B. TECH. (MECHANICAL ENGINEERING)
(w.e.f. session 2018-19)

4th Year **7th Semester**

Sl. No	Course Category.	Subject Code	Name of the Subject	Periods				Evaluation Scheme				Subject Total
								Sessional (CA)			End Sem. Exam. (ESE)	
				L	T	P	C	CT	TA	Total		
1.	DC	ME401	Industrial Engineering	03	01	-	**04**	25	15	40	60	100
2.	DC	ME402	CAD & CAM	03	01	-	**04**	25	15	40	60	100
3.	DE		Departmental Elective-5	03	01	-	**04**	25	15	40	60	100
4.	DE		Departmental Elective-6	03	01	-	**04**	25	15	40	60	100
5.	DE		Departmental Elective-7	03	01	-	**04**	25	15	40	60	100
6.	DC	ME421	CAD/CAM Lab	-	-	02	**01**	30	30	60	40	100
7.	DC	ME422	I.C Engine & Automobile Engg. Lab	-	-	02	**01**	30	30	60	40	100
8.	DC	ME-300	Industrial Training *	-	-	-	**0**	-	50	50	-	50
9.	DC	ME-490	Minor Project	-	-	02	**01**	30	30	60	40	100
	Total			**15**	**05**	**08**	**23**	**245**	**195**	**380**	**420**	**800**

*** Student must clear this paper with at least 50% marks.**

L – Lecture **T** – Tutorial **P** – Practical **C** – Credits **CT** – Class Test **TA** – Teacher Assessment

Sessional Total (CA) = Class Test + Teacher Assessment

Subject Total = Sessional Total (CA) + End Semester Examination (ESE)

BS – Basic Sciences
HM – Humanities
DE – Departmental Elective
DC – Departmental Core
OE – Open Elective
ESA – Engineering Sciences & Arts (Foundation Course & Engineering Courses)

LIST OF ELECTIVE SUBJECTS

B.TECH. MECHANICAL ENGINEERING

Departmental Elective –5 (7th Semester)

1. ME403 Drilling Technology for Water, Oil and Mineral Exploration
2. ME404 Total Quality Management
3. ME405 Unconventional Manufacturing Process
4. ME406 Energy Conservation and Waste Heat Recovery

Departmental Elective –6 (7th Semester)

1. ME407 Automobile Engineering
2. ME408 Mechanical Systems Design
3. ME409 Energy Management
4. ME410 Mechanical Vibration

Departmental Elective –7 (7th Semester)

1. ME411 Heat Ventilation & Air Conditioning
2. ME412 Engineering Materials
3. ME413 Non-Destructive Testing
4. ME414 Fuel & Combustion
5. ME415 Computational Fluid Dynamics

INDUSTRIAL ENGINEERING

ME-401

w.e.f. Session 2018-19

L	T	P	C
3	1	0	4

UNIT –I

Introduction : Concept of Industrial Engineering, Functions of Industrial Engineering, Industrial Engineering techniques, Role of an Industrial Engineer. Applications of Industrial Engineering. **4**

Production and Productivity :

Concept of production, production function, production system, Definition of productivity, Difference between productivity and production, Productivity, efficiency and effectiveness. Measurement of productivity, Types of productivity, productivity index, ways to improve productivity. **4**

UNIT -II

Job Evaluation and Merit Rating :

Concept of job evaluation, job analysis, job description, job simplification, job evaluation methods, Definition and methods of merit rating, wage-incentive payment plans. **4**

Plant Layout and Materials Handling:

Considerations in plant location, Definition of plant layout, types of layout, Principle of plant layout, Material, handling, Material handling equipments. **2**

Production Planning and Control (PPC)

Objectives of PPC, Functions of PPC, production planning, steps in PPC, effectiveness of PPC system. **2**

UNIT -III

Depreciation and Replacement :

Concept of depreciation and obsolescence, Classifications of depreciation, Methods of charging depreciation, Service life of an asset, Replacement of items which deteriorate with time. **2**

Inventory Control :

Inventory, function of inventory, inventory costs, Deterministic inventory models. **3**

Statistical Quality Control:

Introduction, Process control, Control charts, acceptance plan, acceptance sampling, single, Double and sequential Sampling plans, concept of average outgoing quality. **3**

UNIT -IV

Industrial Ownership:

Introduction, Sole proprietor enterprise, partnership firm, joint stock company, Classification of company, Comparison of Public, Private and Joint sector, Cooperative organization. **4**

Factory Legislation in India :

Importance and principles of Labour legislation, Factory Act, Payment of wages Act, Minimum wages Act, Workmen’s compensation Act, Employee’s State Insurance Act. **4**

UNIT -V

Break-Even-Analysis :

Introduction and purpose of BEA, Assumptions, Steps in BEA, Fixed Cost, Variable cost, Margin of safety, Angle of incidence, Profit volume graph. **4**

Brief Introduction of the Following Terms:

Concept of optimization, Concept of value engineering Total quality management, Management of Projects, Management information systems, Professional and business Ethics, Environmental pollution. **4**

Books:

1. Industrial Engineering: M.I. Khan, New-Age Int.
2. Industrial Engineering and Management: O.P. Khanna, Dhanpat Rai
3. Principles of Management, An Analysis of Management Fuction: H.Kontz and C.D. Donnel.
4. Manufacturing Management: J.Moore, Prentice Hall.

Recommended Prerequisite: None **Co-requisite:** None

CAD & CAM
ME-402
w.e.f. Session 2018-2019

L	T	P	C
3	1	0	4

UNIT –I **8**

Introduction and Review of Computer Programming :

Introduction to CAD/CAE, Elements of CAD, Concepts of integrated CAD/CAM, CAD Engineering applications, its importance and necessity. Review of C, C^{++}.

Introduction to MATLAB; Multiplication, addition, subtraction and division. Utility and application. Functions and 2D plots.

Computer Graphics-I

Computer systems, Graphics input devices-cursor control devices, Digitizers, Scanners, speech oriented devices and touch panels, Graphics display devices CRT, colored CRT monitors, Colour models, DVST, Flat-panel display, Graphics output Devices.

UNIT -II **8**

Computer Graphics -II

Graphics software, Graphics functions, output primitives-Bresenham's line drawing and Mid-point circle algorithms.

Geometric Transformations:

Word/device co-ordinate representations, 2D and 3D geometric transformations, Matrix representations-translation, scaling, shearing, rotation and reflection, composite transformations, concatenation about arbitrary axis. Exercise and programs.

UNIT -III **8**

Introduction to NC Machines:

Introduction to Automation, Need and future of NC systems and CAM; Advantages and disadvantages; Classification; Open and closed loop systems; Historical development and future trends.

NC Part programming:

(a) Manual (word address format) programming; Examples Drilling and Milling.

(b) APT programming. Geometry, Motion and Additional statements, Macro-statement.

UNIT -IV **8**

Computer Integrated Manufacturing System:

Group Technology, Manufacturing cell, Transfer lines, FMS, CIM, CAD/CAM, CAPP, Concept of Mechatronics

Interpolators : Principle, Digital Differential Analyzers; Linear interpolator, Circular Interpolator and its software.

Control of NC Systems : Open and closed loops. Automatic control of closed loops with encoder and tachometers; Speed variation of DC motor; Adaptive control.

UNIT -V **8**

Numerical Methods :

Introduction to curve fitting methods. Root-finding and Optimization techniques. Bisection method, Regula-Falsi Method, Newton Rephson method, Interpolation Lagrange and Newton's interpolation, Curve fitting-Least Square method Numerical integration-Trapezoidal and Simpson Method.

Finite Element Methods: Introduction and Application of FEM, Stiffness Matrix/Displacement Matrix, One/Two Dimensional bar and beam element (as spring system) analysis.

Books:

1. Computer Graphics: Hearn and Baker (Pearson/Prentice hall)
2. Computer Aided Design : R.K. Srivastava.
3. Computer Graphics, Theory and Practice: Foley, Van Dam, Feiner, (Pearson Education)
4. CAD/CAM, Theory and practice: Ibrahim Zeid (McGraw Hill International)
5. Computer Aided Analysis and Design of Machine Elements: (Rao and Dukkipati)
6. Mathematical Elements for Computer Graphics: Rogers and Adams (McGraw Hill)
7. CAD/CAM : Groover and Zimmers (Prentice Hall of India Pvt. Ltd.)
8. Computer Oriented Numerical Methods: Rajaraman (Prentice Hall)

Recommended Prerequisite: None **Co-requisite:** None

DRILLING TECHNOLOGY FOR WATER, OILS AND MINERAL EXPLORATION
ME-403
w.e.f. Session 2018-2019

L	T	P	C
3	1	0	4

Basic Concepts
History of Drilling, Geology & classification of rocks, Application of Geo-physics, Hydrology, Geo-chemical prospecting and remote sensing for water, oil & mineral exploration, soil testing location of site. **8**

Unit-II
Drilling Logging and Testing
Reverse and direct rotary, Percussion, DTH, Odex Drilling, Conventional, Wire Line, Auger Drilling and Drilling for Standard Penetration Test (SPT). Borehole Logging ,Drill stem test, **8**

Unit-III
Drilling Fluids
Type of Drilling Fluid, Bentonite –constituents, Maintenance of parameters, Viscosity, Sp. Gravity, Filtration loss, Additives to maintain parameters, use of polymers as fluids. **8**

Unit-IV
Water Well Drilling
Origin, occurrence and movement of ground water, Genetic classification of water, Aquifer, Transmissibilty, Darcy's law, Coefficient of Permeability, Construction of tube well, well development, drilling method, placement Gravel pack, **8**

Unit-V
Drilling for Oil and Minerals
Exploration Diamond Drilling, Horizontal, vertical and directional Drilling, Core samples, Geotechnical order (GTO), Deviation in borehole and wedge design, , Geothermal Drilling, Oil Drilling Exploration. **8**

Books:

1. Diamond Drilling Technology by C.P Chug, Oxford publication
2. A Handbook of Drilling Technology by C.P Chug, Oxford publication

Recommended Prerequisite: None **Co-requisite:** None

TOTAL QUALITY MANAGEMENT (TQM)
ME-404
w.e.f. Session 2018-2019

L T P C
3 1 0 4

UNIT -I
Quality Concepts
Introduction, Need for Quality, Evolution of quality, Definition of quality, Dimensions of manufacturing and service quality, Basic concepts of TQM, Definition of TQM, Contribution of Deming, Juran and Crosby,Barriers to TQM **8**

UNIT -II
Quality Management
Leadership – Strategic quality planning, Customer satisfaction, Customer complaints, Customer retention, Team and Team work, Continuous process improvement – PDSA cycle, 5S, Kaizen – Supplier partnership – Partnering supplier selection – Supplier rating. **8**

UNIT -III
Control Charts
Theory of quality control charts, measurement range, use of control charts. Construction and analysis of OC curve.
Attributes of Control Charts
Defects, construction and analysis of control charts, improvement of quality by control chart, variable sample size, **8**

UNIT -IV
Defects Diagnosis and Prevention
Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle. **8**

UNIT -V
IS0-9000 and its concept of Quality Management:
ISO 9000 series, Taguchi method, JIT in some details **8**

References:

1. Lt. Gen. H.LaI, "Total Quality management", Wiley Eastern Limited, 1990. .
2. P.N.Mukherjee, “Total Quality Management”, PHI
3. Greg Bounds. “Beyond Total Quality Management”. McGraw Hill, 1994.
4. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992

Recommended Prerequisite: *None* ***Co-requisite:*** *None*

UNCONVENTIONAL MANUFACTURING PROCESSES

ME-405
w.e.f. Session 2018-19

L	T	P	C
3	1	0	4

UNIT -I
Introduction: Limitations of conventional manufacturing processes, Need of unconventional manufacturing processes, its classification and future possibilities. Introduction to hybrid processes. **8**

UNIT -II
Unconventional Machining Process:
Principle, working and applications of unconventional machining process such as Electro-Discharge machining, Electrochemical machining, Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet machining. **8**

UNIT -III
Unconventional Machining Process (continued): Principle, working and application of unconventional machining processes such as Laser beam machining, Electron beam machining and Ultrasonic machining. (these can also be used for welding). **8**

UNIT -IV
Unconventional welding processes: Explosive welding, Cladding, Under water welding, Metalizing, Plasma arc welding /cutting. **8**

UNIT -V
Unconventional Forming processes: Principle, working and applications of High energy forming processes such as Explosive forming, Electromagnetic forming, Electro-discharge forming, Water hammer forming, and Explosive compaction. **4**
Electronic-device Manufacturing: Brief description of Diffusion and Photo- lithography process for electronic-device manufacturing. **4**

Books
1. Modern Machining Processes – P.C. Pandey
2. Unconventional Machining – V.K. Jain

Recommended Prerequisite: Manufacturing Science-I (ME 208)**,** Manufacturing Science-II (ME303) **Co-requisite:** None

ENERGY CONSERVATION AND WASTE HEAT RECOVERY
ME-406
w.e.f. Session 2018-2019

L	T	P	C
3	1	0	4

UNIT -I
Introduction to Waste Heat, Importance of Waste Heat Recovery, Review of Thermodynamics – Introduction to First and Second Laws, Entropy, Entropy Generation, First and Second Law efficiency

8

UNIT -II
Gas Turbine Cycle, Combined Cycle, Combined Gas Turbine-Steam Turbine Power Plant, Heat Recovery Steam Generators
Thermodynamic cycles for low temperature application, Cogenerations, Introduction to Heat Exchangers, Analysis – LMTD and ε-NTU method

8

UNIT -III
Analysis of Heat Exchanger – continued, Problem solving, Special Heat Exchangers for Waste Heat Recovery, Synthesis of Heat Exchanger Network
Heat pipes &Vapor Chambers, Direct conversion technologies – Thermoelectric Generators.

8

UNIT -IV
Direct conversion technologies – Thermoelectric Generators (contd.), Thermoionic conversion, Thermo-PV,MHD Heat Pump; Heat Recovery from Incinerators, Energy Storage – Introduction.

8

UNIT -V
Energy Storage Techniques – Pumped hydro, Compressed Air, Flywheel, Superconducting Magnetic storage. Energy Storage Techniques – Thermal storage (Sensible & Latent), Battery, Chemical Energy Storage, Fuel cells.

8

References:

1. Cengel& Boles, "Thermodynamics: An Engineering Approach", McGraw Hill.
2. Ramesh K.Sash and DusanP.Sekulic, “Fundemantals of Heat Exchanger Design” Wiley.com

Recommended Prerequisite: None **Co-requisite:** None

AUTOMOBILE ENGINEERING
ME-407
w.e.f. Session 2018-19

L	T	P	C
3	1	0	4

UNIT –I

Power UNIT and Gear Box :

Principles of Design of main components. Valve mechanism. Power and Torque characteristics. Rolling, air and gradient Resistance. Tractive effort. Gear Box. Gear ratio determination. Design of Gear box. **8**

UNIT -II

Transmission System :

Requirements. Clutches. Torque converters. Over Drive and free wheel. Universal Joint. Differential Gear Mechanism of Rear Axle. Automatic transmission. Steering and Front Axle. Castor Angle, Wheel chamber and Toe in Toe out etc. Steering geometry. Ackerman Mechanism. Understeer and Oversteer. **8**

UNIT -III

Braking System :

General requirements, Road, tyre adhesion. Weight transfer. Braking ratio. Mechanical brakes, Hydraulic brakes. Vaccum and air braks, Thermal aspects. **5**

Chasis and Suspension System:

Loads on the frame. Strength and stiffness. Various suspension systems. **3**

UNIT -IV

Electrical System :

Types of starting motors, generator and regulators, lighting system. Ignition system, Horn, Battery etc. **4**

Fuel Supply System :

Diesel and Petrol vehicle system such as Fuel Injection Pump, Injector and Fuel Pump, Carburetor etc. MPFI **4**

UNIT -V

Automobile Air Conditioning :

Requirements, Cooling and heating systems **3**

Cooling and Lubrication System :

Different type of Cooling and lubrication system. **3**

Maintenance System :

Preventive Maintenance, break down maintenance, and over hauling system. **2**

Books:

1. Automotive Engineering : Hietner
2. Automobile Engineering : Kripal Singh
3. Automobile Engineering : Narang
4. Automotive Mechanics : Crouse
5. Automobile Engineering : Newton and Steeds

Recommended Prerequisite: Machine Design (ME301), Kinematics of Machine (ME 207) **Co-requisite:** None

MECHANICAL SYSTEMS DESIGN
ME-408
w.e.f. Session 2018-19

L	T	P	C
3	1	0	4

UNIT –I

Engineering Process and Systems Approach :

Application of systems concepts in engineering, identification of engineering functions, systems approach, Engineering Activities Matrix, Defining the proposed effort, Role of engineer, Engineering problem solving. Concurrent engineering. A case study: e.g. viscous lubrication system in wire drawing. **6**

Problem Formulation :

Nature of engineering problems, Needs statement, Hierarchical nature of systems, Hierarchal nature of problem environment, problem scope and constraints. A case study: e.g. heating duct insulation-system, High-speed belt drive system. **3**

UNIT -II

System Theories :

System analysis view-points, Black box approach, State theory approach, component integration approach, Decision process approach. A case study; e.g. Automobile instrumentation panel system. **3**

System Modelling :

Need for modelling, Modelling types and purposes, Linear graph modelling concepts, Mathematical modelling Concepts; A case study; e.g. A compound bar system. **4**

UNIT -III

Linear Graph Analysis :

Graph modeling analysis process, Path problem, Network flow problem, A case study: e.g. Material handling system. **4**

Optimization Concepts :

Optimization concepts, Motivation and freedom of choice, Goals and objectives-Criteria, Methods of optimization-Analytical, Combinatorial, Subjective. A case study: e.g. Aluminium extrusion system. **3**

UNIT -IV

System Evaluation :

Feasibility assessment, Planning horizon, Time value of money, Financial analysis. A case study: e.g. Manufacture of a Maize –Starch system. **4**

Calculus Methods for Optimization :

Model with one decision variable, Model with two decision inequality constraint. A case study e.g. Optimization of an insulation-system. **4**

UNIT -V

Decision Analysis :

Elements of a decision problem, Decision model probability a dignity function, Expected monetary value, Utility value, Baye's theorem: A case study : e.g. Installation of machinery. **4**

System Simulation :

Simulation concepts, simulation models, Iconic, Analog, Analytical, Waiting line simulation, Simulation process problem definition, Input model construction, Solution process, Limitation of simulation approach: A case study: e.g. An inventory control in a production-plant. **5**

Books:

1. Design and Planning of Engineering System: D.D. Meredith, K.V.Wong, R.W. Woodhead, R.R. Worthman, prentice-Hall Inc. Englewood Clifts, New Jersey.
2. Design Engineering: J.R. Dixon, Tata McGraw Hill.
3. An Introduction to Engineering Design Method: V.Gupta and P.N. Murthy, Tata McGraw Hill.
4. Engineering Design : Robot Matousck, Blackie and son.
5. Optimization Techniques: S.S. Rao.
6. System Analysis and Project Management : Devid I, Cleland, William R. King, Mc. Graw Hill.

Recommended Prerequisite: None **Co-requisite:** None

ENERGY MANAGEMENT
ME-409
w.e.f. Session 2018-19

L	T	P	C
3	1	0	4

UNIT -1
Introduction to energy, Sources of energy, Forms of energy, Energy reserves, renewable energy sources, Unites of energy and the laws of thermodynamics,, Energy consumption and GDP, energy database , Energy demand analysis, Costs of exploration and utilization of depletable resources, energy pricing, National energy plan. **8**

UNIT -2
Energy audit concepts, Energy audit based on 1st law and 2nd law of thermodynamics, Mass and Energy balances, Availability analysis, Evaluation of energy conserving opportunities, Economic analysis and life cycle costing. **8**

UNIT -3
Energy conservation areas, Energy transmission and storage, Plant wide energy optimization Models, Data base for energy management, Energy conservation through controls, Computer aided energy management, Program organization and methodology. **8**

UNIT -4
Electrical energy conservation in building lighting, heating, ventilating and air conditioning, Energy efficient motor, power factor improvement in power systems, Energy audit of Combustion process, Boilers, Turbines, compressors, Pumps, Heat exchangers, Condensers, Use of industrial, wastes. **9**

UNIT -5
Energy environment interaction, Environmental issues, Global warning, Carbon dioxide emissions, Depletion of ozone layer, Government's regulations, Energy economy interaction. **7**

Books:

1. Energy Management and condevtion, by Clive Beggs, Butterwoth- Heinemann Elsevier Science.
2. Optimising Energy Efficiency in the Industry, By Rajan, Tata Mc Graw Hill Publishers.
3. Guide to energy Management , By C.L Capehart, Fairmont Press.
4. Renewable Energy Sources and their Environment Impact, by Abbasi & Abbasi, Prentice Hall of India.
5. Environmental Risks and Hazards by Cutter, Prentice Hall of India.
6. Energy and Power Risk Management: New Developments in Modeling, Pricing and Hedging, buy Alexander Eydeland, John Wiley & Sons.
7. Energy Management Handbook by, Wayne C. Turner.
8. Thermodynamics, By Kenneth Wark, Tata Mc Graw Hill Publishers.
9. Exergy Analysis of Thermal, Chemical and Metallurgical Process, By Jan Szargut, David R. Morris, Frank R. Steward, Hemisphere Pub, Springer Verlag Publisher

Recommended Prerequisite: ME-202 (Applied Thermodynamics) **Co-requisite:** None

MECHANICAL VIBRATION
ME-410
w.e.f. Session 2018-19

L	T	P	C
3	1	0	4

UNIT - I
Introduction
Periodic motion, harmonic motion, superposition of simple harmonic motions, beats, Fourier analysis **3**

Single Degree Freedom System
Free vibration, Natural frequency, Equivalent systems, Energy method for determining natural frequency, response to an initial disturbance, Torsional vibrations, Damped vibrations, Vibrations of systems with viscous damping, Logarithmic decrement**.** **5**

UNIT - II
Single Degree Freedom: Forced Vibration
Forced vibration, Harmonic excitation with viscous damping, steady state vibrations, Forced vibrations with rotating and reciprocating unbalance, Support excitation, Vibration isolation, Transmissibility, Vibration measuring instruments, Displacement, velocity and acceleration measuring instruments **8**

UNIT - III
Two Degree Freedom systems
Introduction, Principal modes, Double pendulum, Torsional system with damping, coupled system, undamped dynamic vibration absorbers, Dry friction damper. **8**

UNIT - IV
Multi Degree Freedom system: Exact Analysis
Undamped free and forced vibrations of multi-degree freedom systems, influence number, Reciprocal theorem, Torsional vibration of multi-degree rotor system, Vibration of gear system, Principal coordinates. **8**

UNIT – V
CRITICAL SPEED OF SHAFTS
Continuous systems- Longitudinal vibrations of bars, Torsional vibrations of circular shafts **5**

Shaft with one disc with and without damping, Multi-disc shafts, Secondary critical speed. **3**

Books and References:

1. Mechanical Vibrations – P. Srinivasan, TMH
2. Mechanical Vibrations – G. K. Groover, Jain Brothers, Roorkee
3. Mechanical Vibrations – W. T. Thomson
4. Mechanical Vibrations – JS Rao & K Gupta, New Age
5. Mechanical Vibrations – Tse, Morse & Hinkle
6. Mechanical Vibrations – V. Rama Murthy, Narosa Publications

Recommended Prerequisite: None **Co-requisite:** None

HEATING VENTILATION AND AIR CONDITIONING

ME-411

w.e.f. Session 2018-19

L	T	P	C
3	1	0	4

UNIT - I

Human Comfort, requirements of comfort, comfort chart applied psychrometrics of air conditioning systems, components of A.C. System, Central and Unitary A.C. Systems, Industrial and human comfort air conditioning, Cogeneration of power and refrigeration. **8**

UNIT – II

Heat transmission in buildings, building survey and locations of equipment, considerations for heating and cooling loads, load calculation procedures. **8**

UNIT – III

Air Transmission and distribution systems, fans, pressure losses in ducts and duct sizing methods, Natural supply and extraction systems of ventilation and their combinations. Selection of Air distributions and extraction systems for ventilation, Air Cleaners and Scrubbers. **8**

UNIT – IV

Fluid distribution System; open loop & close loop, pipe sizing and layout, Hot water and Steam Heating Systems. **8**

UNIT – V

A.C. Controls: Elements of basic control system, pneumatic, electric and electronic control, Thermostats and humidistat, Building-up of control system, Summer-Winter Changeover, Dampers, freeze protection, sequencing of operations, Temperature reset based on zone load. **8**

Books

1. W.F. Stocker & J.w. Jones; Refrigeration & Air Conditioning, McGraw Hills Inc. Intl. Student's Edition.
2. F.C. Quiston & Jerald J. Parker; HVAC Analysis & Design, John Wiley & Sons.
3. HVAC Systems & Equipment, 1992, ASHRAE Handbook.
4. HVAC Fundamentals, 1993, ASHRAE Handbook.
5. Carrier's Handbook of A.C. System, Design, Carrier D/c Co.
6. C.P. Arora; Refrigeration and Air Conditioning, Tata McGraw Hill, New Delhi

Recommended Prerequisite: Refrigeration and Air Conditioning (ME-315) **Co-requisite:** None

ENGINEERING MATERIALS
ME-412
w.e.f. Session 2018-19

L	T	P	C
3	1	0	4

UNIT –I

Ferrous Materials, their Properties and Applications:

Plan carbon steels, their properties and application: plain carbon steels, effects of alloying elements in plain carbon steels. Alloy steels, tools steels, stainless steels, low and high temperature resisting steels, high strength steels, selections, specifications, form and availability of steel.

Cast irons-white, grey, modular malleable and alloy cast irons. Recognized patterns of distribution of graphite flakes in grey cast iron. **10**

UNIT-II

Heat Treatment of Steels:

TTT diagrams, annealing, normalizing, hardening and tempering of steel. Austempering and martempering of steel. Hardenibility, Journing end quench test. Grain size and its determination. Effect of grain the properties of steel.

Surface Hardening of Steel:

Carbonizing, nitriding, carbonitriding, cyaniding, flues and induction hardening microscopic determination of case depth and depth of hardening. **7**

UNIT-III

Nonferrous Materials:

Their properties and application, brasses, bronzes, cupro-nickel alloys, aluminum, magnesium and titanium alloys, bearing materials, selection, specific form and availability. Heat treatment of nonferrous materials- soputionising and precipitation hardening. **8**

UNIT-IV

Composites:

Polymer-polymer, metal –metal, ceramic-ceramic-polymer, metal-ceramic, metal-poymer composites. Dispersion reinforced, particle reinforced, laminated and fibre reinforced composites. **6**

UNIT-V

Elastromers and Masullaneous:

Types, properties and identifications of different types of rubbers vulcanization, fabrication and forming techniques of rubber. Introduction of plastics and ceramics-types, application and process. Smart materials –introduction and types. Selection of materials and factors effecting deselection, Selection process and systematic evaluation **9**

Books:

1. Callister's Materials Science and Engineering published by Wiley
2. Material Science by K.M Gupta, Umesh Publication
3. Materials Science and Engineering: A First Course by Raghavan V, PHI Publication India

Recommended Prerequisite: None **Co-requisite:** None

NON DESTRUCTIVE TESTING
ME-413
w.e.f. Session 2018-19

L	T	P	C
3	1	0	4

UNIT I

Scope and advantages of N.D.T. some common NDT methods used since ages-visual inspection, Ringing test, and chalk-test (oil-whiting test) their effectiveness in detecting surface cracks
Modern NDT methods. Dye-penetrant test-principle, scope, equipment and techniques. Zyglo testing. **8**

UNIT-II

Magnetic Particle Inspection. Scope of test, Principle equipment and technique. DC and AC magnetization, use of dry and wet powders testing. Interpretation of results. **8**

UNIT-III

X-ray radiography – principle, equipment, and methodology. Interpretation of radiographs, limitations. Gamma ray radiography. Principle, equipment and technique. Precautions against radiation hazards, Advantage over x-ray radiography methods. **8**

UNIT-IV

Introduction Principle of Operation-piezoelectricity and ultrasonic probes, Cathode ray oscilloscope techniques, Advantages and limitations. Application of NDT method in the inspection of castings, forging and welded structures with illustrative examples. **8**

UNIT V

Eddy Current Testing- Introduction, Principle, Current Flow Characteristics, Eddy Current Instruments and Probes, Inspection of Tube, Crack Inspection **8**

Text/Reference Books:

1. P. Halmshaw; Non-Destructive Testing
2. Metals Handbook Vol. II, Non-destructive inspection and quality control.

Recommended Prerequisite: None **Co-requisite:** None

FUEL & COMBUSTION
ME-414
(w.e.f. Session: 2018-19)

L	T	P	C
3	1	0	4

UNIT – I

Fuels: Types of fuels, structure of petroleum fuels, refining process, products of refining process, required properties of an ideal gasoline. Diesel fuels and its properties; flash point, fire point, cloud point, viscosity. **8**

UNIT – II

Ratings of fuels: Rating of gasoline, Rating of diesel fuel; cetane no.,diesel index, API gravity and specific gravity.

Alernative fuels: Petroleum fuels and non petroleum fuels; Benzol, alchohal, ammonia, biodiesel, biogas. Fuels for gas turbine and jet engines. **8**

UNIT – III

Fundamentals of Combustion: Conservation of mass to reacting system to determine balanced reaction equation, Stoichiometry of reactions; Enthalpies of formation reaction and combustion; Adiabatic flame temperature.

Types of combustion: premixed burning, diffusion burning. **8**

UNIT – IV

Flames: Laminar premixed flames; Burning velocity; Effect of Stoichiometry, pressure and temperature on burning velocity.

Chemical Kinetics: Elementary Reactions, Reaction order and molecularity; Arrhenius law; Relation between rate coefficient and equilibrium constant; Chain reactions, Nitrogen oxides kinetics. **8**

UNIT – V

Pollutants from combustion: Pollutants from gasoline engine; evaporative loss, cranckcase blowby, tailpipe exhaust emission. gasoline engine emission control; fuel modification, engine design, treatment of exhaust gas. Diesel engine emission; constituents of diesel engine exhaust, types of diesel smokes; mechanism of smoke formation, and its control, diesel odour and its control. **8**

References Books

1. IC engine by M.L Mathur & R.P Sharma; Dhanpat Rai Publication.
2. IC engine by V. Ganesan; McGraw Hill.
3. Yunus Cengel; Engineering Thermodynamics; Tata Mc-graw Hill
4. Eastop and McConkey; Applied Thermodynamics; Pearson Education Asia.
5. An Introduction to Combustion: Concepts and Applications by Stephen R. Turns, McGraw Hill
6. Principles of Combustion, by D.P Mishra; PHI
7. Combustion Engineering by Borman and Ragland, McGraw Hill.

Recommended Prerequisite: None **Co-requisite:** None

COMPUTATIONAL FLUID DYNAMICS
ME-415
(w.e.f. Session: 2018-19)

L	T	P	C
3	1	0	4

UNIT – I

Classification of Pde's: Linear & Non Linear Pde's, Elliptic, Parabolic and Hyperbolic pde's. System of first order pde's Initial and Boundary conditions, Discretization by finite difference approach, Mixed partial derivatives. **8**

UNIT – II

Parabolic partial differential equation: Finite difference formulations, Explicit and implicit methods, Parabolic equations in two space dimensions, Various explicit and implicit schemes, Approximate factorization, Tridiagonal system of equations, Extension to three space dimensions, Consistency analysis. **8**

UNIT – III

Elliptic pde's & stability analysis, Finite difference formulations, solution procedures, Applications, Von Neumann Stability Analysis, Discrete Petrubation stability analysis, Multi-dimensional problems, Modified equations. **8**

UNIT – IV

Hyperbolic pde's Finite difference formulations, Explicit and implicit formulations, Applications, Non-linear problems, Flux corrected schemes, Upwind schemes. **8**

UNIT – V

Incompressible Navier Strokes equations, Primitive variable formulations, Vorticity stream function formulations, Poission equation for pressure, Boundary conditions, stability considerations. Applications to various problems. **8**

Books

1. Introduction to Computer fluid dynamics by J.D.Anderson Jr.
2. C.A.J. Fletcher; Computational Fluid Dynamics, Vol1 & 2
3. Hirsch; Numerical internal and external flows Vol1 & 2
4. Pletcher & Tannehill; Computational Fluid Dynamics & Heat Transfer.
5. Computational Fluid Dynamics by Ferziger & Peric, Springer.

Recommended Prerequisite: Fluid Mechanics(CE 201), Mathematics-II (MT112) **Co-requisite:** None

CAD/CAM LAB
ME-421
w.e.f. Session 2018-19
(6 from CAD experiments, 4 from CAM experiments)

L	T	P	C
0	0	2	1

A. CAD Experiments:

1. Line drawing or Circle drawing algorithm experiment: Writing the program and running it on computer.
2. Transformations algorithm experiment for translation/ rotation / scaling: Writing program in C or MATLAB and running it on computer.
3. Design problem experiment: Writing the program for design of a machine element or other system and running it on computer.
4. Optimization problem experiment: Writing a program for optimization a function and running it on computer.
5. AutoCAD experiment: Understanding and use of AutoCAD commands.
6. Writing programs for FEM, and simulation.
7. Use of graphics software standards packages e.g. GKs/PHYSICS/GL etc.
8. Solidworks experiment: Understanding and use of Solidworks commands.

B. CAM Experiments :

1. Writing a part-programming (in word address format or in APT) for a job for drilling operation (point-to-point) and running on NC machine.
2. Writing a part-programming (in word address format or in APT) job for milling operation (continuing) and running on NC machine.
3. Experiment on Robot and its programs.
4. Experiment on Transfer line/Material handling.
5. Experiment on difference between ordinary machine and NC machine, study or retrofitting.
6. Experiment on study of system devices such as motor and feed back devices.
7. Experiment on Mechatronics and controls.

Recommended Prerequisite: None **Co-requisite:** None

I.C ENGINE & AUTOMOBILE ENGG. LAB

ME-422

w.e.f. Session 2018-19

(Say any 8 experiments from the following or such experiments).

L	T	P	C
0	0	2	1

1. Study the working mechanism of braking system.
2. Study the working mechanism of fuel supply system.
3. Study the working mechanism of ignition system.
4. Study the working mechanism of steering system.
5. Study the working mechanism of transmission system.
6. Study the working mechanism of suspension system.
7. Study the working mechanism of lubrication and cooling system.
8. Comparative study and features of common small cars (such as Fiat, Ambassador, Maruti, Matiz, Santro, Indica and its variations) available in India.
9. Comparative study and technical features of common scooters and motorcycles available in India. Case study/term paper.
10. Study the working mechanism of MPFI system.
11. Visit of an Automobile factory.
12. Study the working mechanism of main gear box and differential gear box.

Recommended Prerequisite: None **Co-requisite:** None

Integral University Lucknow

Study & Evaluation Scheme

B.TECH. MECHANICAL ENGINEERING

YEAR IV, Semester- VIII

S. No.	Subject Code	Category	Subject	Periods				Evaluation Scheme				Subject Total
								Sessional			Exam.	
				L	T	P	C	CT	TA	Total	ESE	
1	OE		Open Elective-2	3	1	-	**4**	25	15	40	60	100
2	ME-451	DC	Seminar	0	0	3	3	-	100	100	-	100
3	ME-499	DC	B. Tech. Project	-	-	-	4	-	60	60	40	100
4	ME-499	DC	B. Tech. Project	-	-	-	4	-	60	60	40	100
5	ME-499	DC	B. Tech. Project	-	-	-	4	-	60	60	40	100
6	ME-452	DC	Comprehensive Viva	-	-	-	2	-	100	100		100
			Total	**3**	**1**	3	**21**	**25**	**395**	**420**	**180**	**600**

L-Lecture **T-T**utorial **P-**Practical **C-**Credits **CT-**Class Test **TA-**Teacher Assessment

Sessional Total (CA) = Class Test + Teacher Assessment

Subject Total = Sessional Total (CA) + End Semester Examination (ESE)

DC- Departmental Core **HM-** Humanities

DE- Departmental Elective

ESA- Engineering Sciences & Arts (Foundation Course & Engineering Courses)