

## **MATERIAL SCIENCE & METALLURGY**

**Sub Code**

□

**: 06 ME 32 A/**

□

**06 ME 42A**

**IA Marks**

**: 25**

**Hrs/week**

**: 04**

□

**Exam Hours**

**: 03**

**Total Lecture** Hrs

**: 52**

**:**

**Exam Marks**

**: 100**

## **PART – A**

### **UNIT 1:**

Structure of crystalline solids: Fundamental concepts of unit cell space lattice, Bravais space lattices, unit cells for cubic structure & HCP, study of stacking of layers of atoms in cubic structure & HCP, calculations of radius, Coordination Number and Atomic Packing Factor for different cubic structures. Crystal imperfections-point, line, surface & volume defects. Diffusion, Diffusion Mechanism, Fick's laws of diffusion.

**7 Hours**

**UNIT 2:**

Concepts of stress & strain, tensile properties, true stress & strain, Hardness, Rockwell, Vickers & Brinell Hardness testing. Plastic deformation, slip & twinning.

**6 Hours**

**UNIT 3:**

Fracture: types, stages in cup & cone fracture, Griffith's criterion. Fatigue: fatigue tests, S-N curves, Factors affecting fatigue life and protection methods. Creep: The creep curves, Mechanisms of creep. Creep-resistant materials.

**7 Hours**

**UNIT 4:**

Solid solutions, Types, Rules of governing the formation of solids solutions. Phase diagrams: Basic terms, phase rule, cooling curves, construction of phase diagrams, interpretation of equilibriums diagrams, Types of phase diagrams. Lever rule.

**6 Hours**

**PART – B**

**UNIT 5:** □□□□□□□□□□□□□□□□

Iron carbon equilibrium Diagram, phases in the Fe–C system, Invariant reactions, critical temperatures, Microstructure of slowly cooled steels, effect of alloying elements on the Fe-C diagram, ferrite & Austenite stabilizers. The TTT diagram, drawing of TTT diagram, TTT diagram for hypo- & hyper-eutectoid steels, effect of alloying elements, CCT diagram.

**7 Hours**

**UNIT 6:** □□□□□□□□□□□□□□□□

Written by Administrator  
Sunday, 01 November 2009 10:06 -

---

Annealing, and its types, normalizing, hardening, tempering, martempering, austempering, surface hardening like case hardening, carburizing, cyaniding, nitriding Induction hardening, hardenability, Jominy end-quench test, Age hardening of Al & Cu alloys.

**6 Hours**

**UNIT 7: □□□□□□□□□□□□□□**

Engineering Alloys: Properties, composition and uses of low carbon, mild medium & high carbon steels. Steel designation & AISI –SAE designation. Cast irons, gray CI, white CI, malleable CI, SC iron. Microstructures of cast iron. The light alloys, Al & Mg & Titanium alloys. Copper & its alloys: brasses & bronzes.

**7 Hours**

**UNIT 8: □□□□□□□□□□□□□□**

Written by Administrator  
Sunday, 01 November 2009 10:06 -

---

Corrosion & Its Prevention: Galvanic Cell, The Electrode Potentials, Polarization, Passivation, General methods of Corrosion Prevention, Cathodic Protection, Coatings, Corrosion Prevention by Alloying, Stress Corrosion Cracking.

**6hrs**

## **Text Books:**

1. **“Materials Science & Engineering- An Introduction”**, William D.Callister Jr. Wiley India Pvt. Ltd. 6<sup>th</sup> Edition, 2006, New Delhi.
2. **“Essentials of Materials For Science And Engineering”**, [Donald R. Askeland](#) , Pradeep P.Phule Thomson-Engineering, 2006.

## **Reference Books:**

1. **“Introduction to Material Science for Engineering”**, 6<sup>th</sup> edition James F. Shackelford. Pearson, Prentice Hall, New Jersey, 2006.
2. **“Physical Metallurgy, Principles & Practices”**, V Raghavan.PHI 2<sup>nd</sup> Edition 2006, New Delhi.
3. **“Foundation of Material Science and Engineering”**, Smith, 3<sup>rd</sup> Edition McGraw Hill, 1997.

**Scheme of Examination:**

One Question to be set from each chapter. Students have to answer any FIVE full questions out of EIGHT questions, choosing at least 2 questions from part A and 2 questions from part B.

**MECHANICAL MEASUREMENTS AND METROLOGY**

**Sub Code**

**: 06 ME 32 B/**

**06 ME 42 B**



Written by Administrator  
Sunday, 01 November 2009 10:06 -

---

**IA Marks**

**: 25**

**Hrs/week**

**: 04**

**Exam Hours**

**: 03**

**Total Lecture Hrs**

**: 52**

**Exam Marks**

**: 100**

**PART – A**

**UNIT 1:**□□□□□□□□□□□□□□□□

**Standards of measurement:** Definition and Objectives of metrology, Standards of length - International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, comparison, transfer from line standard to end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Indian Standards (M-81, M-112), Numerical problems on building of slip gauges.

□□□□□□□□□□□□□□

**6 Hours**

**UNIT 2:**□□□□□□□□□□□□□□□□

**System of limits, Fits, Tolerances and gauging:** Definition of tolerance, Specification in assembly, Principle of inter changeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS 919 -1963), geometrical tolerance, positional - tolerances, hole basis system, shaft basis of system, classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges -plain plug gauge, ring Gauge, snap gauge, limit gauge and gauge materials.

**7 Hours**

**UNIT 3: □□□□□□□□□□□□□□□□**

**Comparators and Angular measurement:** Introduction to Comparator, Characteristics, classification of comparators, mechanical comparators -Johnson Mikrokator, Sigma Comparators, dial indicator, Optical Comparators -principles, Zeiss ultra optimeter, Electric and Electronic Comparators -principles, LVDT, Pneumatic Comparators, back pressure gauges, Solex Comparators. Angular measurements, Bevel Protractor, Sine Principle and. use of Sine bars, Sine center, use of angle gauges, (numericals on building of angles) Clinometers.

**7 Hours**

**UNIT 4: □□□□□□□□□□□□□□□□**

**Interferometer and Screw thread gear measurement :** Interferometer Principle of interferometry, autocollimator. Optical flats. Terminology of screw threads, measurement of major diameter, minor diameter pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, Best size wire. Toolmakers microscope, gear terminology, use of gear tooth Vernier caliper and gear tooth micrometer

**6 Hours**

**PART – B**

**UNIT 5: □□□□□□□□□□□□□□□□**

**Measurements and Measurement systems:** Definition, Significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times delay. Errors in Measurements, Classification of Errors. Transducers, Transfer efficiency, Primary and Secondary transducers, electrical, Mechanical, electronic transducers, advantages of each type transducers.

**7 Hours**

**UNIT 6: □□□□□□□□□□□□□□□□**

**Intermediate modifying and terminating devices:** Mechanical systems, inherent problems, Electrical intermediate modifying devices, input circuitry, ballast, ballast circuit, electronic amplifiers and telemetry. Terminating devices, Mechanical, Cathode Ray Oscilloscope, Oscillographs, X-Y Plotters.

**6 Hours**

**UNIT 7:**□□□□□□□□□□□□□□□□

**Measurement of Force and Torque, pressure:** Principle, analytical balance, platform balance, proving ring, Torque measurement, Prony brake, hydraulic dynamometer.

Pressure Measurements, Principle, use of elastic members, Bridgeman gauge, Mcloed gauge, Pirani Gauge.

**6 Hours**

**UNIT 8:**□□□□□□□□□□□□□□□□

**Temperature and strain measurement:** Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, pyrometer, Optical Pyrometer. Strain Measurements, Strain gauge, preparation and mounting of strain gauges, gauge factor,

methods of strain measurement

**7 Hours**

**Text Books:**

1. **“Mechanical measurements”** by Beckwith Marangoni and Lienhard, Pearson Education, 6<sup>th</sup> Ed., 2006
2. **“Engineering Metrology”** by R.K.Jain, Khanna Publishers, 1994.

**Reference Books:**

1. **“Engineering Metrology”** by I.C.Gupta, Dhanpat Rai Publications, Delhi

2. **“Mechanical measurements”** by R.K.Jain
  
3. **“Industrial Instrumentation”** Alsutko, Jerry. D.Faulk, Thompson Asia Pvt. Ltd.2002
  
4. **“Measurement Systems Applications and Design”** by Ernest O, Doblin, McGRAW Hill Book Co.

**Scheme of Examination:**

One Question to be set from each chapter. Students have to answer any FIVE full questions out of EIGHT questions, choosing at least 2 questions from part A and 2 questions from part B.