

B.Tech IV-II Semester (ME)

S. No.	Course Code	Subject	L	T	P	C
1.	15A03801 15A03802 15A03803	MOOCS-II a. Industrial Engineering b. Product Design c. Composite Materials	3	1	0	3
2.	15A03804 15A03805 15A03806	MOOCS -III a. Power Plant Engineering b. Gas Turbines and Jet Propulsion c. Energy Management	3	1	0	3
3.	15A03807	Comprehensive Viva Voce	0	0	4	2
4.	15A03808	Technical Seminar	0	0	4	2
5.	15A03809	Project work	0	0	24	12
Total:			6	2	32	22

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**15A03801 INDUSTRIAL ENGINEERING
(MOOCS-II)**

UNIT I

Concepts of Management-Administration and Organization – Functions of Management – Schools of Management Thought: Taylor’s Scientific Management, Fayol’s Principles of Management, Douglas Mc-Gregor’s Theory X and Y, Mayo’s Hawthorne Experiments, Hertzberg’s Two factor Theory of Motivation, Maslow’s Hierarchy of Human needs – Systems Approach to Management.Organizational Structures-Functional- Divisional- Matrix etc., Basic Concepts Related to Organization – Departmentation and Decentralization and their Merits, Demerits and Suitability

UNIT II

Plant Location: Definition, Factors affecting the Plant Location, Comparison of Rural and Urban sites, Selection of Plant Location – Types of Production; Plant Layout: Definition, Objectives, Types of Plant Layout - Materials Handling: Functions- Objectives – Types, Selection Criteria of Material Handling Equipment.

UNIT III

Work Study – Definition, Objectives, Method Study – Steps Involved – Various Types of Process Charts –Micro motion and Memo motion Studies. Work Measurement - Definition, Time Study, Steps involved - Equipment, Different Methods of Performance Rating - Allowances, Standard Time Calculation. Work Sampling - Definition, Steps Involved, Standard Time Calculations - Applications.

UNIT IV

Inventory Models- Deterministic models- EOQ Models – With and Without Shortages Models; Inventory Models with Price Breaks -Probabilistic Models –Discrete Variable, Continuous Variable. Inventory Control Systems

UNIT V

Inspection & Quality Control: Statistical Quality Control- Techniques-Variables and Attributes- Control Charts: X and R Charts; P Charts and C Charts. Acceptance Sampling Plan - Single Sampling and Double Sampling Plans- OC Curves. Introduction to TQM- Quality circles-BIS & ISO Standards-Importance .

Text Books:

1. Manufacturing Organization and Management, T.Amrine/ Pearson, 2nd Edition, 2004
2. Industrial Engineering and Management ,O.P.Khanna, DhanpatiRai, 18th edition, 2013.
3. Industrial Engineering and Management, Dr. C.Nadamuni Reddy, New Age International Publishers, 1st edition, 2011.

Reference Books:

1. *Industrial Engineering and production management*, MartindTelsang S.Chand..
2. *Work Study by ILO(International Labour Organization)*
3. *Management by James AF Stoner, Freeman 6th Ed, Pearson Education, New Delhi,2005*
4. *Production and Operations management, PanneerSelvam, PHI,2004.*
5. *Statistical Quality Control by EL Grantt, McGrawhil*
6. *Motion and time studies by Ralph M Barnes, John Wiley and Sons,2004*

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**15A03802 PRODUCT DESIGN
(MOOCS-II)**

Course Objective:

To make the students understand the product development process, requirements setting, conception design,, embodiment design principles, to understand the basics of mechatronics and adaptronics.

UNIT I

PRODUCT DEVELOPMENT PROCESS

General problem solving process - Flow of Work during the process of designing - Activity Planning Timing and scheduling, Planning Project and Product Costs - Effective Organization Structures - Interdisciplinary Cooperation, Leadership and Team behavior.

UNIT II

TASK CLARIFICATION

Importance of Task Clarification - Setting up a requirements list - Contents, Format, Identifying the requirements, refining and Extending the requirements, Compiling the requirements list, Examples. Using requirements lists - Updating, Partial requirements lists, Further uses - Practical applications of requirements lists.

UNIT III

CONCEPTUAL DESIGN

Steps in Conceptual Design.

Abstracting to identify the essential problems - Aim of Abstraction, Broadening the problem. Formulation, Identifying the essential problems from the requirements list, Establishing functions structures, Overall function, Breaking a function down into sub-functions.

Developing working structures - Searching for working principles, Combining Working Principles, Selecting Working Structures, Practical Application of working structures.

Developing Concepts - Firming up into principle solution variants, Evaluating principle solution variants, Practical Applications of working structures.

Examples of Conceptual Design - One Handed Household Water Mixing Tap, Impulse - Loading Test Rig.

UNIT IV

EMBODIMENT DESIGN - Steps of Embodiment Design, Checklist for Embodiment Design Basic rules of Embodiment Design Principles of Embodiment Design - Principles of Force Transformations, Principles of Division of Tasks, Principles of Self-Help, Principles of Stability and Bi-Stability, Principles of Fault-Free Design

Guide for Embodiment Design - General Considerations, Design to allow for expansion, Design to allow for creep and relaxation, Design against Corrosion, Design to minimize wear, Design to Ergonomics, Design for Aesthetics, Design for Production, Design for Assembly, Design for Maintenance, Design for Recycling, Design for Minimum risk, Design to standards.

Evaluation of Embodiment Designs.

UNIT V

MECHANICAL CONNECTIONS, MECHATRONICS AND ADAPTRONICS

Mechanical Connections - General functions and General Behavior, Material connections, From Connections, Force connections, Applications.

Mechatronics - General Architecture and Terminology, Goals and Limitations, Development of Mechatronic Solution, Examples.

Adaptronics - Fundamentals and Terminology, Goals and Limitations, Development of Adaptronics Solutions, Examples.

Text Books:

1. *Engineering Design: G.Paul; W. Beitzetal, Springer International Education 2010.*
2. *Product Design And Development: Kevin Otto: K. Wood Pearson Education 2016.*

Reference Books:

1. *Product Planning Essentials: Kenith B. Kahu, Yes dee Publishing 2011.*
2. *Product Design and Development: K.T. Ulrich TMH Publishers 2011.*

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**15A03803 COMPOSITE MATERIALS
(MOOCS-II)**

Unit-I

Introduction to Composite Materials: Introduction, Classification: Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, Carbon–Carbon Composites, Fiber. Reinforced Composites and nature-made composites, and applications

Reinforcements: Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and boron carbide. fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosets, Metal matrix and ceramic composites.

Unit-II

Manufacturing methods: Autoclave curing, tape production, moulding methods, filament winding, hand layup, pultrusion, RTM. Compression moulding, tape winding.

Macromechanical Analysis of a Lamina: Introduction ,Definitions: Stress, Strain ,Elastic Moduli, Strain Energy. Hooke's Law for Different Types of Materials, Plane Stress Assumption, Reduction of Hooke's Law in Three Dimensions to Two Dimensions, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina.

Unit-III

Micromechanical Analysis of a Lamina: Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, Strength of Materials Approach, Semi Empirical Models ,Elasticity Approach, Elastic Moduli of Lamina with Transversely Isotropic Fibers, Ultimate Strengths of a Unidirectional Lamina, Coefficients of Thermal Expansion, Coefficients of Moisture Expansion

UNIT-IV

Macromechanical Analysis of Laminates: Introduction, Laminate Code, Stress–Strain Relations for a Laminate, In-Plane and Flexural Modulus of a Laminate , Hygrothermal Effects in a Laminate, Warpage of Laminates

UNIT-V

Failure Analysis and Design of Laminates: Introduction, Special Cases of Laminates, Failure Criterion for a Laminate.

Text Books:

1. Engineering Mechanics of Composite Materials- Isaac and M Daniel, Oxford University Press, 1994.
2. Mechanics of Composite Materials, R. M. Jones, Mc Graw Hill Company, New York, 1975.

References:

1. Analysis and performance of fibre Composites, B. D. Agarwal and L. J. Broutman Wiley- Interscience, New York, 1980.
2. Mechanics of Composite Materials, Second Edition (Mechanical Engineering)- Autar K. Kaw, Publisher: CRC
3. Finite Element Analysis of Composite Materials, Ever J. Barbero , CRC Press, 2007.
4. Analysis of Laminated Composite Structures, L. R. Calcote, Van Nostrand Rainfold, New York, 1969.
5. Mechanics of Composite Materials and Structures, Madhujit Mukhopadhyay, University Press, 2009.
6. Composite Materials Science and Engineering, Krishan K. Chawla, Springer, 2009

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**15A03804 POWER PLANT ENGINEERING
(MOOCS-III)**

UNIT I

Introduction To The Sources Of Energy – Resources and Development of Power in India. Layouts of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Combined Power Cycles - Comparison and Selection, Power Plant Economics and Environmental Considerations: Capital Cost, Investment of Fixed Charges, Operating Costs, General Arrangement of Power Distribution, Load Curves, Load Duration Curve. Definitions of Connected Load, Maximum Demand, Demand Factor, Average Load, Load Factor, Diversity Factor – Tariff - Related Exercises. Effluents from Power Plants and Impact on Environment – Pollutants and Pollution Standards – Methods of Pollution Control. Inspection And Safety Regulations.

UNIT II

Steam Power Plant : Modern High Pressure and Supercritical Boilers - Analysis of Power Plant Cycles - Modern Trends in Cycle Improvement - Waste Heat Recovery, Fluidized Bed Boilers., Fuel and Handling Equipments, Types of Coals, Coal Handling, Choice of Handling Equipment, Coal Storage, Ash Handling Systems.

Steam Power Plant : Combustion Process : Properties of Coal – Overfeed and Under Feed Fuel Beds, Traveling Grate Stokers, Spreader Stokers, Retort Stokers, Pulverized Fuel Burning System And Its Components, Combustion Needs and Draught System, Cyclone Furnace, Design and Construction, Dust Collectors, Cooling Towers And Heat Rejection. Analysis of Pollution from Thermal Power Plants - Pollution Controls.CO2 Recorders

UNIT III

Diesel Power Plant: Diesel Power Plant: Introduction – IC Engines, Types, Construction– Plant Layout with Auxiliaries – Fuel Storage Gas Turbine Plant : Introduction – Classification - Construction – Layout With Auxiliaries – Principles of Working Closed and Open Cycle Gas Turbines. Advantages And Disadvantages Combined Cycle Power Plants.

UNIT IV

Hydro Electric Power Plant: Water Power – Hydrological Cycle / Flow Measurement – Drainage Area Characteristics – Hydrographs – Storage and Pondage – Classification of Dams and Spill Ways.

Hydro Projects and Plant: Classification – Typical Layouts – Plant Auxiliaries – Plant Operation Pumped Storage Plants. .

UNIT V

Power from Non-Conventional Sources: Utilization of Solar Collectors- Principle Of its Working, Wind Energy – Types of Turbines – HAWT & VAWT-Tidal Energy. MHD power Generation.

Nuclear Power Station: Nuclear Fuel – Nuclear Fission, Chain Reaction, Breeding and Fertile Materials – Nuclear Reactor – Reactor Operation.

Types of Reactors: Pressurized Water Reactor, Boiling Water Reactor, Sodium-Graphite Reactor, Fast

breeder Reactor, Homogeneous Reactor, Gas Cooled Reactor, Radiation Hazards and Shielding –

Radioactive Waste Disposal.

Text Books:

1. *Power plant Engineering*, P.K. Nag, TMH, 3rd edition, 2013.
2. *A course in power plant Engineering*, Arora and S. Domkundwar.

Reference Books:

1. *A Text Book of Power Plant Engineering*, Rajput, Laxmi Publications, 4th edition, 2012.
2. *Power plant Engineering*, Ramalingam, Scietech Publishers
3. *power plant engineering* P.C. Sharma, S.K. Kataria Publications, 2012.

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**15A03805 GAS TURBINES AND JET PROPULSION
(MOOCS- III)**

UNIT-I

Gas Turbine Operating Cycles: Simple open cycle gas turbine or air standard Brayton cycle, Actual Brayton cycle, the cycle air flow rate, the cycle work ratio, optimum pressure ratio or maximum cycle thermal efficiency, means of improving the efficiency and the specific out put of simple cycle.

UNIT-II

Gas Turbines; gas turbine applications, gas turbine advantages & disadvantages, energy flow & back work, deviation from ideal cycle, gas turbine with regeneration, thermal efficiency of gas turbine with & without regenerator, gas turbine engines, inter-cooling & reheating, turbojet engine, turbofan engine, turboprop engine.

UNIT-III

Jet propulsion: Historical sketch- reaction principle- essential features of propulsion devices- Thermal jet engines, classification of – energy flow, thrust, thrust power and propulsion efficiency- need for thermal jet engines and applications.

Turboprop and turbojet – thermodynamic cycles, plant layout, essential components, and principles of operation – performance evaluation – thrust augmentation and Thrust reversal – contrasting with piston engine propeller plant.

UNIT-IV

Ram jet- Thermo dynamic cycle, plant lay out, essential components – principle of operation – performance evaluation – comparison among atmospheric thermal jet engines- serquet and pulse jet, elementary treatment.

Rocket Engines: Need for, applications- basic principle of operation and parameters of performance – classification, solid and liquid propellant rocket engines, advantages, domains of application – propellants – comparison of propulsion systems.

UNIT-V

Rocket Technology: Flight mechanics, application thrust profiles, acceleration-staging of rockets, need for – feed systems, injectors and expansion nozzles – rocket transfer and ablative cooling.

Testing & instrumentation - need for Cryogenics – advanced propulsion systems, elementary treatment of Electrical nuclear and plasma Arc Propulsion.

TEXT BOOKS:

1. Gas Turbines , V. Ganesan TMGH
2. Gas turbines , cohen , Rogers & Sarvana Muttoo , Addison Wiley & longman

REFERENCES BOOK:

1. Thermodynamics of propulsion, Hill & Paterson.
2. Rocket Propulsion , Sutton.
3. Element of Gas Turbines propulsion , Jack D Matingly, MGH

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**15A03806 ENERGY MANAGEMENT
(MOCS-III)**

UNIT - I

ENGINEERING ECONOMICS:

Managerial objectives - steps in planning- Capital budgeting- Classification of costs- Interest- Types- Nominal and effective interest rates Discrete and continuous compounding - discounting - Time value of money - Cash flow diagrams - Present worth factor, Capital recovery factor, Equal annual payments - Equivalence between cash flows.

UNIT - II

DEPRECIATION & COST ANALYSIS:

Aims-Physical depreciation-Functional depreciation- Methods of depreciation-Straight line method, Declining balance method, Sum of years digits method, Sinking fund method, Service output method- Capital recovery with return-Service life estimation- Morality curves. Break even analysis and break even chart- Minimum cost analysis- Benefit cost analysis- Life cycle cost analysis.

UNIT - III

PROJECT MANAGEMENT:

Methods of investment appraisal- Rate of return method, Payback period method, Net present value method (NPV)- Internal Rate of Return method(IRR)- Adoption of the methods in energy conservation campaign- Types of projects- Purpose of project management - Classification – Role and qualities of project manager - Types of budgets - Budget committee – budgeting.

ENERGY MANAGEMENT PROGRAMS:

Necessary steps of energy management programmer - Concepts of Energy management - General principles of energy management – Energy management in manufacturing and process industries- Qualities and functions of Energy manager - Language of Energy manager-Checklist for top management.

UNIT - IV

ENERGY AUDITING:

A definition- Objectives- Level of responsibility- Control of Energy- Uses of Energy checklists - Energy conservation- Energy index - Cost index - Pie charts-sankey diagrams Load profiles - Types of energy audits- Questionnaire - Energy audit of industries - General energy audit- Detailed energy audit - Energy saving potential.

UNIT - V

ENERGY POLICY, SUPPLY, TRADE& PRICES:

Energy resources in India – level of power generation – transmission & distribution of power. Indian energy policy, Energy trade & its economic impacts – domestic energy production – Energy transformation & distribution & energy self sufficiency. International & National crude oil prices – domestic fuel prices – natural gas, LPG, kerosene and firewood - pricing policy.

TEXT BOOKS:

1. Energy Management, Murphy W.R and Mckay G, , Elsevier, 2007
2. Albert Thumann, Handbook of Energy Audits, The Fairmont Press Inc., Atlanta gergia, 1979.

REFERENCES BOOKS:

1. Albert Thumann, Plant Engineer and Management guide to Energy Conservation, Van Nost and Reinhold Co., Newyork.
2. Energy Audits, E.E.O.-Book-lets, U.K. 1988.
3. Craig B.Smith, “Energy Management Principles”, Pergamon Press.
4. The role of Energy Manager, E.E.O., U.K.
5. The Energy conservation Design Resource Hand Book-The Royal architectural Institute of Canada.
6. Energy Management Hand Book-Ed. By Wayne C. Turner, John Wiley and sons, 1982.