ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY
Guwahati

Course Structure and Syllabus

(From Academic Session 2018-19 onwards)

B.TECH
MECHANICAL ENGINEERING

7th SEMESTER

ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Course Structure
(From Academic Session 2018-19 onwards)

B.Tech 7th Semester: Mechanical Engineering
Semester VII/ B.TECH/ME

Sl. No.	Sub-Code	Subject	Hours per Week			Credit	Marks	
			L	T	P	C	CE	ESE
Theory								
1	ME181701	Vibration of Mechanical Systems	3	0	0	3	30	70
2	ME181702	Applied Thermodynamics - II	3	0	0	3	30	70
3	ME181703	Industrial Engineering and Management	3	0	0	3	30	70
4	ME181PE1*	Program Elective -1	3	0	0	3	30	70
5	ME181OE1*	Open Elective -1	3	0	0	3	30	70
6	HS181704	Principles of Management	3	0	0	3	30	70
Practical								
1	ME181722	Project-1	0	0	8	4	50	50
2	ME181723	Grand Viva Voce-I	0	0	0	1	0	50
3	SI181721	Internship-III (SAI - Industry)	0	0	0	2	0	200
		TOTAL	18	0	8	**25**	**230**	**720**
Total Contact Hours per week: 26								
Total Credit: 25								

Program Elective-1

Sl No	Code	Subject
1	ME181PE11	Hydraulic Machines
2	ME181PE12	Machine Tools
3	ME181PE13	Power Plant Technology
4	ME181PE14	Quality Engineering
5	ME181PE15	Refrigeration
6	ME181PE16	Rotordynamics
7	ME181PE1*	Any other subject offered from time to time with the approval of the University

Open Elective-1

Sl No	Code	Subject
1	ME181OE11	Operation Research
2	ME181OE12	Renewable Energy Sources
3	ME181OE13	Solid Waste Management
4	ME181OE1*	Any other subject offered from time to time with the approval of the University

Detailed Syllabus:

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181701	**Vibration of Mechanical Systems**	**3-0-0**	**3**

Course Outcomes (COs):

CO1: Construct free body diagram and formulate the equation of motion for free vibration of mechanical system under damped and undamped conditions.

CO2: Develop mathematical models of physical systems under forced vibration using Newton's laws of motion and principles of conservation of energy and solve.

CO3: Analyze results of seismic instruments to estimate vibration parameters.

CO4: Evaluate vibration parameters and noise for multi degrees of freedom system and estimate the critical speed of a shaft for whirling motion.

CO5: Develop mathematical model using MATLAB for mechanical vibrating system.

MODULE 1:

Basic Concepts: Introduction, importance, main causes of vibration, characteristics of vibration, harmonic analysis, beats, periodic and non-harmonic excitation, mathematical models, elements of a vibratory system, lumped or discrete parameter system, continuous or distributed parameter systems, equivalent springs and dashpots.

MODULE 2:

Undamped Free Vibration: Introduction, derivation of differential equation of motion-energy method, Newton's 2nd law method, Rayleigh's method, solution of differential equations of motion, angular oscillation, compound pendulum.

MODULE 3:

Damped Free Vibration: Introduction, viscous damping, free vibration with viscous damping – over damped, critically damped and under damped systems, critical damping coefficient, logarithmic decrement, Coulomb damping, structural damping, interface damping: comparisons.

MODULE 4:

Forced Vibration SDOF (Single Degree of Freedom System): Introduction, forced harmonic vibration, magnification factor, resonance, excitation due to rotating and reciprocating unbalance, vibration isolation, force transmissibility, motion transmissibility.

MODULE 5:

Two Degrees of Freedom System (2DOF): Introduction, principal modes of vibration, modes shapes, torsional Vibration, coordinate coupling static and dynamic, dynamic vibration absorber, torsional vibration absorber, pendulum type vibration absorber, generalized co-ordinates.

MODULE 6:

Seismic Instruments: Introduction, vibrometer, accelerometer, phase distortion.

MODULE 7:

Multi Degree of Freedom Systems (MDOF): Introduction, equation of motion, matrix methods, orthogonality and principal modes of vibration, approximate method of determining fundamental frequencies- Dunkerley's method, Rayleigh's method, Holzer's methods, method of matrix iteration.

MODULE 8:

Introduction to Whirling Motion and Critical Speed, critical speed of a single rotor, multiple rotors. Introduction to Noise Engineering.

Textbooks/ Reference Books:

1. Mechanical Vibrations, Singiresu S Rao, Pearson
2. Vibration Theory & Application, W T Thomson, Prentice–Hall
3. Mechanical Vibrations, V P Singh, Dhanpat Rai & Co
4. Mechanical Vibration & Noise Engineering, A G Ambekar, Prentice–Hall

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181702	**Applied Thermodynamics - II**	**3-0-0**	**3**

Course Outcomes (COs): On successful completion of this course the student should be able to:

1. Analyse the thermodynamic processes and cycles involved in compressors, gas turbines, jet engines and refrigerator systems using air/gas as working fluid to reduce them to solvable mathematical models.
2. Estimate all the design parameters of the components used in thermodynamic devices using thermo-fluidic considerations.
3. Estimate the effects of irreversibility on the design of the single-process thermodynamic devices from thermodynamic properties.
4. Compare the performances in terms of efficiency, power and COP of each of the thermodynamic devices for selection in domestic and small industrial applications.
5. Evaluate the positive and negative aspects of space heating and cooling technology with reference to environment using psychrometric properties.

MODULE 1: Air Compressors

Introduction; Reciprocating type – Single stage and multi-stage, Compression ratio and volumetric efficiency, effect of clearance, compressor efficiencies. Methods for improving thermal efficiencies. Compressor work and power. Intercooler and after-cooler. Rotary compressors – Classification, Centrifugal compressors – theory of operations, impeller and diffuser, impeller work; efficiency. Rotary Vs Reciprocating compressor. Introduction to axial flow compressors, charging and choking of compressors.

MODULE 2: Gas Turbine

Introduction – gas turbine cycles – open and closed, Ideal and Actual cycles. Isentropic efficiencies and thermal efficiencies. Power output. Methods to improve thermal efficiencies; Gas turbine vs I C Engines.

MODULE 3: Jet and Rocket Propulsion

Introduction. Types of jet engines – turbojet, turboprop, ramjet, pulsejet. Analysis of turbojet engine cycle, thrust, jet thrust, propeller thrust, effective speed ratio, specific fuel consumption, thrust, impulse, performance. Types of rocket engines – solid propellants rockets, liquid propellants rockets, hybrid rockets, analysis of rocket propulsion, performance, comparison between jet and rocket propulsion.

MODULE 4: Refrigeration

Introduction – Reversed Carnot cycle and air refrigeration cycles; COP; Capacity of a refrigerating unit. Vapour compression and vapour absorption cycles. Properties of refrigerants. Heat pump.

MODULE 5: Psychrometry

Introduction; Psychrometric terms; Delton’s law of partial pressures. Psychrometric processes. Psychrometric Chart. Psychrometr.

Textbooks/ Reference Books:

1. Engineering Thermodynamics (Principles and Practices, Dr D S Kumar, Kataria and sons, First Edition, 2012.
2. Applied Thermodynamics, T. D. Eastor and A McConkey, 5th Edn (18th impression), Pearson Education, 2015.
3. Engineering Thermodynamics, P K Nag, 5th Edn, McGraw Hill Publications, 2013.
4. Thermodynamics – An Engineering Approach, Cengel and Boles, 5th Edn, Tata McGraw Hill Publications, 2006.
5. Thermal Engineering, R Rajput, Laxmi Publications, 2014.
6. Engineering Thermodynamics, Rogers and Mayhew, 4th Edn (2nd impression), Pearson Education, 2007.

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181703	Industrial Engineering and Management	3-0-0	3

Course Outcomes (COs): After the completion of the Course, the students will be able to:

1. Explain the concept of Organization, functions of Management and Organization types
2. Analyze the problems to related to Plant Location and Layout for optimal solutions
3. Utilize the concept of Project Management to solve various problems related to time optimization of Projects
4. Explain the concepts of Work Study, Product Design, Production Planning and Control and Inventory Management
5. Explain the concepts of Maintenance and Quality Control Techniques practice in Organizations

MODULE 1: Introduction to Organization (2 Lectures)

Definition of organization, organizational structure, types of organization, span of control, delegation of authority and responsibility.

MODULE 2: Plant Location and Layout (4 Lectures)

Objectives, Locational factors, Economics of plant location; Meaning, objectives and types of plant layout and their relevance to mass, batch and job-order production systems.

MODULE 3: Network Analysis (6 Lectures)

Objectives, Network development technique, Network computations – Critical Path and its significance, Earliest and Latest dates, calculation of float. Deterministic and probabilistic network models, Assumptions and computations related to PERT model, Crashing of jobs for minimum cost-time schedule for CPM models

MODULE 4: Work Study (6 Lectures)

Meaning and scope, subdivisions of work study – Method/Motion study and Work Measurement; Method/Motion study- its meaning and scope, steps in method/motion study, Tools and techniques of method/motion study, Principles of motion economy; Micro-motion study – Meaning and scope, therbligs, use of motion camera in micro-motion study; Work measurement – concept of observed time, rating factor, average worker and standard time for jobs. Use of stop watch and work sampling techniques in the determination of standard time.

MODULE 5: Product Design and Development (6 Lectures)

Meaning of product, Product life cycle (PLC) and Product mix; Decisions to be taken during product development and design, Procedure for product development and design, Value of a product – its meaning, Value Analysis

MODULE 6: Production Planning and Inventory Control (6 Lectures)

Meaning and Objectives, Effects of types of production, steps in Production Planning and Control, Use of Gantt chart, Machine Scheduling Problems, Make/Buy decision and Break-even analysis and Inventory Control: EOQ Model, ABC, VED, FSN analysis.

MODULE 7: Maintenance Management (6 Lectures)

Meaning and Types of maintenance, and their suitability, Standards of maintenance, Total Productive Maintenance (TPM).

MODULE 8: Quality and Quality Control Engineering (6 Lectures)

Meaning of Quality, Inspection, Quality Control, Process Control, Control Charts, Acceptance Sampling, Total Quality Management Philosophy

Textbooks/ Reference Books:

1. Industrial Engineering and Management - O P Khanna.
2. Industrial Engineering – M Telsang
3. Essentials of Management – Koontz O' Donnel
4. Industrial engineering – M Mahajan
5. Operations Management – Panneerselvam
6. Motion and Time study – R M Barnes
7. Network and project management – Punmia
8. Total Quality Management – Besterfield et.al.

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181PE11	**Hydraulic Machines**	**3-0-0**	**3**

Course Outcomes (COs):

1. Students will be able to extend knowledge of fluid mechanics to understand working of different types of hydraulic machines namely turbines and pumps.
2. Students will be able to recognize different types of turbines based on their working principles and calculate the work output and efficiency to draw the characteristic curves.
3. Students will be able to differentiate the principles of operation of different types of pumps to draw a comparison between them.
4. Students will be able to illustrate the performance characteristics of pumps.
5. Students will be able to deduce problems related to the various types of hydraulic machines, and calculate their working parameters and estimate the optimum working conditions.

MODULE 1:
Eular equation for turbo machines, Radial, axial and mixed flow machines. Impulse and Reaction machines

MODULE 2:
Impulse turbine- Pelton wheel, wheel diameter, jet diameter, bucket shape, size and number, speed control of Pelton wheel. Use of Pelton wheel and efficiency, specific speed and specific diameter range

MODULE 3:
Reaction Hydraulic turbine- Francis turbine – runner, flow and speed ratio, casing guide, vanes, flow control, speed control, runner shape variation with the change of specific speed. Draft tube, surge tank, penstock, cavitation. Axial flow turbine and Kaplan turbine. Blade profile, specific speed, diameter change of blade, pitch, guide vane, flow control, cavitation characteristics, draft tube, speed control of Kaplan turbines.

MODULE 4:
Centrifugal Pump and Reciprocating pump- Centrifugal pumps-single and multistage, radial and mixed flow pumps, vane pump, volute casing pump. Pump efficiencies-hydraulic efficiency, overall efficiency, loss in pump, speed ratio, efficiency. Pump characteristics- surging, cavitaion on pump. Priming of centrifugal pumps, self priming of pumps, multi stage pumps, runner, casing and stationary vanes. Axial pump-specific speed, flow ratio, speed ratio characteristics, applications. Propeller pump, blade-shape and aerofoil analysis-lift and drag estimate of pressure rise and power requirements

MODULE 5: Fluid System- Fluid couplings, Hydraulic dynamometer, Gear pumps

Textbooks/ Reference Books:

1. A Textbook of Fluid Mechanics and Hydraulic Machines by Dr. R.K. Bansal, Laxmi Publications (P) Ltd.
2. Introduction to Fluid Mechanics and Fluid Machines by S.K.Som, Gautam Biswas and Suman Chakraborty, Tata McGraw Hill Publication
3. A Textbook of Fluid Mechanics and Hydraulic Machines by Er. R.K. Rajput, S Chand Publications

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181PE12	**Machine Tools**	**3-0-0**	**3**

Course Outcomes (COs): At the completion of the course the students will be able to:

1. Apply principles of mechanics of machining in determination of force, torque, power etc. in metal cutting
2. Apply the concept of kinematic principles in design of machine tool drive
3. Apply the basic principles in design of hydraulic and also electrical drive
4. Apply the concept of machine tools for semi-automatic or automated production
5. Apply the principles of machine tools in economics of production

MODULE 1:
Metal cutting fundamental principles. Forces acting on the cutting tools. Merchant's theory of metal cutting. Vibration and chatter during metal cutting processes. Tool wear, tool life in relation to speed and surface.

MODULE 2:
Design and constructional principles of machines tools. Basic features of construction and fundamental kinetics requirements of machine tools.
Kinematic drives of machine tools – selection of range of speeds and feeds; layout in G P. – Ray diagrams for machine tools, gear boxes sliding and clutches drives. Feed gear-box analysis.

MODULE 3:
Considerations affecting the design of machine tools (Lathe, Milling and drilling machines) with reference to their purpose, strength, rigidity and accuracy. Single purpose and general purpose machine tools – effect on design.

MODULE 4: Application of hydraulic drives – circuit diagram, pumps and valves. Effect on power consumption and surface finish.

MODULE 5: Electric equipment for machine tools. Characteristics demanded from the machine tools.

MODULE 6: Automation in machine tools – Capstan and Turret lathe and their operation lay out. Single spindle automatic screw cutting machine tools and their cam lay out. Swiss type automatics.

MODULE 7: Economics of automation, Elementary principle of numerical control of machine tools, Acceptance tests for machine tools.

Textbooks/ Reference Books:

1. Principles of machine tools, Vol I & II, by G C Sen and A Bhattacharyya.
2. Design of machine tools by S K Basu
3. Design of machine tools by S K Basu and D K Pal
4. Production Technology, Vol II, by Dr. O P Khanna

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181PE13	**Power Plant Technology**	**3-0-0**	**3**

Course Outcomes (COs): At the completion of the course the student will be able:

CO1: Identify the different components of power plants and understand local and global energy scenario.
CO2: Evaluate the performance of steam power plant and its different components.
CO3: Compare the working and performance of diesel and gas turbine power plant.
CO4: Differentiate the working and relative merits between different non-conventional power plants.
CO5: Analyse the economics of power generation in different power plant.

MODULE 1:
Introduction of local and global Energy Scenario, history of power plant technology, key terminologies, various components and basic concepts of power plant, Resources and development. Concepts of captive power plant and co-generation Types of power plants

MODULE 2:
Steam turbine, Site selection, General lay-out of thermal power plants, Energy losses in steam turbine, Steam Generator- High Pressure Boiler, Economiser, Superheater, Reheater, Regenerator, Air preheater, coal firing furnace, fluidised bed combustion, waste heat boiler

MODULE 3:
Diesel Electric power plant, Plant layout, Engine performance, Gas Turbine Power Plant, Site selection, layout, fuels, materials, combined cycle

MODULE 4: Hydro Electric Power Plant, Classification, Hydro turbine, Principles of Nuclear Energy, Nuclear power plant, Fast breeding reactors

MODULE 5: Non-Conventional Power Plants- Geothermal, Wind, Solar power plants and Direct Energy Conversion Systems, Economics of power generation

Textbooks/ Reference Books:

1. Power Plant Technology Author: M.M. El-Wakil Publisher: McGraw-Hill Education
2. Power Plant Engineering Author: Domkundwar, Arora, Domkundwar Publisher: Dhanpat Rai & Co
3. Thermal Engineering Author: R.K.Rajput Publisher : Laxmi Publication
4. Steam Turbine Theory and Practice Author: William J. Kearton Publisher: CBS Publication
5. Gas Turbines Author: V Ganeshan, Publisher: McGraw Hill Education

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181PE14	**Quality Engineering**	**3-0-0**	**3**

Course Outcomes (COs): At the completion of the course the student will be able:

1. Recall and explain the basic concepts of Quality, Evolution of Quality, Variations, Quality Characteristics, classification of Quality Characteristics, Internal and External Customers, Juran's Quality Trilogy, Cost of Quality
2. Explain Statistical Process Control, Statistical Aspects of Quality Control, Type I and Type II Error in Statistical Analysis, Shewart Control Charts for Variables and Attributes. Interpretation of the Charts
3. Develop Sampling plans: Single, double, multiple and Sequential Sampling Plans
4. Explain Sampling Schemes and Sampling Systems, application of Dodge and Romig Tables
5. Explain and apply the Concepts of TQM, the salient contributions of Quality Gurus like Deming, Juran and Crosby, Deming's Philosophy leading to TQM, philosophy of Continuous Improvement, Quantification of Quality, Quality Scales, Six Sigma Approach, Reliability

MODULE 1: Introduction (8 Lectures)

The history and Background of Quality Control, Need for Quality Control, Evolution of Quality Control and different Quality Management Philosophies(Overview), Quality Assurance - Phases of Quality Assurance. Quality Definition: Characteristics / dimensions of quality, Juran's Quality Trilogy Quality Spiral, Causes of Variation change and Assignable Causes. Quality Costs: Reason for Quality Costs Analysis, Categories of Quality Costs(Cost of poor Quality), Concept of Optimum Quality Cost Model

MODULE 2: Statistical Concepts (7 Lectures)

Sample Parameters and Universe Parameters, Central Tendency and Dispersion and their measures, Data Representation Frequency Distribution Curves, Continuous and Discrete Distributions, Normal curve and its characteristics, Normal Table, Hypothesis Testing, Chi-square distribution. Inspection: Types of Inspection, Inspection Error, Inspection and Quality, Samples Inspections- Its Importance and Application Theory of Sampling: Population and Sample, Sample Statistics and Population Parameters, Rational Sub Grouping, Stewart Normal Bowl Experiment.

MODULE 3: Statistical Process Control (10 Lectures)

Statistical Aspects of Quality Control, Type I and Type II Error in Statistical Analysis, Shewart Control Charts-Variable and Attribute Charts (X,R-charts, b-chart, c-chart, up-chart) Control Charts for Variables: X Bar and R Charts, X Bar and Sigma Charts construction of the charts. Interpretation of the Charts. Manufacturing and Non-Manufacturing Application of the Charts. Control Charts for Attributes: p Chart, 100p Chart, n-p Chart, c Chart, U chart Interpretation of the Charts, Application

MODULE 4: Acceptance Sampling Plans for Attributes (10 Lectures)

Introduction, Importance, Situation leading to Economic Use Sampling Plans, Concept of AQL and relevant terms, OC Curves-Type A and Type B OC Curves, Different types of Sampling Plans, ASN Curve, ATI Curve. Sampling Schemes-MIL STD105D-Rules for Switching, Dodge and Romig Tables: Acceptance Sampling Plans for Variables: Introduction, Sampling Plans for Sigma Known and Sigma Unknown, Application.

MODULE 5: Concept of Total Quality Management (7 Lectures)

Introduction, Tools and Techniques of TQM, Brief Introduction Reliability: Distinction between Reliability and Quality, Relevant Terms, The Characteristics Curve (Bath-Tub Curve), Failure- Types, Causes of Failure, Reliability Function in terms of Failure Rate and its characteristics, Reliability improvement- Series and parallel Systems

Textbooks/ Reference Books:

1. Principles of Quality Control: Jerry Banks: Publisher: John Wiley & Sons
2. Introduction to Statistical Quality Control: Douglas Montgomery: Publisher: John Wiley & Sons
3. Statistical Quality Control: Eugene Grant and Richard Leavenworth: Publisher: Mc Graw Hill
4. Total Quality Management : Dale H., Besterfield, Glen H. Besterfield, Mary Besterfield-sacre: Publisher: Pearson

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181PE15	**Refrigeration**	**3-0-0**	**3**

Course Outcomes (Cos): At the completion of the course the student will be able:

1. Students will be able to *describe* refrigeration process and *illustrate* different related thermodynamic cycles.
2. Students will be able to *list* different applications of refrigeration and *analyse* the respective processes.
3. Students will be able to *categorise* and *compare* different types refrigerants used for various applications.
4. Students will be able to *explain* various refrigeration equipment used in VCRS and VARS.
5. Students will be able to *explain* and *analyse* practical refrigeration systems namely Vapour compression (VCRS) and Vapour absorption refrigeration cycles (VARS) and other non-conventional refrigeration systems.

MODULE 1: Refrigeration

Introduction, history, methods of refrigeration, Ice, Evaporation expansion of air, throttling of gas, vapour compression and absorption, steam jet, liquid gas, dry ice, units of refr. Difference between engine, refrigerator and heat pump.

MODULE 2: Gas Cycle Refrigeration

Simple cycles – Carnot and Bell-Coleman; Regenerative & reduced ambient system; Air-craft refrigerating system - simple boot-strap, reduced ambient; Actual cycles, ramming; Advantages and disadvantages of DART.

MODULE 3: Vapour Compression Systems

Analysis of simple cycles, representation of TS, pH plans; methods of improving COP; Deviations of actual cycles from theoretical cycles. Compound compression with liquid flash cooler, flash inter-cooler multiple systems – COP, power required, Ewing diagram.

MODULE 4: Vapor Absorber Ref. System

Thermodynamical analysis of systems, Advantages and disadvantages, Components, Practical systems NHe Watt. Water LiBr, Electrolux systems, Calculations based on concentration; Properties of binary mixtures.

MODULE 5: Non – Conventional Ref. System

Steam jet ref. Thermoelectric, Vortex tube refr. – merits and demerits and applications.

MODULE 6: Refrigerants

Nomenclature, classification, desirable properties. Important refrigerants and their comparisons, selection of refrigerants.

MODULE 7: Ref. Equipment

Brief introduction to compressors, condensers, expansion devices, evaporators; Piping, line valves, solenoid valves, oil separators, driers, filters, moisture indicators, purging and controls.

MODULE 8: Application of Refrigeration

Production of dry ice, cascading, multi-staging domestic, commercial, industrial and medical, preservator of food-spoilage, methods of preservation, cold storage, preparing of insulating materials using in ref. Systems.

Textbooks/ Reference Books:

1. Refrigeration and Air-Conditioning by Ahmedul Ameen, PHI
2. Refrigeration and Air-Conditioning by C.P.Arora, Tata McGraw Hill Publication.
3. Refrigeration and Air-Conditioning by M.Prasad

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181PE16	**Rotordynamics**	**3-0-0**	**3**

Course Outcomes (COs): At the completion of the course the student will be able:

1. Predict rotor system dynamic characteristics for design of any type of machinery.
2. Develop knowledge of problems relating to rotating machineries during operation such as unbalances, misalignment, gyroscopic effect
3. analyze torsional vibration of rotor for high power transmission and high speed application
4. Identify rotor bearing system parameters and apply in futuristic model based condition monitoring
5. Develop knowledge about recent development in active magnetic bearing.

MODULE 1: Simple Rotor System (6 Lectures)
Basic transverse vibration of Single DOF rotor model, Jeffcott Rotor with central and offset disc, calculation of natural frequencies

MODULE 2: Transverse Vibration of Simple Rotor Bearing Foundation System (4 Lectures)
Symmetrical rigid and flexible shaft on Anisotropic bearing, unbalance forces, bearing forces

MODULE 3: Gyroscopic Effect in Rotor System (6 Lectures)
Effect of spinning disk, synchronous whirl of an overhang rotor, asynchronous rotational motion

MODULE 4: Tranverse Vibration of Multi Dof Rotors (3 Lectures)
Influence co-efficient method for static and dynamic case

MODULE 5: Torsional Vibration of Rotors (8 Lectures)
Direct and transverse matrix method, TMM for geared and branched system.

MODULE 6: Balancing of Rotors (4 Lectures)
Rigid rotors balancing single and two plane balancing, flexible rotor balancing

MODULE 7: Active Magnetic Bearings in Rotors (6 Lectures)
Basics of active magnetic bearing, block diagram and transfer functions, tuning of the controller parameters

MODULE 8: Signal Processing in Rotating Machineries and Condition Monitoring (3 Lectures)

Textbooks/ Reference Books:

1. J. S. Rao, Rotor Dynamics, Third Ed., New Age, New Delhi.
2. M. J. Goodwin, Dynamics of Rotor Bearing System, Unwin Hyman, Sydney.
3. Rajiv Tewari, Rotor Systems, Analysis and Identification, CRC Press.

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181OE11	**Operation Research**	**3-0-0**	**3**

Course Outcomes (COs): At the completion of the course the student will be able:

1. To analyze techno-managerial problems for effective use of resources in professional life.
2. To analyze & solve engineering and managerial problems by classical methods and interpret results.
3. To identify technical and managerial situations needing effective, economic and efficient methods for problem solution.
4. To formulate mathematical models for optimization of engineering & business problems for quantitative analysis, solution and interpretation of results.
5. To formulate and solve problems by simulation technique in engineering problems to verify and validate the model

MODULE 1:

Introduction to OR, Engineering applications, Statements of an OR problems, Types of problems handled in OR

MODULE 2:

a) Linear programming (deterministic)- Problem formulation, Feasibility and optimality, Basic and Non-basic solutions.
b) Graphical methods of solving LPP, Simplex Algorithm and problem solution, use of slack, surplus and Artificial variables and their meanings.
c) Big-M method and 2-phase method.
d) Dual Simplex algorithm.
e) Meaning and examples of unique, Alternate/Multiple, unbounded and Infeasible solutions.
f) Degeneracy and cycling

MODULE 3:

Special Linear Programming Problems – their formulations and solutions in such cases as Integer Programming Problems (IPP), Transportation problem (TP) and Assignment Problem (AP). Discussion on method extended to Travelling Salesman Problem (TSP)

MODULE 4:

Classical Optimization – Introduction, single and Multi-variate problems, Lagrangean method, Karush-Kuhn Tuker (KKT) conditions.

MODULE 5:

Inventory modelling – Classification of inventory, Deterministic versus Stochastic problems situations, Formulation and solution of Deterministic inventory problems.

MODULE 6:

Simulation – Meaning, Monte-Carlo simulation, generation of random observations, use of digital computers in simulation, Discussion on Simulation examples such as inventory, queuing etc.

Textbooks/ Reference Books:

1. Operations Research –H A Taha
2. Operations Research –Gupta and Hira
3. Operations Research –Billy E Gillet
4. Operations Research –Panneerselvam
5. Optimization – S S Rao
6. Operations Research – N G Nair
7. System Simulation by digital computers – N Deo

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181OE12	Renewable Energy Sources	3-0-0	3

Course Outcomes (COs): At the completion of the course the student will be able:

1. Identify energy demand and relate with available energy resources and also explain the Non-conventional energy sources & systems
2. Analyze harnessing of solar energy
3. Analyze harnessing of wind energy
4. Analyze harnessing of Biomass energy
5. Analyze harnessing of Geothermal and Ocean energies
6. Analyze Magneto hydrodynamics and Fuel cell technology

MODULE 1:
Different forms of non-conventional energy sources: Solar, Bio-gas, wind, tidal, geothermal etc.

MODULE 2: Basic Bio-Conversion Mechanism
Source of waste, simple digesters; composition and calorific value of biogas, Bio-mass as a source of energy, energy plantation, production of fuel from wood, agricultural and municipal solid and animal wastes, sludge and waste water, bio-gas generation and utilization

MODULE 3: Solar Option
Energy from sun – availability of solar radiation, technique of collection, storage and utilization; Types of solar collectors; selective surfaces; solar thermal processes – heating, cooling, drying, power generation etc. Thermoelectric conversion and thermal storage. Introduction to photoelectric conversion

MODULE 4: Wind and Tidal Energy Generation
Special characteristics, turbine parameters, optimum operation, electric power generation from wind/tidal energy; Types of wind mills, Elementary design principles, Principle of ocean thermal energy conversion; Power plant based on OTEC

MODULE 5: Geothermal Energy
System. Extent of available resources. Heat transport in geothermal systems. Hot springs and steam injections

MODULE 6: The Nuclear Options
Fission, fusion technology fundamentals. Thermal and fast reactors. State of art Breeder reactors, prospect and limitations, economics. Fusion energy – controlled fusion of H_2, He etc. Energy release rate, future possibilities

MODULE 7: Direct Conversion Methods
Thermo-ions, MHD, electrochemical devices, fuel cells etc. Intrigated energy packages using solar, biomass, wind etc.

MODULE 8: Comparative study of non-conventional energy source, cost consideration and economic

Textbooks/Reference Books:

1. Waste water Engineering - by MetCaff, Eddy – McGrow Hills
2. Solar Energy - by SP Sukhatme – TMG
3. Solar Energy Utilization - Duffie & Beckman – Wiley Int. Ltd.

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181OE13	**Solid Waste Management**	**3-0-0**	**3**

Course Outcomes (COs): At the completion of the course the student will be able:
CO1: Explain the principles of Solid Waste Management
CO2: Apply modern techniques at different stages of waste processing
CO3: Design solid waste management system for any area
CO4: Understand the environmental problems relating to solid waste management
CO5: Cater to the needs of the society for implementing scientific waste management

MODULE 1: Introduction to Solid Waste Management
Introduction to Solid Waste, 4-R Principle in waste minimization, Concept of Zero Waste, Types and Sources of Solid Waste, Characteristics & Quantification technique of Solid Waste, Legislation & Regulations

MODULE 2: Collection Systems of Solid Waste
Refuse collection: Primary collection system, secondary collection system, transfer to disposal site, Commercial wastes, Transfer stations

MODULE 3: Processing of Municipal Solid Waste
Storing, Conveying, Compacting, Shredding, Material separation, Trommel screens, magnets & electromechanical separators

MODULE 4: Biochemical Processes
Fundamentals of Composting, Different techniques of Composting, anaerobic digestion, Bio-gas production

MODULE 5: Combustion and Energy Recovery
Incineration, Waste to energy combustors, Pyrolysis, Plasma Gasification, Undesirable effects of combustion

MODULE 6: Current Issues in Solid Waste Management
Life cycle analysis & management, social stigma associated with waste management, public or private ownership, financing solid waste facilities, role of solid waste engineer

Textbooks/ Reference Books:
1. P. Aarne Vesilind, William Worrell, Reinhart, Solid Waste Engineering, Thomson Publishing House
2. Prasad Modak, Waste Minimization- A Practical Guide to Cleaner Production & Enhanced Profitability, Centre for Environment Education, Ahmedabad

Course Code	Course Title	Hours per week L-T-P	Credit C
HS181704	Principles of Management	3-0-0	3

MODULE 1: Introduction (6 Lecture)
Definition and meaning of management, Characteristics of management, importance of management, functions of management-planning, organising, directing, staffing, coordination and controlling etc., principles of management, Difference between administration and management

MODULE 2: Financial Management (6 Lecture)
Definition and management of financial planning, importance and characteristics of sound financial plan, concepts of capital- fixed capital and working capital, source of finance, fund flow statement

MODULE 3: Marginal costing (6 Lecture)
Definition and meaning of marginal costing, advantages, marginal cost equation, contribution, profit-volume ratio, break even analysis, margin of safety

MODULE 4: Cost Accounting (6 Lecture)
Cost Accounting- Concept and benefit, elements of cost, preparation of cost sheet with adjustment of raw materials, work-in-progress and finished goods

MODULE 5: Capitalisation (4 Lecture)
Definition and meaning of capitalisation, over and under capitalisation

MODULE 6: Motivation (6 Lecture)
Introductory observation, definition of motivation, motivational technique, features of sound motivational system

MODULE 7: Leadership (6 Lecture)
Concept of leadership, principles of leadership, functions of leadership, qualities of leadership, different styles of leadership

Textbooks/Reference Books:

1. Principle of Business Management: RK Sharma, Shashi K.Gupta
2. Business Organisation and Management: SS Sarkar, RK Sharma, Shashi K.Gupta
3. Industrial Organisation and Management: SK Basu, KC Sahu, B Rajviv
4. Principles of Management by Dr. A. K. Bora: Chandra Prakash, Guwahati.
5. Management Accounting: RK Sharma, Shashi K Gupta
6. Cost Accounting: SP Jain, K I Narang
7. Cost Accounting, RSN Pillai, V Bhagawati
8. Principles of Management: RN Gupta
9. Principles of Management: RSN Pillai, S. Kala
10. Principles of Management: Dipak Kumar Bhattacharjee

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181722	Project-1	0-0-8	4
GUIDELINES WILL BE ISSUED BY THE UNIVERSITY FROM TIME TO TIME			

Course Code	Course Title	Hours per week L-T-P	Credit C
SI181721	Internship-III (SAI - Industry)	0-0-0	2
GUIDELINES WILL BE ISSUED BY THE UNIVERSITY FROM TIME TO TIME			

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