### III YEAR I SEMESTER

<table>
<thead>
<tr>
<th>S. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MM501PC</td>
<td>Heat Treatment</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>MM502PC</td>
<td>Iron Making</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>MM503PC</td>
<td>Mechanical Working</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>SM504MS</td>
<td>Fundamentals of Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Open Elective – I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>MM505PC</td>
<td>Heat Treatment Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>MM506PC</td>
<td>Mechanical Working Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>MM507PC</td>
<td>Basic Metallurgical Computations Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>*MC500HS</td>
<td>Professional Ethics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td><strong>Total Credits</strong></td>
<td></td>
<td>21</td>
<td>0</td>
<td>9</td>
<td>24</td>
</tr>
</tbody>
</table>

### III YEAR II SEMESTER

<table>
<thead>
<tr>
<th>S. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MM601PC</td>
<td>Steel Making</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>MM602PC</td>
<td>Welding Metallurgy</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>MM603PC</td>
<td>Foundry Technology</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Open Elective – II</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Professional Elective - I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>MM604PC</td>
<td>Welding Metallurgy Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>MM605PC</td>
<td>Foundry Technology Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>EN606HS</td>
<td>Advanced English Communication Skills Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Total Credits</strong></td>
<td></td>
<td>18</td>
<td>0</td>
<td>9</td>
<td>24</td>
</tr>
</tbody>
</table>

During Summer Vacation between III and IV Years: Industry Oriented Mini Project
Professional Elective – I

<table>
<thead>
<tr>
<th>Subject</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MM611PE</td>
<td>Non Ferrous Extractive Metallurgy</td>
</tr>
<tr>
<td>MM612PE</td>
<td>Surface Engineering</td>
</tr>
<tr>
<td>MM613PE</td>
<td>Electronic and Magnetic Materials</td>
</tr>
</tbody>
</table>

*Open Elective* subjects’ syllabus is provided in a separate document.

*Open Elective* – Students should take Open Electives from the List of Open Electives Offered by Other Departments/Branches Only.

**Ex:** - A Student of Mechanical Engineering can take Open Electives from all other departments/branches except Open Electives offered by Mechanical Engineering Dept.
HEAT TREATMENT

B.Tech. III Year I Sem.  
Course Code: MM501PC  
L  T  P  C  4  0  0  4

Course Objective
This course is mainly focused to develop knowledge among the students about the basic practices and process variables of heat treatment. Thermo-mechanical treatment, surface hardening techniques, heat treatment of steels, non ferrous alloys.

Course Outcome: end of the course student is in a position to, know how to approach the problem of choosing an alloy for a particular application and know how to approach the design of a heat treatment for an alloy for a particular application.

UNIT-I
Annealing, Normalizing, Hardening, Mechanism of heat removal during quenching, quenching media, size and mass effect, Tempering and its stages

UNIT-II
Time Temperature Transformation (TTT) and CCT Curves, effect of cooling on transformation of Austenitic, perarlitic, bainite, and martensite.

UNIT-III
Effect of alloying elements on Fe-C system and TTT curves, Hardenability of Steels, Factors affecting and its determination

UNIT-IV
Thermo-mechanical treatments, Austempering, Martempering, Patenting, Spheoridizing, Ausforming strain tempers, Subzero treatment, Isoforming, Cryoforming

UNIT-V
Surface Hardenting: Carburizing, Nitriding, Cyaniding, Carbonitriding, Induction and Flame Hardening. Heat treatment of Cast Irons, Carbon Steels and Alloy Steels, Maraging Steels, and Al- Alloys

TEXT BOOK:
1. Heat Treatment Principle and Techniques - Rajan & Sharma

REFERENCES:
1. Engineering Physical Metallurgy and Heat Treatment by Yu. Lakhtin
IRON MAKING

B.Tech. III Year I Sem.  
Course Code: MM502PC

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

Course Objective:
The course objective is to provide the knowledge of Iron making by Blast Furnace, Physio-
chemical principles involved in iron making, recent advances. Necessity and advantages of
alternative routes of iron making.

Outcome:
The student will be in a position to understand the process of Iron Making in detail, there by
he/she would be understanding the process variables to enhance the productivity and
efficiency of the Blast Furnace and alternative routes of Iron Making.

UNIT-I
History of Iron making, valuation of iron ores and classification of iron ores, Principles of
Iron making, Reduction, Smelting, Direct Reduction, Smelt Reduction; Raw materials for
Iron making, their distribution, occurrence in India and in the world.

UNIT-II
Preparation of iron ores; Agglomeration of Iron ore fines, Sintering; Principles, Factors
affecting sintering, sintering bonds, sintering machines; Pelletisation; Theory of Pelletisation,
Water-particles system. Production of green pellets in; disk and drum pelletizers, Induration
of pellets, Shaft, traveling grate and continues grate kiln machine.

UNIT-III
Blast Furnace profile and its design, Refractory lining. Water cooling system. Raw materials
handling and charging, Burden distribution, Construction and operation of Hot blast Stoves.
Gas cleaning system and its utilization

UNIT-IV
Physical chemistry of Iron making, Blast furnace reactions, Physical and chemical factors
affecting reduction of ores; Effect of temperature CO/CO_2 and H_2/H_2O on reduction of iron
ore. Control of C, Si, S, P in pig iron. Types of Pig Irons & Blast furnace Slags and its
properties. Blast furnace operations and difficulties, Modern Trends in Blast furnace; Burden
calculations, Limitations of Blast furnace Iron production;

UNIT-V
Alternate Routes of Iron Making, Principles of Sponge Iron Making, Degree of Metallization,
Percentage Reduction, Classification of Sponge Iron making methods. Using gases reducing
agent, process as Midrex , HY and Krupp-Renn, Using solid reducing agent process such as
SL/RN process, Smelt Reduction Methods; COREX, INRED, ELRED, Plasma Smelting;
Sponge Iron making in India.
TEXT BOOKS:
2. Beyond Blast furnace – Amit Chaterjee – CRC Press
3. Modern Iron Making – Dr. R. H. Tupkary

REFERENCES:
1. Iron making and Steel making – Ahindra Ghosh & Amit Chaterjee PMI Pvt. Ltd. 2008
MECHANICAL WORKING

B.Tech. III Year I Sem.                   L  T  P  C
Course Code: MM503PC                   4  0  0  4

Course Objective: This course is mainly designed to provide knowledge about various metal forming operations, their process parameters, and mathematical equations associated with the process.

Course Outcome: The student will be able to solve problems on calculation of required stress, extent of deformation in metal forming techniques.

UNIT-I

UNIT-II

UNIT-III
Fundamentals of Metal Working: Classification of forming processes, Mechanics of metal working for slab method and uniform deformation energy method. Cold working, Recovery, recrystallisation and grain growth, hot working, Strain-Rate effects, Work of plastic deformation.

UNIT-IV
Rolling of Metals: Classification of rolling process, rolling mills. Hot rolling, cold rolling, rolling of bars and shapes, forging and geometrical relationships in rolling.
Simplified analysis of rolling load, rolling variables, problems and defects in rolled products. Theories of hot rolling, torque and horsepower, theories of cold rolling, torque and horsepower.

UNIT-V
Drawing of Rods, Wires and Tube: rod and wire drawing, tube drawing processes, deep drawing, residual stresses in rod, wire and tubes.
TEXT BOOKS:
1. Mechanical Metallurgy by GE Dieter (3rd edition)
2. Technology of Metal Forming Processes – Surender Kumar PHI 2008

REFERENCES:
1. Mechanical Working of Metals - Avitzur.
FUNDAMENTALS OF MANAGEMENT

B.Tech. III Year I Sem.  
Course Code: SM504MS  3 0 0 3

Course Objective: To understand the Management Concepts, applications of Concepts in Practical aspects of business and development of Managerial Skills.

Course Outcome: The students understand the significance of Management in their Profession. The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspects are learnt in this course. The students can explore the Management Practices in their domain area.

UNIT-I  

UNIT-II  

UNIT-III  

UNIT-IV  
Leading and Motivation: Leadership, Power and Authority, Leadership Styles; Behavioral Leadership, Situational Leadership, Leadership Skills, Leader as Mentor and Coach, Leadership during adversity and Crisis; Handling Employee and Customer Complaints, Team Leadership.
Motivation - Types of Motivation; Relationship between Motivation, Performance and Engagement, Content Motivational Theories - Needs Hierarchy Theory, Two Factor Theory, Theory X and Theory Y.

UNIT-V

Controlling: Control, Types and Strategies for Control, Steps in Control Process, Budgetary and Non-Budgetary Controls. Characteristics of Effective Controls, Establishing control systems, Control frequency and Methods.

Text Books:

References:
HEAT TREATMENT LAB

B.Tech. III Year I Sem.  
Course Code: MM505PC

<table>
<thead>
<tr>
<th>C</th>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Course Objective:
This Laboratory course is designed to make the student understand and demonstrate the various types of heat treatment processes, process variables and surface hardening treatments for ferrous and non-ferrous metals and alloys.

Course Outcome: The student would gain hands on experience to define heat treatment cycles for ferrous and non-ferrous metals and alloys with proper understanding of different heat treatment process variables.

LIST OF EXPERIMENTS:
1. Annealing of plain carbon steel and observation of hardness and microstructure
2. Normalizing of plain carbon steel and observation of hardness and microstructure
3. Hardening of plain carbon steel and observation of hardness and microstructure
4. Study of tempering characteristics of hardened steel.
5. Study of age hardening phenomenon in an Al-Cu alloy or Cu-Be alloy
6. Spheroidizing of high carbon steel
7. Determination of hardenability of a steel using Jominy End Quench Test
8. Re-crystallization studies on cold worked Cu or Cu alloys

EQUIPMENT:
1. Muffle Furnaces 1200 °C
2. Hardenability Apparatus
3. Microscopes
4. Rockwell Hardness Tester
MECHANICAL WORKING LAB

B.Tech. III Year I Sem. □□□□
Course Code: MM506PC □□□□

Course Objective
This lab course is mainly designed to know the various testing methods for evaluation of metal forming techniques.

Course Outcome
Upon successful completion of this course, the student will be able to understand various deformation processes in materials.

LIST OF EXPERIMENTS
1. To determine the formability of given materials by Erichson cup test
2. To manufacture washer components using fly press (progressive dies /compound dies)
3. Deep drawing of a cup with / without blank holder by hydraulic press
4. To determine the friction factor by ring compression test
5. Determination of strain hardening exponent ‘n’ and strength coefficient ‘k’
6. To verify hall petch relation in MS specimen

EQUIPMENT
1. UTM
2. Hydraulic press
3. Fly press
4. Erichson cup
LIST OF EXPERIMENTS: Programming of
1. Estimation of proportion of phases using Lever rule
2. Determination of ASTM grain size
3. Determination of packing factor for bcc, fcc and hcp
4. Determination of ΔH using Kirchhoff’s equation
5. Determination of ΔG from thermal data
6. Determination of Entropy
7. To solve the problems on conduction
8. Hall Petch relation
9. Calculation of UTS and YS

TEXT BOOKS:
2. Computer programming and Numerical methods – S. Saran
3. Numerical methods in engineering – Mario G. Salvadori and Melvin L. Baron
PROFESSIONAL ETHICS

B.Tech. III Year I Sem. Course Code: MC500HS

Course Objective: To enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and Professional lives.

Course Outcome: The students will understand the importance of Values and Ethics in their personal lives and professional careers. The students will learn the rights and responsibilities as an employee, team member and a global citizen.

UNIT-I
Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

UNIT-II

UNIT-III
Professional Practices in Engineering: Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession.
Central Responsibilities of Engineers - The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walkaway Collapse.

UNIT-IV
Work Place Rights & Responsibilities, Ethics in changing domains of Research, Engineers and Managers; Organizational Complaint Procedure, difference of Professional Judgment within the Nuclear Regulatory Commission (NRC), the Hanford Nuclear Reservation.
Ethics in changing domains of research - The US government wide definition of research misconduct, research misconduct distinguished from mistakes and errors, recent history of attention to research misconduct, the emerging emphasis on understanding and fostering responsible conduct, responsible authorship, reviewing & editing.
UNIT-V

TEXT BOOKS:

REFERENCES
STEEL MAKING

Course Objective: This course is primarily of industrial oriented ore and designed to make the student to understand and demonstrate the various types of primary steel making processes, Hot metal route and scrap route, casting pit side practice, Continuous casting of steel and secondary steel making process to produce quality steels.

Course Outcomes: The student would gain knowledge on different primary and secondary steel making processes to produce quality steels with less cost and more efficiently.

UNIT-I
Introduction to Steel Making: Current scenario of steel making in India and world, Raw materials of steel making. Factors affecting the efficiency of steel making.

UNIT-II
Primary Steel Making (Hot Metal): Steel making by Acid and Basic Bessemer Processes, Construction and lining details, sequence of elimination of impurities, Steel Making by LD process, Construction, lining and process details in LD, LD-AC or OLP, Kaldo, LD-Kaldo, Rotor oxygen steel making, Oxygen bottom blowing (OBM), Hybrid process of steel making, Improvements and modification of the above steel making process.

UNIT-III
Primary Steel Making (From Scrap): Open Hearth Steel Making: Construction and process details; Electric Arc Furnace (EAF); Construction and Process details: Induction furnace. Stainless steel making.

UNIT-IV

UNIT-V
Solidification of steels: Ingot defects and remedies; Casting pit side practice: Types of Moulds, Teeming Methods, Killed, Semi Killed, capped and rimmed Steels, Continuous casting of steels.

TEXT BOOKS:
1. Steel Making – V. Kudrin
2. Modern Steelmaking – Dr. R.H. Tupkary and V. H. Tupkary

REFERENCES:
1. Iron Making & Steel Making Theory and Practice - Ahindra Ghosh & Amit chatterjee
2. Secondary Steel Making; Principles and applications – Ahindra Ghosh
3. Physical Chemistry of Iron & Steel by Bodsworth.
WELDING METALLURGY

B.Tech. III Year II Sem.  
Course Code: MM602PC

Course Objective: The basic objective of this course is to provide in depth knowledge about various metal joining techniques, the thermal, residual, and transformational stresses associated with, the equipment used, their modern developments, and defects and defectoscopy of weldments.

Course Outcome: The student will be able to apply various metal joining techniques for various ferrous and nonferrous alloys, fixing of process parameters to obtain a sound welding, precautionary measures to be taken to avoid weld defects, and advancements in Metal Joining technologies.

UNIT-I

UNIT-II
Working principle. Advantages and limitations of solid state welding processes. Friction, friction stir, explosive, diffusion and ultrasonic welding

UNIT-III

UNIT-IV
Welding of dissimilar metals, Joining of ceramics with case studies.

UNIT-V
Quality Testing of Weldments by Dye Penetrant and Radiography Testing, Defects in weldments, causes, effects and remedies, hot and cold cracking.

TEXT BOOKS:
1. Welding Technology – R.S. Parmar
2. Welding Technology – O.P. Khanna
REFERENCES:
1. Welding Metallurgy - JF Lancaster
2. Welding and Welding Technology - Little
FOUNDRY TECHNOLOGY

B.Tech. III Year II Sem. Course Code: MM603PC

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

Course Objective: This course is mainly intended to introduce and explain various moulding, casting techniques and equipment used. Principles of Solidification of casting, defects in castings and their remedies are also dealt in detail.

Course Outcome: This course would pave a platform for students to develop a thorough understanding on the casting technology, solidification of metals and alloys.

UNIT-I
Introduction to Foundry – Types of Foundries and Patterns: Materials for patterns, types of patterns; functions and pattern allowance. Moulding materials; moulding sands, properties and selection of materials and additives.

Moulding Processes: Green and dry sand moulding; shell moulding, CO₂ moulding. Core making. Plaster moulding, Gating Risering and their design.

UNIT-II
Casting Methods: Permanent mould casting, pressure die-casting, Gravity die casting, Vacuum die casting, centrifugal casting, Investment Casting, Squeeze casting and Composite Casting.

UNIT-III:

UNIT-IV:
Modern Developments: Recently developed processes-V-Forming Full Mould Process, Furon-No-Bake Sand Moulds and Cores, continuous Casting, Cold Setting and Self Setting Processes.

UNIT-V:
Casting Defects and Remedial Measures: Casting defects arising due to moulding, cores, melting and pouring practice. Inspection and Testing of castings.

TEXT BOOKS:

REFERENCES:
NONFERROUS EXTRACTIVE METALLURGY
(Professional Elective - I)

B.Tech. III Year II Sem.
Course Code: MM611PE

Course Objective: The main objective of the course is to expose the student to understand basic principles of extraction of important non ferrous metals.

Course Outcome: Student will be in a position to ascertain the method of extraction of a particular metal and also understands the importance of recovery of byproducts during extraction. Upon successful completion of this course, the student will be able to:

- Describe and explain processes and reactors for extraction and refining of metals and alloys
- Explain processes based on a thermodynamic perspective
- Describe and explain material and energy flows related to extraction of metals and alloys
- Describe and explain ore treatment techniques
- Plan and carry out experimental work related to extraction and refining of non ferrous metals

UNIT-I

UNIT-II
LEAD: Smelting – smelting, Reduction process, Roast Reaction process, direct smelting reduction process – Air flash smelting, oxygen flash, oxygenslip bath smelting, QSL process, refining of lead bullion. Pyro and electrolytic refining

UNIT-III

UNIT-IV
TITANIUM: Upgrading of ilmenite, chlorination of titania, Kroll’s process. Refining.
UNIT-V

URANIUM: Acid and alkali processes for digestion of uranium ores, Purification of crude salt, Production of reactor grade UO₂ and uranium. Simplified flow sheets for the extraction of nickel, tungsten and gold. Review of non-ferrous metal industries in India. Extraction of Zirconium

TEXT BOOKS:
1. Extraction of Non-Ferrous Metals - HS Ray, KP Abraham and R. Sridhar

REFERENCES:
3. Nuclear Chemical Engineering - Manstion Bendict and Thomas H. Pigfort
SURFACE ENGINEERING  
(Professional Elective - I)

B.Tech. III Year II Sem.  
Course Code: MM612PE  
Course Code: MM612PE  

<table>
<thead>
<tr>
<th>Course Objective:</th>
<th>3 0 0 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>This course is mainly designed to make the students understand the importance of surface engineering techniques, scope, limitations and areas of applications. This course also focuses on industrially significant coating techniques, selection and evaluation of coating characteristics.</td>
<td></td>
</tr>
</tbody>
</table>

Course Outcomes: at the end of the course, the student will be able to
1. Understand the significance of surface modification processes
2. Describe the principles of surface modification processes
3. Identify the testing approaches to evaluate a modified surface
4. Suggest a surface modification process for a particular wear situation

UNIT-I
Importance and necessity of surface engineering; past, present and future scenario of surface engineering; classification of surface engineering processes; substrates and their pretreatments; coating characteristics: coating thickness, continuity, hardness, adhesion, porosity, and bond strength

UNIT-II
Thermally Sprayed Coatings: Plasma spraying; flame spraying, detonation spray coating, High velocity oxy-fuel spraying; cod gas dynamic spray process; thermal barrier coatings. Factors influencing thermal spray coatings. Electrochemical coatings.

UNIT-III
Diffusion Coatings: Process fundamentals, advantages, limitations and applications of carburizing, liquid nitriding, carbonitriding, nitrocarburizing, and boronizing. Aluminized, chromized, and siliconized coatings.

UNIT-IV
Thin Film Coating Technology: Chemical Vapor deposition (CVD); Physical Vapor Deposition (PVD); Electron beam evaporation; magnetron sputtering; diamond like carbon coating technology; sol-gel coating technologies

Plasma Processes: Plasma carburizing and plasma nitriding; plasma immersed ion implantation; plasma enhanced physical vapor deposition; plasma enhanced chemical vapor deposition.
UNIT-V

**Thermal Modification Processes:** different types of lasers and their applications. Laser assisted surface modification processes.

**Evaluation of Coatings:** Thickness, bond strength and porosity measurement; hardness, wear resistance and corrosion resistance.

**TEXT BOOKS:**

3. Howard E. Boyer (Editor), Case Hardening of Steel, ASM International, metals Park, OH 44073

**REFERENCES:**

1. Materials science- Van Vlack
2. Electroplating: Basic Principles and Practice - Kanan. N (Elsevier) 2004
ELECTRONIC AND MAGNETIC MATERIALS
(Professional Elective - I)

B.Tech. III Year II Sem.
Course Code: MM613PE

Course Objective
With the ever growing material world, the subject of metallurgy and materials engineering has grown in alarming complex manner. At the present the study of materials science has been greatly developed in many modern fields due to the new material such as magnetic, microelectronic and smart alloys. This subject is formulated to expose the students to the fundamentals and processing of magnetic and electronic materials

Course Outcome
At the end of the course the student will be able to
1. Understand the properties to be considered in designing magnetic and electronic materials know the manufacturing process of electronic materials
2. Understand the concepts in development of smart materials and devices

UNIT-I
Magnetic Materials: Definition of Magnetic field, Magnetic Induction, Magnetic Field Intensity, Magnetic Susceptibility.
Types of Magnetic Materials: Paramagnetic, Diamagnetic, Ferromagnetic, Anti Ferromagnetic, Ferrimagnetic materials.

UNIT-II
Theories of Para, Dia and Ferromagnetism, Curie Temperature, Domain theory of Ferromagnetism, Reversible and Irreversible domains, Bark Haussan Effect.

UNIT-III
Hysteresis loop, Domain Interpretation of Hysteresis curve, interpretation of hysteresis and hand magnetic Materials, differences in magnetic properties of hard and soft magnetic materials, magnetic anisotropy and magnetostriction.
Applications of magnetic materials: soft and hard, high energy hard magnetic materials, magnetic storage, ferrite core memories, bubble memories

UNIT-IV
Semi conductors, Band theory and solids, distribution of energy states, classification of semi conductors, intrinsic and extrinsic, n type and p type, variation of carrier concentration with temperature, Hall effect, forward biasing and reverse biasing semi conductor devices

UNIT-V
Production of metallurgical grade silicon, photo lithography pattern transfer, metallization, silicon IC chip, packaging, encapsulation of IC chip, tape automated bonding, smart,
intelligent, active materials, piezo electric ceramics, polymers, chemical sensors, electrochemical sensors, shape memory alloys

TEXT BOOKS:
1. Electronic properties of materials, R E Hummel
2. Ferromagnetic materials structure and properties, RA Macurie

REFERENCES:
1. An introduction to materials science , HL Mancini
2. Magnetic Materials fundamentals and devices, Nicols Spaldin
WELDING METALLURGY LAB

B.Tech. III Year II Sem.  L  T  P  C
Course Code: MM604PC  0  0  3  2

Course Objective:
This Laboratory course is designed to make the student to understand and demonstrate the various types Welding processes and its variables, testing methods and correlation between micro structure and Mechanical properties of the Welded joints.

Course Outcomes:
The student would gain hands on experience in various methods of welding and joining of metals and understand the mechanical behavior of the joint with respect to microstructure and mechanical properties.

LIST OF EXPERIMENTS
2. Study of Arc welding process, comparison of the bead geometry with DCSP, DCRP and A.C.
3. Study of resistance spot welding process and plot the variation of spot area with time and current variation.
4. Study of Tungsten Inert Gas (TIG) welding process and measurement of temperature during TIG welding process.
5. Study of fundamental aspects of Submerged Arc Welding (SAW) process and finding out deposition efficiency of the process.
6. Study of fundamental aspects of MIG welding process.
7. To conduct tests on weld joints to evaluate the mechanical properties of the joints, like bend test and ram tensile test.
8. To evaluate the microstructure of welded joint and understand the structural difference in Weld zone, Heat Affected Zone and Base metal.
Course Objective: This lab course is mainly designed to provide hands on practice on the various foundry testing methods for evaluation of moulding sand properties

Course Outcome: Upon successful completion of this course, the student will be able to:
1. Determine moulding sand dry, hot and green strength
2. Understand the preparation of moulding sand
3. Determine moulding sand properties by varying additives
4. Understand the Melting of Al alloys

LIST OF EXPERIMENTS
1. Preparation of gating system using green moulding sand.
2. Study of particle size distribution of the sand.
3. Study of the variation of permeability of the green sand with clay and water.
4. Determination of the variation of sand properties like green hardness, green compact strength with additives in sands.
5. Determination of the variation of hot compact hardness and hot shear strength with additives in sands.
6. Determination of clay content in sand.
7. Determination of the shatter index of green sand.
8. Melting of Al alloys in a pit furnace and casting into light components.
9. Study of Charge calculations and melting practice of cast iron in cupola.
11. Study of Non-destructive testing of few components.

EQUIPMENT

<table>
<thead>
<tr>
<th>1. Mould Boxes, Patterns, Core Boxes, Tool Boxes.</th>
<th>2. Rotap Sieve Shaker with Sieves</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Sand Hardness tester.</td>
<td>6. Clay Content Apparatus</td>
</tr>
<tr>
<td>7. Shatter Index test.</td>
<td>8. For Melting; Pit Furnace; Electric Furnace</td>
</tr>
<tr>
<td>11. Ultra Sonic Tester</td>
<td>12. Ladles, Crucibles and other Accessories</td>
</tr>
<tr>
<td>13. Muffle Furnace 1000°C</td>
<td></td>
</tr>
</tbody>
</table>
ADVANCED ENGLISH COMMUNICATION SKILLS (AECS) LAB

B.Tech. III Year II Sem.  
Course Code: EN606HS  
L T P C 0 0 3 2

Introduction
A course on Advanced English Communication Skills (AECS) Lab is considered essential at the third year level of B.Tech and B.Pharmacy courses. At this stage, the students need to prepare themselves for their career which requires them to listen to, read, speak and write in English both for their professional and interpersonal communication. The main purpose of this course is to prepare the students of Engineering for their placements.

Course Objectives
This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve students’ fluency in spoken English
- To enable them to listen to English spoken at normal conversational speed
- To help students develop their vocabulary
- To read and comprehend texts in different contexts
- To communicate their ideas relevantly and coherently in writing
- To make students industry-ready
- To help students acquire behavioural skills for their personal and professional life
- To respond appropriately in different socio-cultural and professional contexts

Course Outcomes
Students will be able to:

- Acquire vocabulary and use it contextually
- Listen and speak effectively
- Develop proficiency in academic reading and writing
- Increase possibilities of job prospects
- Communicate confidently in formal and informal contexts

Syllabus
The following course activities will be conducted as part of the Advanced English Communication Skills (AECS) Lab:

1. Inter-personal Communication and Building Vocabulary - Starting a Conversation – Responding Appropriately and Relevantly – Using Appropriate Body Language – Role Play in Different Situations - Synonyms and Antonyms, One-word Substitutes, Prefixes and Suffixes, Idioms and Phrases and Collocations.

2. Reading Comprehension – General Vs Local Comprehension, Reading for Facts, Guessing Meanings from Context, , Skimming, Scanning, Inferring Meaning.


4. Presentation Skills – Oral Presentations (individual or group) through JAM Sessions/Seminars/PPTs and Written Presentations through Posters/Projects/Reports/ e-mails/Assignments… etc.,

**Minimum Hardware Requirement**
Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics
- Eight round tables with five movable chairs for each table.
- Audio-visual aids
- LCD Projector
- Public Address system
- Computer with suitable configuration

**Suggested Software:**
The software consisting of the prescribed topics elaborated above should be procured and used.

- Oxford Advanced Learner’s Compass, 8th Edition
- DELTA’s key to the Next Generation TOEFL Test: Advanced Skill Practice.

**REFERENCES:**