gulati ; Geotechnical Engineering; TMH*
11. *P.K. Mukerjee – " A text Book of Geology"*
12. *Das and Sobhan, Principles of Geo-technical Engineering, Cengage Learning*
13. *Kueffer and Lillesand, Remote sensing and Image interpretation*
14. *. Understanding GIS, ISRI Publications.*
15. *Valdiya K. S., Environmental Geology in Indian Context –Tata Mc Graw Hill*

LIST OF EXPERIMENT

1. Identification of simple rock-forming minerals and important ores.
2. Identification of rocks.
3. Simple map Exercises.
4. Field Visit / Geological Excursion.