DEPARTMENT OF MECHANICAL ENGINEERING

8th Semester

SL.No	Course code	Course Title	L-T-P	Credits
1.	MEL1846	Advance Manufacturing Processes	3-0-0	6
2.	MEL1847	Environment Pollution & its Control	3-0-0	6
3.	MEL18XX	Elective -III	3-0-0	6
4.	MEP18XX	Open Elective	3-0-0	6
5.	MEP1856	Project- II	0-0-12	12
6.	MEP1857	Manufacturing Laboratory- III	0-0-2	2
		Total		**38**

Elective-III

SL.No	Course code	Course Title	L-T-P	Credits
1.	MEL1848	Computational Fluid Dynamics	3-0-0	6
2.	MEL1849	Soft Computing	3-0-0	6
3.	MEL1850	Experimental stress Analysis	3-0-0	6
4.	MEL1851	Innovation & Entrepreneurship	3-0-0	6

Open Elective

SL.No	Course code	Course Title	L-T-P	Credits
1.	MEL1852	Optimization Techniques	3-0-0	6
2.	MEL1853	Finite Element Method	3-0-0	6
3.	MEL1854	Mechatronics	3-0-0	6
4.	MEL1855	Marketing Management	3-0-0	6
5.	MEL1856	Exergy- A Measure of Work Potential	3-0-0	6

Course code	Course Title	Semester	L-T-P	Credits
MEL 1846	Advance Manufacturing Process	8th	3-0-0	6

Introduction to Numerical Control: Fundamentals of Numerical Control (NC), Computer Numerical control (CNC), Direct Numerical control (DNC), comparison between conventional and CNC systems, Classification of CNC system, Design consideration in CNC machine tools, Industrial applications of CNC, Economic benefit of CNC.

Control Systems: Fundamental problems of control, Position or point to point, straight line and contouring control, Machine tool control, Open and closed loop control, Adaptive Control system.

NC Part Programming Concepts: NC coordinate system, Part programming terminology, preparatory and miscellaneous Codes, Part programming formats, procedures and methods, Manual programming, Computer aided programming, APT programming and practice.

Advanced Machining Processes: Introduction of advanced machining processes, process principle, applications, advantages and limitations of processes such as Abrasive Jet Machining (AJM), Water Jet Machining (WJM), Abrasive Water Jet Machining (AWJM), Ultrasonic Machining (USM), Electrochemical Machining (ECM), Electro Discharge Machining (EDM), Electron Beam Machining (EBM), Laser Beam Machining (LBM) processes.

Advanced Casting Processes: Metal mould casting, Continuous casting, Squeeze casting, Vacuum mould casting, Evaporative pattern casting, Ceramic shell casting their process principles and applications.

Advanced Welding Processes: Electron Beam Welding (EBW), Laser Beam Welding (LBW), Ultrasonic Welding (USW), their process principles and applications.

Advanced Metal Forming Processes: High energy rate forming (HERF) process, Electromagnetic forming, explosive forming, Electro hydraulic forming, Stretch forming, Contour roll forming, their process principles and applications.

Rapid Prototyping (RP): Importance of RP, Introduction of solid-based, liquid-based, powder-based RP processes.

Books:-

SL.No	Name of the book	Author	Publication
1	Introduction to Manufacturing Processes	Schey	Mc Graw hill international.
2	Micromanufacturing and Nanotechology	N. P. Mahalik	Springer
3	Computer Aided Manufacturing	Rao, Tiwari and Kunda	Tata McGraw Hill

Course code	Course Title	Semester	L-T-P	Credits
MEL1847	Environmental Pollution & its Control	8th	3-0-0	6

Causes, effects and control measures: Air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear pollution, solid waste management, causes, effects and control measures of urban and industrial wastes, pesticides pollution.

Air pollution: SOx, NOx, CO, global warming. CO_2 emissions, impacts, climate change, global warming, acid rain, ozone layer depletion

Solid and water pollution: particulates, formation of pollutants, measurement and controls; sources of emissions.

Control and Legislation: effect of operating and design parameters on emission, control methods, exhaust emission test, procedures, standards and legislation; environmental audits; emission factors and inventories laws related to environmental pollution.

Books:-

SL.No	Name of the book	Author	Publication
1	Principles of Environmental Science: Inquiry & Applications	Cunninghum	McGraw-Hill, Special Indian Edition), 4/e
2	Environmental Engineering	Keily	McGraw-Hill, Special Indian Edition), 4/e
3	Basic Environmental Technology:	: J. A. Nathanson	PrenticeHall of India, New Delhi

Elective-III

Course code	Course Title	Semester	L-T-P	Credits
MEL1848	Computational Fluid Dynamics	8th	3-0-0	6

Introduction to CFD: Goals of CFD; Problem definition and sources of error.

Spatial discretization: interpolation and function approximation, method of weighted residuals for function approximations, Fourier (spectral) interpolation and function approximation, derivatives of functions, Discretization methods and grids, performance metrics, designing methods.

Finite Volume and Finite Difference Schemes: FVM & FDM for linear/non linear & incompressible/compressible flows; Solution of systems of equations- classical iterative techniques, introduction to multigrid, basic convergence analysis; Navier-Stokes equations-, pressure in incompressible flow, implicit convection, specific methods for incompressible flow- fractional step, stream function /vorticity form; turbulence modeling

Books:-

SL.No	Name of the book	Author	Publication
1	Computational Fluid Dynamics	Anderson	McGraw-HillPublisher
2	Numerical Heat Transfer and Fluid Flow	S. Patankar	Taylor & Francis publication
3	Introduction to Computational Fluid Dynamics	P. Niyogi, M. K Laha & S. K.Chakrabartty	Pearson publication

Course code	Course Title	Semester	L-T-P	Credits

| MEL1849 | Soft Computing | 8th | 3-0-0 | 6 |

Introduction to Soft Computing: Artificial neural networks - biological neurons, Basic models of artificial neural networks - Connections, Learning, Activation Functions, McCulloch and Pitts Neuron, Hebb network.

Neutral Network: Perceptron networks — Learning rule - Training and testing algorithm, Adaptive Linear Neuron, Back propagation Network — Architecture, Training algorithm.

Fuzzy Logic: Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, crisp logic, fuzzy logic, introduction & features of membership functions, fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic.

Genetic Algorithm: Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional method

Books: -

SL. No	Name of the book	Author	Publication
1	Advanced Mechanics of solids	L.S. Srinath	Tata McGraw-Hill, 5/e
2	Mechanics of Materials	Beer & Johnston	Tata McGraw-Hill, 5/e
3	Mechanics of Materials	E. P. Popov	Pearson publication

Course code	Course Title	Semester	L-T-P	Credits
MEL1850	Experimental stress Analysis	8th	3-0-0	6

Introduction to CFD: Goals of CFD; Problem definition and sources of error.

Spatial discretization: interpolation and function approximation, method of weighted residuals for function approximations, Fourier (spectral) interpolation and function approximation, derivatives of functions, Discretization methods and grids, performance metrics, designing methods.

Finite Volume and Finite Difference Schemes: FVM & FDM for linear/nonlinear & incompressible/compressible flows; Solution of systems of equations- classical iterative techniques, introduction to multigrid, basic convergence analysis; Navier-Stokes equations-, pressure in incompressible flow, implicit convection, specific methods for incompressible flow- fractional step, stream function /vorticity form; turbulence modeling

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3	Introduction to Computational Fluid Dynamics	P. Niyogi, M. K Laha & S. K.Chakrabartty	Pearson publication

Course code	Course Title	Semester	L-T-P	Credits
MEL1851	Innovation & Entrepreneurship	8th	3-0-0	6

Introduction to innovation: Defining innovation, Differences between invention and innovation, Product innovation and process, Radical and incremental innovation, Technological innovation, commercial or organizational innovation indicators, Characteristics of innovation in different sectors.

Economics and Management of Innovation: Main literature Schumpeter and creative destruction, The evolutionary theory of Nelson and Winter, The model of the dynamic capabilities of David Teece, Porter and competitive advantages: the model of the five competitive forces or extended rivalry, The value chain.

Introduction to Entrepreneurship: The Entrepreneurial Process and the Scientific Theories of Entrepreneurship, the Entrepreneurial Process: Ideas and Wealth Creation, Introduction to Entrepreneurial Operation: Staying Entrepreneurial.

Innovation and entrepreneurship: The entrepreneur, Profile analysis, Behavior and motivations, Lean Start –up, The entrepreneurial ecosystem, Entrepreneurs and strategic decisions

Books: -

SL.No	Name of the book	Author	Publication
1	Technology Ventures: From Idea to Enterprise	Richard C. Dorf and Thomas H. Byers	McGraw-Hill Education
2	Business Model Generation	Alexander Osterwalder	Wiley India Pvt. Ltd.

Course code	Course Title	Semester	L-T-P	Credits
MEL1852	Optimization Techniques	8th	3-0-0	6

Nonlinear programming: Convex sets and convex functions, Kuhn-Tucker conditions. Convex quadratic programming: Wolfe's and Pivot complementary algorithms. Separable programming

Geometric programming: Problems with positive coefficients up to one degree of difficulty, Generalized method for the positive and negative coefficients.

Dynamic programming: Discrete and continuous dynamic programming (simple illustrations).

Search Techniques :
One dimensional Search Methods: Unimodal functions, simultaneous uniform search method, Sequential search method, Fibonacci search method, Golden section search method.
Unconstrained Multi-dimensional Search Methods:
Univariate search method, Method of steepest descent, Conjugate radiant method, Fletcher Reeves method,
Constrained Multi-dimensional Search Methods: Rosen's Gradient projection method, Penalty function method.

Books:-

SL.No	Name of the book	Author	Publication
1	Optimization for Engineering Design: Algorithms and Examples	Kalyanmoy Deb	PHI Learning
2	Engineering Optimization: Theory and Practice	Singiresu S. Rao	Wiley - Mehul Excluisve
3	Engineering Optimization: Methods and Applications	A.Ravindran, K.M Ragsdell, G.V. Raklaitis	Wiley India Pvt. Ltd.

Course code	Course Title	Semester	L-T-P	Credits
MEL1853	Finite Element Method	8th	3-0-0	6

Introduction: historical background, applications, advantages, finite element softwares. Theory of elasticity - stress and equilibrium, stress-strain relationship, strain-displacement, relationship, plane stress, plane strain and axi-symmetric approximation. Temperature effects. Potential energy and equilibrium, Principle of minimum potential energy. Discrete and Continuous systems, Rayleigh-Ritz method, Galerkin method. Solution of Algebraic equations, Banded and skyline solutions. Global, Local and Natural coordinates in 1, 2 and 3 dimensions - Area coordinates. Numerical Integration using Gauss quadrature.

Finite element modeling: types of elements, Discretization, Mesh generation and numbering. Shape functions - types and properties.

Iso parametric formulation. Largrangean and Serendipity elements.

One dimensional elasticity problems: discretisation of domain into elements – generalized coordinates approach - derivation of elements equations - assembly of element equations - transformation matrices - global equations, load vector, properties of stiffness matrices, imposition of Boundary conditions - penalty and elimination approach, multi-point constraints. Finite element formulation of plane trusses, beams and beams on elastic supports.

Finite element formulation of 2D problems: using constant strain triangle element and isoparametric quadrilateral element. Axi-symmetric solids subjected to axi-symmetric loading. Features of 3D problems in stress analysis. Scalar field problems - one dimensional heat conduction through composite walls and fins, potential flow. Dynamic problems-Hamilton's principle, Mass matrices, lumped and consistent formulations.

Books:-

SL.No	Name of the book	Author	Publication
1	An Introduction to Finite Element Method	Reddy	McGraw-Hill, 3/e
2	Finite Element Analysis: Theory and Programming	Krishnamoorthy	McGraw-Hill, 2/e
3	Finite Element Method	K. S. Bathe & E. L. Wilson	Prentice Hall of India

Course code	Course Title	Semester	L-T-P	Credits

MEL1854	Mechatronics	8th	3-0-0	6

Introduction: Definition – Trends - Control Methods: Standalone, PC Based (Real Time Operating Systems, Graphical User Interface, Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.

Signal Conditioning: Introduction – Hardware - Digital I/O, Analog input – ADC, resolution, sped channels Filtering Noise using passive components – Resistors, capacitors - Amplifying signals using OP amps – Software - Digital Signal Processing – Low pass , high pass , notch filtering.

Precision Mechanical Systems: Pneumatic Actuation Systems - Electro-pneumatic Actuation Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts – Ball Screw and Nut - Linear Motion Guides - Linear Bearings - Harmonic Transmission - Bearings- Motor / Drive Selection.

Electronic Interface Subsystems: TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids , motors Isolation schemes- opto coupling, buffer IC's - Protection schemes – circuit breakers, over current sensing, resetable fuses, thermal dissipation - Power Supply - Bipolar transistors / mosfets

Electromechanical Drives: Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives, PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.

Microcontrollers Overview: 8051 Microcontroller , micro processor structure – Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming – Assembly, C (LED Blinking, Voltage measurement using ADC).

Programmable Logic Controllers: Basic Structure - Programming: Ladder diagram - Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection - Application.

Programmable Motion Controllers: Introduction - System Transfer Function – Laplace transform and its application in analysing differential equation of a control system - Feedback Devices: Position , Velocity Sensors - Optical Incremental encoders - Proximity Sensors : Inductive , Capacitive, Infrared - Continuous and discrete processes - Control System Performance & tuning - Digital Controllers - P, PI, PID Control - Control modes – Position, Velocity and Torque - Velocity Profiles – Trapezoidal - S. Curve - Electronic Gearing - Controlled Velocity Profile - Multi axis Interpolation , PTP , Linear, Circular - Core functionalities – Home, Record position, Go to Position - Applications : SPM, Robotics.

Books:-

SL.No	Name of the book	Author	Publication
1	Mechatronics	Mahalik	McGraw-Hill
2	Mechatronics Source Book	Newton C Braga	Thomson Publications, Chennai
3	Mechatronics	M.D.Singh/J.G.Joshi	PHI.

Course code	Course Title	Semester	L-T-P	Credits
MEL1855	Marketing Management	8th	3-0-0	6

Introduction: Definition of marketing, Understanding marketing, Sales, Company orientations, Journey from sales to marketing, New economy, Environmental forces, Marketing task, Marketing concepts and tools, Major drivers of the economy, Changing of business practices, Changing of marketing practices, E- business.

Customer value and satisfaction: Organizational culture, Attracting and retaining customers, Cost of lost customer, Total customer satisfaction, Customer relationship management, Survey of customer needs, Consumers, Organizational and Government buyers. Customer focus, Advertising, Sales promotion, Motivation research, Consumer behavior, Buying decision process, Competitive strategies.

Production Management: Assessing marketing opportunities, Gathering information and measuring marketing demand, Forecasting and demand measurement, Differentiation, Segmenting, Targeting, Positioning, Marketing decision support system, Product life cycle, Portfolio management, Customer perception of product features, New product development.

Market Management: Competition, Market research, Management strategies, 4Ps of product marketing and 7Ps of service marketing, Product policies, Product brands, Services offering, Pricing, Customer perceived value, Distribution channels, Retailing, Marketing Plan and implementation, Market testing. 10 5 Marketing Organization, Selection of marketing staff, Specialized Training, Role of a salesman, Routine management, Salaries and incentives, Marketing intelligence, Marketing performance.

Books:-

SL.No	Name of the book	Author	Publication
1	Marketing Management	Philip Kotler	Prentice Hall
2	Marketing: A Managerial Introduction	J. C. Gandhi	Tata McGraw-Hill
3	Marketing management	V. S. Ramaswamy & S. Namakumari	Macmillan India Limited

Course Code	Course Title	Semester	L-T-P	Credits
MEL 1856	Exergy - A Measure of Work Potential	8th	3-0-0	6

Introduction: *Energy:* Concept and applications of energy; Different forms of energy; The first law of thermodynamics (FLT); Energy and the FLT; Energy and economics; Energy audit & energy management. *Entropy:* Order and disorder; Reversibility and irreversibility; Characteristics and significance of entropy; Carnot's contribution; The second law of thermodynamics (SLT); SLT statements; The Clausius inequality; Useful relationships. *Exergy:* The quantity exergy; Exergy analysis; Characteristics of exergy; The reference environment (theoretical characteristics and models); Exergy vs. energy; Exergy efficiencies.

Energy and Exergy Analysis: Introduction; Balances for mass, energy and entropy; Exergy of systems and flows; Exergy consumption; Exergy balance; Efficiencies and other measures of merit; Procedure for energy and exergy analysis; Implications of results of energy and exergy analysis.

Exergy Analysis of Psychrometric Systems: Basic psychrometric concepts; Balance equations (mass, energy and exergy) for air-conditioning processes; Case studies for energy and exergy analysis of moist air streams.

Exergy Analysis of Reacting Mixture and Combustion: Fuels and combustion; Theoretical and actual combustion processes; Enthalpy of formation; Enthalpy of combustion and heating values; Energy analysis of reacting systems; Adiabatic flame temperature; Absolute entropy and the third law of thermodynamics; Introducing chemical exergy; Standard chemical exergy of gases and gas mixtures; Standard chemical exergy of hydrocarbon (coal, biomass, fuel oil) fuels; Exergetic efficiencies of reacting systems; Fuel cells.

Applications of Exergy in Industry: Introduction; Advantages and benefits of using exergy; Conservation of energy through exergy; Disadvantages and drawbacks of using exergy; Possible measures to increase applications of exergy in industry; Exergy analysis of drying processes and systems; Exergy analysis of thermal energy storage systems; Exergy analysis of steam power plants.

Exergy Analysis of Renewable Energy Systems: Introduction; Exergy analysis of solar photovoltaic systems; Exergy analysis of solar ponds; Exergy analysis of wind energy systems; Exergy analysis of geothermal energy systems.

Exergoeconomic Analysis of Thermal Systems: Introduction; Economic aspects of exergy; Modeling and analysis of exergoeconomic methodology; Difference between economic and thermodynamic balances; Exergy, cost, energy and mass analysis (EXCEM analysis).

Books:-

Sl. No	Name of the Books	Author	Publication
1	Fundamentals of Engineering Thermodynamics	Moran and Shapiro	**Wiley - India**
2	Basic and Applied Thermodynamics	Nag	Tata McGraw Hill
3	Thermodynamics- An Engineering Approach	Cengel and Boles	McGraw Hill
4	Thermal Design and Optimization	Bejan, Tsatsaronis and Moran	John Wiley & Sons