

Course code	CSE-103				
Category	Program Core Course				
Course title	AI for Engineering				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

### Objectives of the course

1. Understand the evolution and various approaches of AI K2
2. Understand data storage, processing, visualization, and its use in regression, clustering etc.
3. Understand natural language processing and chatbots K2.
4. Understand the concepts of neural networks K.
5. Understand the concepts of face, object, speech recognition and robots.

### Unit -1

#### An overview to AI

The evolution of AI to the present, various approaches to AI, What should all engineers know about AI? Other emerging technologies, AI and ethical concerns

#### Data & Algorithms

History Of Data, Data Storage And Importance of Data and its Acquisition, The Stages of data processing Data Visualization, Regression, Prediction & Classification, Clustering & Recommender Systems

### Unit -2

#### Natural Language Processing

Speech recognition, Natural language understanding, Natural language generation, Chatbots, Machine Translation

### Unit 3

#### Artificial Neural Networks

Deep Learning, Recurrent Neural Networks, Convolutional Neural Networks. The Universal Approximation Theorem, Generative Adversarial Networks

### Unit 4

#### Applications

Image and face recognition, Object recognition, Speech Recognition besides Computer Vision, Robots, and Applications

#### Reference Books:

1. Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig, Prentice Hall
2. Artificial Intelligence by Kevin Knight, Elaine Rich, Shivashankar B. Nair, Publisher : McGraw Hill

3. Data Mining: Concepts and Techniques by Jiawei Han, MichelineKamber, Jian Pei, Publisher: Elsevier Science.
4. Speech & Language Processing by Dan Jurafsky, Publisher : Pearson Education
5. Neural Networks and Deep Learning A Textbook by Charu C. Aggarwal, Publisher: Springer International Publishing
6. Introduction to Artificial Intelligence By RajendraAkerkar, Publisher : PHI Learning

Course code	BSC-102				
Category	BASIC SCIENCE COURSES				
Course title	Chemistry				
Scheme and Credits	L	T	P	Credits	
	2	0	0	2	
Class work	30Marks				
Theory Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

### Course Objective:

1. To analyse microscopic chemistry
2. Understand the concept of hardness of water and phenomenon of corrosion
3. Rationalise periodic properties
4. Distinguish the ranges of the electromagnetic spectrum

### UNIT-I

**Atomic and molecular structure:** Schrodinger equation (Introduction and concept only). Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations (derivation excluded). Molecular orbital energy level diagrams of diatomic molecules. Pi-molecular orbitals of butadiene and benzene. Crystal field theory and the energy level diagrams for transition metal ions.

### UNIT-III

**Periodic properties:** Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states.

### UNIT-III

**Stereochemistry:** Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations, symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis.

**Organic reactions:** Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization (mechanism excluded).

### UNIT-IV

**Intermolecular forces:** Ionic, dipolar and Van der Waals interactions.

**Water Chemistry:** Hardness of water- Introduction, Types, Measurement of hardness by EDTA method, Methods of water softening (Lime soda process, Zeolite Process, Demineralisation process).

### Suggested Text Books:

- (i) University Chemistry, Bruce M. Mahan, Pearson Education.
- (ii) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane

(iii) Essentials of Analytical Chemistry, Shobha Ramakrishnan and Banani Mukhopadhyay, Pearson Education.

(iv) Fundamentals of Molecular Spectroscopy, by C. N. Banwell

(v) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

(vi) Physical Chemistry, by P. W. Atkins

(vii) Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition.

**Course Outcomes:**

The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Understand the concept of hardness of water and phenomenon of corrosion.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electron affinity.

Course code	EEE-104				
Category	Program Core course				
Course title	<b>Electrical Measurement and Measuring instruments</b>				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Class work/ Practical	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

### Objectives of the course:

- The course will focus on evaluating errors in measurement as well as identify and use different types of instruments for the measurement of voltage, current, power and energy.
- This course will widen the knowledge of measurement of electrical quantities resistance, inductance and capacitance with the help of bridges.
- The course will demonstrate the working of instrument transformers as well as calculate the errors in current and potential transformers.
- This course will Manifest the working of electronic instruments like voltmeter, multi-meter, frequency meter and CRO.
- Along with the above, the course will also give knowledge of transducers, their classifications and their applications for the measurement of physical quantities like motion, force, pressure, temperature, flow and liquid level.

### UNIT I

Electrical Measurements: Measurement system, Characteristics of instruments, Methods of measurement, Errors in Measurement & Measurement standards, Review of indicating and integrating instruments: Voltmeter, Ammeter and Wattmeter.

### UNIT II

Measurement of Resistance, Inductance and Capacitance: Measurement of low, medium and high resistances, insulation resistance measurement, AC bridges for inductance and capacitance measurement.

Instrument Transformers: Current and Potential transformer, ratio and phase angle errors, design considerations and testing.

### UNIT III

Electronic Measurements: Electronic instruments: Voltmeter, Multimeter, Wattmeter & energy meter. Time, Frequency and phase angle measurements using CRO; Storage oscilloscope, Spectrum & Wave analyser, Digital counter, frequency meter, and Digital Voltmeter.

DISPLAY DEVICES: Nixie tubes, LED's LCD's, discharge devices.

#### **UNIT IV**

Instrumentation: Transducers & sensors, classification & selection of sensors, Measurement of force using strain gauges, Measurement of pressure using piezoelectric sensor, Measurement of temperature using Thermistors and Thermocouples, Measurement of displacement using LVDT, Measurement of position using Hall effect sensors. Concept of signal conditioning and data acquisition systems, concept of smart sensors and virtual instrumentation.

#### **Text Book:**

1. A K Sawhney, "Electrical & Electronic Measurement & Instrument", Dhanpat Rai & Sons, India
2. BC Nakra & K. Chaudhary, "Instrumentation, Measurement and Analysis," Tata McGraw Hill 2<sup>nd</sup> Edition
3. Purkait, "Electrical & Electronics Measurement & Instrumentation", TMH

#### **Reference Books:**

1. Forest K. Harris, "Electrical Measurement", Willey Eastern Pvt. Ltd. India
2. M. Stout, "Basic Electrical Measurement", Prentice Hall of India
3. WD Cooper, "Electronic Instrument & Measurement Technique", Prentice Hall International
4. EW Golding & F.C. Widdis, "Electrical Measurement & Measuring Instrument", AWWheeler & Co. Pvt. Ltd. India

Course code	EEE-104 (P)				
Category	Program Core course				
Course title	<b>Electrical Measurement and Measuring instruments (P)</b>				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Class work	50 Marks				
Exam	<b>50 Marks</b>				
Total	<b>100 Marks</b>				
Duration of Exam	03 Hours				

**Note:** At least 8 experiments are to be performed by the students.

**List of Experiments:**

- 1) Study blocks wise construction of a analog oscilloscope & Function generator.
- 2) Study blocks wise construction of a Multimeter & frequency counter.
- 3) Study Measurement of different components & parameters like Q of a coil etc using LCRQ meter.
- 4) Study of distortion factor meter and determination of the % distortion of the given oscillator
- 5) Determine output characteristics of a LVDT and Measure displacement using LVDT
- 6) Study characteristics of temperature transducer like Thermocouple, Thermistor & RTD with implementation of a small project using signal conditioning circuits like instrumentation amplifier.
- 7) Measurement of Strain using Strain Gauge.
- 8) To study differential pressure transducer & signal conditioning of output signal.
- 9) Measurement of level using capacitive transducer.
- 10) Study of Distance measurement using ultrasonic transducer.

Course code	MEE-102				
Category	Program Core Course				
Course title	Engineering Mechanics				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

### Course Outcomes (COs):

At the end of the course, the student shall be able to:

1. Understand the basic force system.
2. Apply principles of particle kinematics.
3. Grasp the concepts of particle dynamics.
4. Learn energy methods & momentum methods.

### UNIT-I

Introduction: Force system, dimensions and units in mechanics, laws of mechanics, vector algebra, addition and subtraction of forces, cross and dot products of vectors, moment of a force about a point and axis, couple and couple moment, transfer of a force to a parallel position, resultant of a force system using vector method, Problems involving vector application

Equilibrium: Static and dynamic equilibrium, static in determinacy, general equations of equilibrium, Varignon's theorem, Lami's theorem, equilibrium of bodies under a force system, Problems.

### UNIT-II

Truss and Frames: Truss, classification of truss, assumptions in truss analysis, perfect truss, analysis of perfect plane truss using method of joints and method of sections, Problems. Centroid, Centre of mass and Centre of gravity, Determination of centroid, centre of mass and centre of gravity by integration method of regular and composite figures and solid objects, Problems.

### UNIT-III

Moment of Inertia: Area moment of inertia, mass moment of inertia, parallel axis and perpendicular axis theorems, radius of gyration, polar moment of inertia, product of inertia, principle axis, problem based on composite figures and solid objects.

Kinematics: Concept of rigid body, velocity and acceleration, relative velocity, translation and rotation of rigid bodies, equations of motion for translation and rotation, problems.

### UNIT-IV

Particle Dynamics: Energy methods and momentum methods, Newton's laws, work energy Equation for a system of particles, linear and angular momentum equations, projectile motion, problem. Shear Force and Bending Moment Diagram for statically determinant beams classification Of beams, types of loads, shear force and bending moment calculation and their graphical presentation, point of inflection, problem.



**RecommendedBooks:-**

- Engineering Mechanics– Irving H. Shames, PHI Publication
- Engineering Mechanics–U.C. Jindal, Galgotia Publication
- Engineering Mechanics–A.K.Tayal, Umesh Publication

Course code	BSC-102				
Category	BASIC SCIENCE COURSES				
Course title	Chemistry				
Scheme and Credits	L	T	P	Credits	
	2	0	0	2	
Class work	30Marks				
Theory Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

### Course Objective:

1. To analyse microscopic chemistry
2. Understand the concept of hardness of water and phenomenon of corrosion
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4. Distinguish the ranges of the electromagnetic spectrum

### UNIT-I

**Atomic and molecular structure:** Schrodinger equation (Introduction and concept only). Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations (derivation excluded). Molecular orbital energy level diagrams of diatomic molecules. Pi-molecular orbitals of butadiene and benzene. Crystal field theory and the energy level diagrams for transition metal ions.

### UNIT-III

**Periodic properties:** Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states.

### UNIT-III

**Stereochemistry:** Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations, symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis.

**Organic reactions:** Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization (mechanism excluded).

### UNIT-IV

**Intermolecular forces:** Ionic, dipolar and Van der Waals interactions.

**Water Chemistry:** Hardness of water- Introduction, Types, Measurement of hardness by EDTA method, Methods of water softening (Lime soda process, Zeolite Process, Demineralisation process).

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(iii) Essentials of Analytical Chemistry, Shobha Ramakrishnan and Banani Mukhopadhyay, Pearson Education.

(iv) Fundamentals of Molecular Spectroscopy, by C. N. Banwell

(v) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

(vi) Physical Chemistry, by P. W. Atkins

(vii) Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition.

**Course Outcomes:**

The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Understand the concept of hardness of water and phenomenon of corrosion.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electron affinity.

Course code	BSC-102P				
Category	BASIC SCIENCE COURSES				
Course title	Chemistry (P)				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
External Practical	50 Marks				
Internal Practical	50 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

**Course Objective:**

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

**LIST OF EXPERIMENTS: -**

1. Determination of surface tension of given liquid by drop number method.
2. Determine the viscosity of given liquid by using Ostwald's viscometer / Redwood viscometer.
3. Calculate the R<sub>f</sub> value of given sample using Thin layer chromatography / Paper chromatography.
4. Removal of Ca<sup>2+</sup> and Mg<sup>2+</sup> hardness from given water sample using ion exchange column.
5. Determination of chloride content in given water sample.
6. Calculate the strength of strong acid by titrating it with strong base using conductometer.
7. Calculate the emf value of given cell.
8. To prepare the of urea formaldehyde and phenol formaldehyde resin.
9. To determine the rate constant of a reaction.
10. To Prepare iodoform.
11. Calculate the saponification value / acid value of given oil sample.
12. Chemical analysis of two anions and two cations in given sample of salt.
13. Determination of the partition coefficient of a substance between two immiscible liquids.
14. To determine the total hardness of given water sample by EDTA method.

**Note: At least 08 experiments are to be performed by the students.**

**Suggested Books:**

1. A Text book on Experiments and Calculation –Engineering Chemistry by S.S.Dara, S.Chand & Company Ltd.
2. Essentials of Analytical Chemistry, Shobha Ramakrishnan, Pearson Education.
3. Essential of Experimental Engineering chemistry, Shashi Chawla, Dhanpat Rai Publishing Co.
4. Theory & Practice Applied Chemistry – O.P.Virmani, A.K. Narula ( New Age).
5. Engineering Chemistry, K.Sesha Maheswaramma and Mridula Chugh, Pearson Education.

Course code	MEE- 104P				
Category	Engineering Science Course				
Course title	Engineering Graphics and Drawing (P)				
Scheme and Credits	L	T	P	Credits	
	1	0	3	2.5	
Class work	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

### Course Outcomes:

On completion of this course, the students will be able to:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modeling

### UNIT-I

#### Module 1: Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

#### Module2: Orthographic Projections

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes –Auxiliary Planes;

### UNIT-II

#### Module3: Projections of Regular Solids

Those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

#### Module4: Sections and Sectional Views of Right Angular Solids

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

#### Module5: Isometric Projections

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

### UNIT- III

#### Module6: Overview of Computer Graphics

Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Back ground, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]

## **UNIT-IV**

### **Module7: Annotations, layering & other functions**

Applying dimensions to objects, applying annotations to drawings; layers to create drawings, orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies.

Drawing of Engineering objects like coupling, crank shaft, pulley.

### **Module8: Demonstration of a simple team design project that illustrates**

Geometry and topology of engineered components, Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

### **Suggested Text/Reference Books:**

- (i) Shah, M.B. & Rana B.C., Engineering Drawing, Pearson Education
- (ii) Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
- (iii) Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
- (iv) Narayana, K.L. & P Kanniah (2008), Text book on Engineering Drawing, Scitech Publishers
- (v) CAD Software Theory and User Manuals

Course code	CEE-102				
Category	Program Core Course				
Course title	Engineering Mechanics				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Class work	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

### Course Outcomes:

At the end of the course, the students will be able to

- Identify different materials and their behaviour.
- Analyse various civil engineering structures under different loading conditions.
- Apply the principles of structural mechanics in design of structural elements.
- Apply the concepts of failure theories for design of structures.

### UNIT-1

**Properties of Metals, Stress and Strain:** Properties of materials, concept of stresses and strains, volumetric strains, stress-strain curves, Types of metal failures, Behaviour of various metals, Hooke's law, elastic constants and relationship between E, G, K &  $\mu$ , axial elongation and deflection in bars, strain energy, thermal stress and strain.

**Shear Force and Bending Moment:** Types of beams, Shear Force, Bending Moment, relationship b/w Bending moment and Shear Force, Definition and Sign conventions, Axial Force, Shear Force and Bending moment diagrams.

### UNIT-2

**Principal Stress/Principal Strain and Theory of Failure:** Definition and Sign conventions, Normal stress, tangential Stresses, Stresses induced due to Uniaxial loads, stresses induced by state of simple shear, stresses induced due to biaxial loads, Mohr's Circle (Graphical Method), Principal stresses and principal planes, Maximum shear stresses. Theories of failure: maximum principal stress theory, maximum principal strain theory, maximum shear stress theory, maximum strain energy theory, distortion energy theory, comparison of the failure theories.

**Deflection of Beam:** Slope and Deflection of Beam, Double Integration Method, Moment Area Method, Strain Energy Method, Conjugate Beam Method.

### UNIT-3

**Pressure Vessels:** Types of pressure vessels, Hoop Stress and Strain, Longitudinal Stress and Strain, and Radial Stress, Ratio of Hoop Strain to Longitudinal Strain, Volumetric strains, Analysis of Thick Cylinders & Spheres by Lamé's Theorem.

**Torsion of Shaft and Shear Centre:** Definition of Torsion, torsion equation, its applications to the hollow and solid circular shafts, pure bending and pure torsion effects, comparison of solid and hollow shafts, Compound Shafts: series and parallel. Shear Centre, Distance of Shear Centre for: Channel section, Semi-circular section and open circular slit.

#### **UNIT-4**

**Columns and Springs:** Column and Strut, Buckling Failure, Euler's Theory & its Limitations, Euler's Load for different conditions, Slenderness Ratio, Rankine's formula, Shape of Kern in Eccentric Loadings, Types of Springs, Series and Parallel arrangement of Springs, Closed coil helical spring under axial load and Strain energy in Springs.

**Trusses:** Different types of trusses, Analysis of plane determinate trusses by method of joints, method of sections and analysis of Space Trusses using Tension Coefficient Method.

#### **Suggested Books:**

- Strength of Material by G.H. Ryder, MacMillan Publishers India Ltd.
- Mechanics of Materials by E.J. Hearn, Elsevier Publications.
- Mechanics of Materials by Punmia and Jain, Laxmi Publications (P) Ltd.
- Mechanics of Materials by R.C.Hibbeler, Pearson Higher Education.
- Strength of Materials by Timoshenko and Young, East West Press.
- Mechanics of materials by V Gupta, Narosa publishing house.



Course code	CEE-102 P				
Category	Program Core Course				
Course title	Engineering Mechanics (P)				
Scheme and Credits	L	T	P	Credits	
	0	0	3	1.5	
Class work	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

### **LIST OF EXPERIMENTS**

1. To determine elastic properties of a beam.
2. Torsion of cylindrical rods (Shaft).
3. To determine and analyse deflection of curved beams.
4. Experimental and analytical study of behaviour of struts with various end conditions.
5. To determine deflection of trusses – Horizontal and vertical deflection of various joints of a pin jointed truss.
6. Experimental and analytical study of a 3bar pin jointed Truss.
7. Experimental and analytical study of an elastically coupled beam.

Course code	CEE-101			
Category	Program Core Course			
Course title	CIVIL ENGINEERING MATERIALS			
Scheme and Credits	L	T	P	Credits
	3	0	0	3
Class work	30 Marks			
Exam	70 Marks			
Total	100 Marks			
Duration of Exam	03 Hours			

### COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

1. Understand the properties of different types of cement.
2. Design concrete mixes and conduct tests on cement and aggregates.
3. Use different types of special concretes in construction of structures.
4. Understand and use properties of bricks, stones, wood in building construction, properties of flyash, paints, varnishes, gypsum and water proofing materials in building constructions.

### UNIT-1

**Cement:** Compounds and prepositions, types of Portland cement, pozzolanic cement, high alumina cement and other types, hydration mechanism and hydration products, setting and hardening, curing, strength of hardened cement, grade of cement, tests on cements, relevant BIS codes.

### UNIT-II

**Aggregates:** Properties of coarse & fine aggregates, tests on aggregates, relevant BIS codes, concrete: Ingredients of concrete, properties of fresh and hardened concrete, strength of concrete, W/C ratio of porosity, additives and their types, concrete mix design.

### UNIT-III

**Special Concretes:** Reinforced cement concrete, polymer concrete, fibre reinforced concrete, ferrocement, light weight concrete, roller compacted concrete, ready mix concrete, self compacting concrete, high performance concrete, bacterial concrete.

### UNIT-IV

**Bricks, Stones & Other materials:** Forms of bricks, properties of bricks and stones, tests on bricks and stones, relevant BIS codes, timber: structure of wood, defects in timber, seasoning, preservation, plywood and its manufacturing. Fly ash paints & varnishes, gypsum, tar, bitumen & asphalt, nano materials, smart materials, composite materials, geosynthetics, heat & sound insulating materials, water proofing materials.

#### Textbook:

1. Building Materials by S.K. Duggal
2. Engineering Materials by S.C. Rangwala
3. Concrete Technology by M L Gambhir
4. Properties of concrete by A M Neville

**Reference Books:**

1. Engineering Materials by R K Rajput
2. Civil Engineering Materials by Neil Jackson
3. Design of concrete mixes by Krishna Raju N, CBS publishers
4. Concrete Technology by Neville A.M and Brooks. J.J. PEARSON education.
5. Concrete properties and manufacturing by Akroyd T.N.W, Pergamon press