

**MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR**  
**(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)**  
**Department of Mechanical Engineering**

**For batches admitted in Academic Session 2020-21**

**Material Science**

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	
Departmental Core-DC	Material Science	190211/120211/120301/ 190301/BMEL305/ BAUL301/MEL302/3223	3	-	-	Max.Marks-60 Min.Marks-19 Duration-3hrs.

**Course Objectives:** To make the students to understand:

1. The basic fundamentals of materials science and engineering.
2. The different classes of materials, their properties, structures and imperfections present in them.
3. The functional properties of materials and the roles of microstructure, heat treatment defects and environment play in typical engineering applications.

**Syllabus**

**Unit-I Structure and Properties of Materials**

Concept of crystalline and non-crystalline materials, Crystal structures analysis and Crystal system, Homogeneous and heterogeneous solidifications, Crystal imperfections. Miller indices and directions, Properties and uses of engineering materials. Stress-strain diagram for steels.

**Unit-II Engineering Materials**

Ferrous and non-ferrous metals and alloys, Nano-materials, Ceramic material, Composite material with their properties, uses and coding.

**Unit-III Deformation of Materials**

Types of deformations, Mechanism of deformations, Role of dislocations, Slip and twinning processes. Stages of deformation, Mechanism of ductile and brittle fracture.

**Unit-IV Phase Diagrams**

Concept of phases, Solidification of metals and alloys, Allotropy of iron, Fe-C diagram, Lever-rule, Eutectic, Eutectoid, Peritectic and Peritectoid systems.

**Unit-V Heat Treatment of Steels**

Micro constituents of steel, Importance of heat treatment processes, "S-curve and C-curve", Heat treatment processes and surface treatment processes.

**Course Outcomes:** After successful completion of this course students will be able to:

- CO1. State** the principles of diffusion theory and various types of defects in materials.
- CO2. Discuss** mechanical properties of materials
- CO3. Compare** the different processes to alter the material properties.
- CO4. Determine** the effect of different phases, impurities on the behavior of materials.
- CO5. Analyze** crystal structure and composition of different materials.
- CO6. Create** the different engineering materials and alloys.

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**Text & Reference Books**

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1. Elements of Material Science and Engineering **by** Lawrence, H. Vanvlackdison; Wesley. Mention the Year or the Edition and Publisher and Place of Publication
2. Material Science and Engineering **by** Raghvan, V; Prentice Hall of India.
3. Introduction to Engineering Materials **by** Agrawal, B.K; Tata McGraw Hill, N. Delhi.

**NPTEL Link for Material Science**

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[https://onlinecourses.nptel.ac.in/noc18\\_mm05/preview](https://onlinecourses.nptel.ac.in/noc18_mm05/preview)

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**Basic Mechanical Engineering**

Category	Title	Code	Credit-3			Theory Paper
			L	T	P	
Engineering Science-ESC	Basic Mechanical Engineering	100022/100204/CEL/ MEL/CSL/EEL/ ELL/ITL/CHL/ BTL114/2X24	3	-	-	Max.Marks-60 Min.Marks-19 Duration-3hrs.

**Course Objectives:** To make the students:

1. Develop the fundamentals of Engineering materials, measurement and reciprocating machines.
2. Develop an ability to understand the Thermodynamic laws, steam generator and reciprocating machines for solving engineering problems.
3. Demonstrate Engines and Boiler fundamentals using models.

**Syllabus**

**UNIT-I:**

**Materials:** Classification of engineering material, composition of cast iron and carbon steels on iron-carbon diagram and their mechanical properties; Alloy steel and their applications; Stress-Strain diagram, Hooks law and modulus of elasticity. Tensile, shear, hardness and fatigue testing of materials.

**UNIT-II:**

**Measurement:** Temperature, pressure, velocity, flow, strain, force and torque measurement, concept of measurement error & uncertainty analysis, measurement by Vernier caliper, micrometer, dial gauges, slip gauges, sine-bar and combination set; introduction to lathe drilling, milling and shaping machines.

**UNIT-III**

**Fluids:** Fluid properties, pressure, density and viscosity; pressure variation with depth, static and kinetic energy; Bernoulli's equation for incompressible fluids, viscous and turbulent flow, working principle of fluid coupling, pumps, compressors, turbines, positive displacement machines and pneumatic machines. Hydraulic power & pumped storage plants for peak load management as compared to base load plants.

**UNIT-IV**

**Thermodynamics:** Zeroth, First, second and third law of thermodynamics; steam properties, steam processes at constant pressure, volume, enthalpy & entropy, classification and working of boilers, efficiency & performance analysis, natural and induced draught, calculation of chimney height. Refrigeration, vapour absorption and compression cycles, coefficient of performance (COP).

**UNIT-V**

**Reciprocating Machines:** Steam engines, hypothetical and actual indicator diagram; Carnot cycle and ideal efficiency; Otto and diesel cycles; working of two stroke & four stroke petrol and diesel IC engines.

**Course Outcomes:** After successful completion of this course students will be able to:

- CO1. Define the essential concepts of thermal, design and production used in Mechanical Engineering.
- CO2. Summarize fundamental techniques and process used in power generating machines
- CO3. Solve the various problems based on basic concepts of Mechanical Engineering.
- CO4. Analyze the various gas, steam and air cycles.

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**CO5. Evaluate** the problems of Steam Generator, Thermodynamics, Steam and I.C. engines

**CO6. Generate** the skills to demonstrate steam Generator and reciprocating machine in depth.

**Reference Books:**

1. Narula; Material Science; TMH
2. Agrawal B & CM; Basic Mechanical Engineering; TMH
3. Nag PK, Tripathi et al; Basic Mechanical Engineering; TMH
4. Rajput; Basic Mechanical Engineering;
5. Sawhney GS; Fundamentals of Mechanical Engibneering; PHI
6. Nakra and Chaudhary; Instrumentation and Measurement; TMH
7. Nag PK; Engineering Thermodynamics; TMH
8. Ganesan; Combustion Engines; TMH

**Lists of Experiments:**

1. Study of simple vertical boilers.
2. Study of Locomotive boilers.
3. Study of Babcock and Wilcox boilers.
4. Study of Lancashire, Cornish and Cochran boilers.
5. Study of boiler mounting and accessories.
6. Study of 2 stroke diesel and petrol engines.
7. Study of 4 stroke diesel and petrol engines.
8. Study of simple steam engines.
9. Study of Lathe machine.
10. Study of Vernier and Micrometer.
11. Study of Internal Combustion Engine Parts.

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**Manufacturing Practices**

Category	Title	Code	Credit-1			Practical End Sem
			L	T	P	
Engineering Science-ESC	Manufacturing Practices	100025/100106	L	T	P	Max.Marks-60 Min.Marks-19
			-	-	2	

**Course Objectives:**

1. To familiarize with the basics of tools and equipments used in fitting, carpentry, sheet metal, welding and smithy.
2. To with the production of simple models in the above trades.
3. To develop general machining skills in the students.

**Syllabus**

**UNIT-I**

**Introduction:** Manufacturing Processes and its Classification, Casting, Machining, Plastic deformation and Metal forming, Joining Processes, Heat treatment process, Assembly process.

**Black Smithy Shop**

Use of various smithy tools. Forging operations; Upsetting, Drawing down, Fullering, swaging, Cutting down, Forge welding, Punching and drafting.

**Suggested Jobs:** Forging of chisel, forging of Screw Driver.

**UNIT-II Carpentry Shop**

**Timber:** Type, Qualities of timber disease, Timber grains, Structure of timber, Timber seasoning, Timber preservation. Wood Working Tools: Wood Working Machinery, joints and joinery, various operations of planning using various carpentry planes sawing & marking of various carpentry joints.

**Suggested Jobs:** Name Plate, Any of the carpentry joint like mortise or tennon Joint.

**UNIT-III Fitting Shop:**

Study and use of measuring instruments, Engineer steel rule, Surface gauges caliper, Height gauges, feeler gauges, Micrometer. Different types of files, File cuts, File grades, Use of surface plate, Surface gauges drilling tapping Fitting Operations: Chipping filling, Drilling and Tapping.

**Suggested Jobs:** Preparation of job piece by making use of filing, sawing and chipping, drilling and tapping operation.

**UNIT-IV Foundry:**

**Pattern Making:** Study of pattern materials, pattern allowances and types of patterns. Core box and core print, Use and care of tool used for making wooden patterns.

**Moulding:** Properties of good mould& Core sand, Composition of Green, Dry and Loam sand. Methods used to prepare simple green and bench and pit mould dry sand bench mould using single piece and split patterns.

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**UNIT-V Welding:** Study and use of tools used for Brazing, Soldering, Gas& Arc welding. Preparing Lap & Butt joints using Gas and Arc welding methods, study of TIG and MIG welding processes. Safety precautions.

**Course Outcome:** After successful completion of this course students will be able to:

**CO1. Discuss** the hand tools, machine tools and power tools.

**CO2. Utilize** appropriate tools required for specific operation.

**CO3. Apply** safety measures required to be taken while using the tools in floor shops, Machine shops and carpentry shop.

**CO4. Use** the techniques, skills, and modern engineering tools necessary for manufacturing and production engineering.

**CO5. Conduct** experiments in the field of Production engineering.

**CO6. Design** a system, components, or process to meet desired needs, ethical, health and safety, manufacturability and sustainability.

**Text & References Books:**

1. Bawa HS; Workshop Practice, TMH
2. Rao PN; Manufacturing Technology-Vol.1 & 2, TMH
3. John KC; Mechanical Workshop Practice; PHI
4. HazraChoudhry; workshop Practice-Vol.1 & 2.
5. Jain R. K.; Production Technology

**NPTEL Link for Manufacturing Practices**

<http://nptel.ac.in/courses/112107145/>

**Laboratory Work:**

Relevant shop floor exercises involving practice in forging, Carpentry, fitting, pattern making, Sand casting, Moulding, Welding, Sheet metal fabrication techniques.