# DEPARTMENT OF MECHANICAL ENGINEERING
# JORHAT ENGINEERING COLLEGE
## JORHAT : 785007, ASSAM
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Date : 11-01-2023

## NOTICE

Mechanical Engineering department of Jorhat Engineering College has offered following electives for the 8th semester B.Tech 2023 even semester. Google form will be released on 20th January 2023 at 11 AM for choosing elective subjects. Seats for each elective subject will be limited (First cum first serve basis) as mentioned in the below table.

| 8th Semester | Name of Electives | Course instructor | No of seats available |
|---|---|---|---|
| **Program Elective-2** | Air Conditioning (ME1818PE21) | Dr. Diganta Hatibaruah | 33 |
| | Compressors and Gas Turbines (ME1818PE21) | Dr. Parag Kamal Talukdar | 33 |
| | Computational Fluid Dynamics (ME1818PE25) | Mr. Prince Kumar | 33 |
| **Program Elective-3** | Operations Management (ME1818PE32) | Mr. Ranbir Kalita | 50 |
| | Internal Combustion Engines (ME1818PE33) | Mr. Sanjeev Vishwakarma | 50 |
| **Open Elective-2** | Industrial Safety Engineering (ME1818OE22) | Mr. Dhrupad Sarma | 50 |
| | Engineering Economic Analysis (ME1818OE23) | Mr. Palash Saikia | 50 |

Date: 11.01.2023

Dr. Diganta Hatibaruah
Prof. & HoD, M. E. Deptt., JEC

| Course Code | Course Title | Hours per week L-T-P | Credit C |
|---|---|---|---|
| **ME1818PE21** | **Air Conditioning** | **3-0-0** | **3** |

**MODULE 1: Psychrometry**
Psychrometric properties, representations of properties in charts, preparation of charts

**MODULE 2: Psychrometric processes**
Constant sensible heat and latent heat processes, adiabatic saturation and enthalpy deviation. Adiabatic mixing of air stream. Humidification, Dehumidification water spray processes, sensible heat factors, grand sensible heat ratio lines, apparatus dew points, Bypass factors, Air washer-humidifying efficiency

**MODULE 3: Comfort A/C**
Air temperature, human health, body temperature regulation, comfort indices, comfort charts and their limitations

**MODULE 4: Load analysis**
Inside and outside design conditions, load classification, summer cooling loads, solar heat gain and transmission and radiation. Flywheel effect of building materials, equipment temperature differential loads due to human beings, load due to electric light, equipment and appliances. Infiltrator and ventilator loads, product loads, miscellaneous loads such as duct heat gain, duct air leakage, fans, pumps etc. Winterheat load – computation of loads

**MODULE 5: Duct design and Air distribution**
Different methods of duct design such as velocity reduction, equal friction and static regain, aspect ratio duct losses, distribution of air in rooms, nature and supply grill; duct arrangement and air handling system

**MODULE 6: A/C System**
Unitary control system, special features of residential, commercial and industrial A/C system, Year rounda/c zoning

**MODULE 7: Equipment**
(1) Fans – types of fans, characteristics, curves, fan selection. (2) Air filter and cleaner. (3) Cooling towers, evaporators, condensers (4) Cooling coils and water capacity, (5) Chemical dehumidifiers, (6) Heaters, radiators, Convection coils

**MODULE 8: Instruments and controls**
Temperature, humidity, air velocity measuring instruments, Thermostat, humidistat. By pass and dampercontrol. Dew point control, noise control, Pneumatic control

| Course Code | Course Title | Hours per week L-T-P | Credit C |
|---|---|---|---|
| **ME1818PE24** | **Compressors and Gas Turbines** | **3-0-0** | **3** |

**MODULE 1: Introduction**
Classification of Turbo machines, Application of Euler equation to radial and axial flow turbomachines.

**MODULE 2: Centrifugal Compressors**
Impeller, blade shape, diffuser, velocity diagram, inlet guide vane and pre-whirl, slip, work done, pressure rise, temperature rise, enthalpy-entropy diagram, efficiency, characteristics, surging.
**Axial-flow Compressors**: Stage, stage blading arrangement, velocity diagram, blade angles, thermodynamics of the compressor stage, enthalpy-entropy diagram, efficiency, degree of reaction,

stagepressure and temperature rise, work done factor, stage loading, pressure ratio of a multistage compressor,surging and stall, characteristics curve.

**MODULE 3: Axial-flow Turbines**
**Impulse Turbines**: Single stage and multi stage turbine, blading, velocity diagram, blading efficiency, Thermodynamics of stage, stage enthalpy-entropy diagram, efficiency.
**Reaction Turbine**: Stage, blading, stage velocity diagram, Thermodynamics of the stage, enthalpy- entropy diagram, efficiency, degree of reaction, free vortex design, variation of degree of reaction with radius, flow characteristics of multistage turbine.
**Gas Turbine**: Combined cycles, compounding and governing of gas turbine.

**MODULE 4: Combustion system**
Types of combustion chambers, the combustion chamber performance.
**Blading material**: Influence of blading material on the maximum temperature of the cycle, desirableproperties of a gas turbine blading material, various blading material and their strength and weakness

**MODULE 5: Jet Propulsion**
Turboprop, turbofan, turbojet and ramjet systems, matching of turbine and compressor.

| Course Code | Course Title | Hours per week L-T-P | Credit C |
|---|---|---|---|
| **ME1818PE25** | **Computational Fluid Dynamics** | **3-0-0** | **3** |

**MODULE 1: The Basic Equations of Fluid Dynamics**
General form of a Conservation law: equation of mass conservation, conservation law of momentum, conservation equation of Energy.

**MODULE 2: The dynamic levels of approximation**
The Navier-Stokes(NS) equation: The Reynold's averaged NS equation, The thin layer NS approximation, The parabolized NS approximation, The boundary layer approximation The distributed loss model, The inviscid flow model, Euler equations, steady inviscid rotational flow, The potential flow model, small disturbance approximation of the potential equation, Linearised potential flow, singularity methods, mathematical nature of flow equations.

**MODULE 3: Basic discretization techniques**
(a) The finite difference method, (b)The finite volume method and conservative discretization.

**MODULE 4: Analysis and application of Numerical schemes**
Consistency, stability, convergence, Fourier and Von Neumann stability analysis, modified equation, application of finite difference methods, to wave, heat. Laplace and Burger's equation.

**MODULE 5: Solution methods**
Solution of 1D heat conduction equation, wave equation, Laplace equation using various schemes.

**MODULE 6: Heat Transfer**
Basics of finite difference and finite element methods: Numerical methods for conduction heat transfer, Numerical methods for convection heat transfer, Numerical methods for radiative heat transfer.

| Course Code | Course Title | Hours per week L-T-P | Credit C |
|---|---|---|---|
| **ME1818PE32** | **Operations Management** | **3-0-0** | **3** |

**MODULE 1: Operations Management**
Introduction, Operations Management and Strategy, Tools for Implementation of Operations.

**MODULE 2: Forecasting**
Introduction, The Strategic Importance of Forecasting, Benefits, Cost implications and Decision making using forecasting, Classification of Forecasting Process, Methods of Forecasting, Forecasting andProduct Life Cycle, Selection of the Forecasting Method, Qualitative Methods of Forecasting, Quantitative Methods, Accuracy of Forecasting

**MODULE 3: Inventory Management**
Need for holding stock, Planning and controlling stock levels, Product Classification, Demand analysis,ABC analysis, Product Coding. Inventory Cost and Service, Lead Time, Management of Stock Levels, Replenishment Methods

**MODULE 4: Layout Planning**
Introduction, Objectives of Layout, Classification of Facilities, Why Layout decisions are important, Nature of layout problems, redesigning of a layout, Manufacturing facility layouts, Types of Layouts, Layout Planning, Evaluating Plant Layouts

**MODULE 5: Total Quality Management**
Introduction, Meaning and Dimensions of Quality, Quality Control Techniques, Quality Based Strategy,Total Quality Management (TQM), Towards TQM – ISO 9000 as a Platform

**MODULE 6: Supply Chain Management**
Introduction, Domain Applications, Views on Supply Chain, Bullwhip Effect in SCM, Collaborative Supply Chain, Inventory Management in Supply Chain, Financial Supply Chain

**MODULE 7: Operations Scheduling**
Introduction, Purpose of Operations Scheduling, Factors Considered while Scheduling, Scheduling Activity under PPC, Scheduling Strategies, Scheduling Guidelines,

**MODULE 8: Value Engineering**
Introduction, Value Engineering/Value Analysis, Relevance of VE in Modern Manufacturing, Processof Value Analysis, VE– Approaches and Aim, Providing Value to the Customers, Benefits

**MODULE 9: Project Management**
Planning Process: Introduction, need, Project Management Principles, Essentials of Project ManagementPhilosophy, Project Planning, Project Process Flows.

| Course Code | Course Title | Hours per week L-T-P | Credit C |
|---|---|---|---|
| **ME1818PE33** | **Internal Combustion Engines** | **3-0-0** | **3** |

**MODULE 1:**
Fuel Air cycle – effect of variation of specific heats, fuel-air ratio, compression ratio and dissociation. Actual cycle – losses in actual cycle.

**MODULE 2:**
Exhaust gas analysis – its interpretation and use in determination of combustion characteristics; Pollutionnorms

**MODULE 3:**
I C engines fuels - - Petrol, Diesel, natural gases and some other alternative fuels and their characteristics and use in engines. Combustion process in S. I. And C. I. engines, abnormal combustion, detonation andfuel knock – additives. Rating of I. C. engine fuel.

**MODULE 4:**
Design features of combustion chambers used in S I and C I engines, some important types of

combustionchambers.

**MODULE 5:**
Carburetion – desirable characteristics – compensation for simple jet carburetor, calculation for air-fuelratio.

**MODULE 6:**
Injection processes – requirements and methods –mechanical, electronic and MPF injection system.Ignition processes in petrol engines – requirements and types – battery magneto and electronic.

**MODULE 7:**
Performance characteristics of petrol and Diesel engines. Part load and full load characteristics in respect to thermal efficiency, mechanical efficiency, fuel consumption, bmep and torque. I C engine ratings and volume capacity compression ratio and weight to power output ratio and its trends in power – weight characteristics. Supercharging of I C engines – effect of supercharging on Diesel and petrol engines – performance characteristics for supercharged engines.

**MODULE 8:**
Supercharger – types, principles of duel-fuel and multi-fuel engines and Stratified combustion engines.

| Course Code | Course Title | Hours per week L-T-P | Credit C |
|---|---|---|---|
| **ME1818OE22** | **Industrial Safety Engineering** | **3-0-0** | **3** |

**MODULE 1: Key concepts and basic terminologies**
History of Industrial Safety Movement in India and abroad. Basic concepts and importance of industrial safety, key concepts and basic terminologies like safety, risk, accidents, incidents, mishaps, hazards, hazard-mishap entity, examples of hazard components and its description, hazard theory, hazard triangleand hazard analysis, causal factors, hazard actuation, hazard causal factors. Fundamental concepts in safety domain ontology and accident causation.

**MODULE 2: Failure modes and effects analysis**
Failure modes and effects analysis (FMEA), its history and importance, identification of failure modes, system breakdown concept, methodology and example of a case study of identifying failure modes of compressor sub system.

**MODULE 3: Failure tree analysis**
Failure tree analysis (FTA), its history and importance, different measures, primary failures, secondary failures, command failures, event symbols, gate symbols with application, failure tree construction concept, P-S-C concept of failure analysis, example of fault tree construction and analysis of gas oven burner system.

**MODULE 4: Industrial risk and losses**

Concept and definition of industrial risk, risk profile, risk assessment process, risk contour map, individual risk assessment, industrial losses, identification and classification of losses, framework for consequence assessment, loss estimation, safety function deployment and steps of stakeholders concernsabout safety.

**MODULE 5: Safety audit**
Introduction, Components of safety audit, types of audit, audit methodology, non conformity reporting (NCR), audit checklist and report – review of inspection, remarks by government agencies, consultants, experts – perusal of accident and safety records, formats – implementation of audit indication - liaison with departments to ensure co-ordination – check list – identification of

unsafe acts of workers and unsafeconditions in the shop floor.

**MODULE 6: Industrial Fire Prevention and Protection**

Sources of ignition – fire triangle – principles of fire extinguishing – active and passive fire protection systems – various classes of fires – A, B, C, D, E – types of fire extinguishers – fire stoppers – hydrant pipes – hoses – monitors – fire watchers – layout of stand pipes – fire station-fire alarms and sirens –

maintenance of fire trucks – foam generators – escape from fire rescue operations – fire drills – notice-first aid for burns.

| Course Code | Course Title | Hours per week L-T-P | Credit C |
|---|---|---|---|
| **ME1818OE23** | **Engineering Economic Analysis** | **3-0-0** | **3** |

**MODULE 1: Introduction**

Introduction to Engineering Economy, Physical & Economic Environment, Phases in Engg. process, Some economic concepts, Value and utility; Interest and Interest rate, Time value of money; Interestformulas: - Simple and compound interest, Cash flow diagrams, Interest formulas for discretecompounding and discrete payments: Single payment (CAF & PWF), Interest formulas for discretecompounding and discrete payments: Equal payment series (CAF, CRF & PWF).

**MODULE 2: Problem solving by compounding**

Problem solving on discrete compounding, discrete payment; Interest formulas for Uniform gradient series; Interest formulas for geometric gradient series; Compounding frequency of Interest: Nominal and Effective interest rates; Problem solving on frequency compounding of interest and gradient series factors.

**MODULE 3: Economic equivalence**

Economic equivalence: Meaning and principles of equivalence; Equivalence calculations involving cash flows; Methods of comparison of alternatives: Present worth, Annual equivalent, Future worth, Internalrate of return; Comparison of alternatives: - Capitalized equivalent amount, Capital recovery with returnProblem solving on equivalence and comparison of alternatives.

**MODULE 4: Replacement analysis**

Replacement analysis: Reason, Concept of defender and challenger; Proper treatment of sunk cost in replacement; Replacement because of improved efficiency, inadequacy, demand etc.; Problem solving on replacement analysis; Economic life of the asset.

**MODULE 5: Depreciation**

Depreciation: Definition, Reasons, Types of property, Value time function and book value; Basic depreciation methods: S-L method, declining balance method; Depreciation: Declining balance switching to S-L, SOYD Method; Modified accelerated cost recovery system (MACRS) method of depreciation, Depletion; Depreciation: Units of production method, Depletion.

**MODULE 6: Break even and EOQ**

Breakeven analysis, Effect of fixed and variable cost on BEP; Economic order quantity; Problem solvingbased on Break-even analysis and EOQ.