UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

M TECH (MECHANICAL ENGINEERING)
Programme
2018

Tech (Mechanical Engineering)

Proposed Curriculum

S.No	Course Code	Course Title	Credits	L	T	P	Evaluation Scheme				Univ. Exam	Te
							Sessional					
							CT	ATT D.	TA	TOTAL	ESE	
I YEAR						**I Semester**						
1	MMET-100	Numerical Methods and Computer Programming	4	3	1	2	30*	10	10	50	100	15
2	MMET-101	Simulation ,modelling and Analysis	4	3	1	--	30	10	10	50	100	15
3	MMET-102	Applied Operations Research	4	3	1	--	30	10	10	50	100	15
4	MMET-103	Advanced Thermal Engineering	4	3	1	--	30	10	10	50	100	15
Total			**16**	**12**	**4**	**2**				**200**	**400**	**60**
1 YEAR						**II Semester**						
1	MMET-201	Optimization for Engineering Design	4	3	1	--	30	10	10	50	100	15
2	MMET-202	Advanced Mechanics of Solids	4	3	1	--	30	10	10	50	100	15
3	MMET-203	Production Technology	4	3	1	--	30	10	10	50	100	15
4	MMET-21x	Elective -1	4	3	1	--	30	10	10	50	100	15
5	MMES-201	Seminar	4	--	--	4				50		50
Total			**20**	**12**	**4**	**4**				**250**	**400**	**65**
II YEAR						**III Semester**						
1	MMET-32x	Elective -2	4	3	1		30	10	10	50	100	15
2	MMET-33x	Elective -3	4	3	1	--	30	10	10	50	100	15
3	MMEP-301	Project	8			8				100	100	20
4	MMED-301	Dissertation#	8			8				150		15
Total			**24**	**6**	**2**	**16**				**350**	**300**	**65**
II YEAR						**IV Semester**						
1SS	MMED-401	Dissertation	24	--	--	24				250	350	60
Total			**24**			**24**				**250**	**350**	**60**
Grand Total												**25**

Note:* 15 Marks are for class tests and 15 Marks are for Labs if any. Otherwise 30 marks are for class tests.

Dissertation to be continued in IV semester.

Minimum pass mark in theory (including sessional mark)shall be 40% ,but 40% Marks are essential in End Semester Examination

The minimum pass mark in practical/ seminar/project/dissertation (including sessional marks) shall be 50%

IST OF ELECTIVES

Elective-I (MMET121 to MMET124)

S.N.	Subject Code	Subject
1.	MMET-211	Product Design and Development
2.	MMET-212	Manufacturing System Analysis
3.	MMET-213	Computational Fluid Dynamics & Heat Transfer
4.	MMET-214	Internal Combustion Engines

Elective-II (MMET 231 to MMET 234)

S.N.	Subject Code	Subject
1.	MMET-321	Theory of Elasticity & Plasticity
2.	MMET-322	Advanced Welding Technology
3.	MMET-323	CNC, FMS & CIM
4.	MMET-324	Renewable Energy systems

Elective -III (MTME -331 to 334)

S.N.	Subject Code	Subject
1.	MMET-331	Total Quality Management
2.	MMET-332	Industrial Design and Ergonomics
3.	MMET-333	Management Information Systems
4.	MMET-334	Environmental Pollution & Its Control

SYLLABUS

M.Tech (Mechanical Engineering) Semester I
Compulsory Subjects (Regular)

MMET-100 NUMERICAL METHODS AND COMPUTER PROGRAMMING

L	T	P
3	1	2

UNIT - 1

Solution of Algebraic and Transcendental Equation: Newton-Raphson method including method of complex roots, Graeffe's root square method (Computer based algorithm and programme for these methods)

UNIT – 2

Interpolation and Approximation: Lagrange's and Newton-divided difference formula, Newton interpolation formula for finite differences, Gauss's forward and backward interpolation formulae, Bessel's and Laplace-Everett's formulae, Cubic spline, least squares approximation using Chebyshev polynomial.

UNIT - 3

Solution of Linear Simultaneous Equations: Cholesky's (Crout's) method, Gauss-Seidel iteration and relaxation methods, Solution of Eigenvalue problems; Smallest, largest and intermediate Eigen values (Computer based algorithm and programme for these methods)

UNIT - 4

Numerical Differentiation and Integration: Numerical differentiation using difference operators, Simpson's 1/3 and 3/8 rules, Boole's rule, Weddle's rule.

UNIT - 5

Solution of Differential Equations: Modified Euler's method, Runge-Kutta method of 2^{nd}, 3^{rd} and 4^{th} orders, Predictor-Corrector method, Stability of Ordinary differential equation, Solution of Laplace's and Poisson's equations by Liebmann's method, Relaxation method.

Books:

1	Numerical Method for Scientific and Engineering Computation	M. K. Jain, S. R. K. Iyenger and R. K. Jain	Wiley Eastern Ltd., 2007
2	Numerical Methods	A. D. Booth	Academic Press, NY, 1998
3	An Introduction to Numerical Analysis	K. E. Atkinson	John Wiley & Sons, NY, 1997
4	Introduction Methods of Numerical Analysis	S. S. Sastry	Prentice Hall of India, 2012
5	Elementary Numerical Analysis	S. D. Conte	McGraw Hill, 2005

MMET-101 SIMULATION, MODELLING AND ANALYSIS

L	T	P
3	1	-

UNIT - 1

Introduction: A review of basic probability and statistics, random variables and their properties, Estimation of means variances and correlation.

UNIT - 2

Physical Modelling: Concept of System and environment, Continuous and discrete systems, Linear and non-linear systems, Stochastic activities, Static and Dynamic models, Principles of modeling, Basic Simulation modeling, Role of simulation in model evaluation and studies, advantages of simulation

UNIT-3

System Simulation: Techniques of simulation, Monte Carlo method, Experimental nature of simulation, Numerical computation techniques, Continuous system models, Analog and Hybrid simulation, Feedback systems, Computers in simulation studies, Simulation software packages.
System Dynamics: Growth and Decay models, Logistic curves, System dynamics diagrams.

UNIT -4

Probability Concepts in Simulation: Stochastic variables, discrete and continuous probability functions, Random numbers, Generation of Random numbers, Variance reduction techniques, Determination of length of simulation runs.
Simulation of Mechanical Systems: Building of Simulation models, Simulation of translational and rotational mechanical systems, Simulation of hydraulic systems.

UNIT -5

Simulation of Manufacturing Systems: Simulation of waiting line systems, Job shop with material handling and Flexible manufacturing systems, Simulation software for manufacturing, Case studies.

Books:

1. System Simulation — Geoffrey Gordon — Prentice Hall, 1989
2. System Simulation: The Art and Science — Robert E. Shannon — Prentice Hall, 1975
3. System Modelling and Control — J. Schwarzenbach and K.F. Gill — Edward Arnold, 1992
4. Modelling and Analysis of Dynamic Systems — Charles M Close and Dean K. Frederick — Houghton Mifflin, 2001
5. Simulation of manufacturing — Allan Carrie — John Wiley & Sons, 1988

MMET-102 APPLIED OPERATIONS RESEARCH

L	T	P
3	1	-

UNIT -1

Introduction: Definition and scope of OR, Techniques and tools, model formulation, general methods for solution, Classification of Optimization problems, Optimization techniques

Linear Optimization Models: Complex and revised Simplex algorithms, Degeneracy and duality, Post optimum and Sensitivity analysis, Assignment, transportation and transshipment models, Traveling salesman problem, Integer and parametric programming.

UNIT -2

Game Problems: Minimax criterion and optimal strategy, two persons zero sum game, Games by Simplex dominance rules.

UNIT -3

Waiting Line Problems: Classification of queuing problems, M/M/1 & M/M/1/N queuing systems, Steady state analysis of M/M/m queues, Discrete and continuous time Markov models, Chapman-Kolmogorov equation, Birth & death processes in manufacturing, Open and Closed queuing networks.
Inventory Management: ABC analysis, deterministic and Probabilistic models.

UNIT -4

Dynamic Programming: Characteristics of dynamic programming problems, Bellman's principle of optimality, Problems with finite number of stages.

UNIT -5

Stochastic Programming: Basic concepts of Probability theory, Stochastic linear programming.

Books:

1.	Elements of Queuing Theory	Saaty	Pitam, 1983
2.	Fundamentals of Operations Research	Ackoff & Sasieni	Wiley eastern, 1985
3.	Principles of OR with Applications to Managerial Decisions	Wagner	Prentice Hall, 1970
4.	Operations Research	Taha	McMillan, 2008
5.	Introduction to Operations Research	Hillier and Lieberman	Prentice Hall,2001

MMET-103 ADVANCED THERMAL ENGINEERING

L	T	P
3	1	-

UNIT- 1
Basic Definitions & Concepts, Equation of state, Calculation of thermodynamic properties.

UNIT -2
Generalized compressibility charts, Second law analysis, Availability, irreversibility, Maxwell equations, Joule-Thomson coefficient, Thermodynamics of reactive mixtures, Stoichiometry.

UNIT-3
Generalized conduction equation, Steady and unsteady heat conduction in a slab of finite thickness; Effect of heat generation; Non-zero initial condition, Constant flux and convective boundary conditions.

UNIT-4
Heat conduction in an inhomogeneous medium; Examples of composite media; Radiation heat transfer, Surface properties, Configuration factor, Radiative heat exchange between gray surfaces.

UNIT -5
Navier-Stokes equation, Stream function, Velocity potential, Vorticity and circulation potential flow theory, Boundary layer theory.

Books:

1	Engineering thermodynamics	P.K Nag	TMH, 2013
2	Engineering Thermodynamics	C. Chattopadhaya	Oxford University Press, 1996
3	Fundamentals of Heat and Mass Transfer	C. P. Kothadaraman	New Age Publication, 2009
4	Thermal Engineering	Domkundwar, Kothadaraman	Dhanpat Rai and Co., 2001
5	Thermal Engineering	R. K. Rajput	Laxmi Publication, 2010

SYLLABUS

M.Tech. (Mechanical Engineering) Semester II
Compulsory Subjects (Regular)

MMET-201 OPTIMIZATION FOR ENGINEERING DESIGN

L	T	P
3	1	-

UNIT-1
Introduction: Historical Developments, Engineering applications of Optimization
Classical Optimization Techniques: Introduction, Review of single and multivariable optimization methods with and without constraints, Non-linear one-dimensional minimization problems, Examples.

UNIT -2
Constrained Optimization Techniques: Introduction, Direct methods - Cutting plane method and Method of Feasible directions, Indirect methods - Convex programming problems, Exterior penalty function method, Examples and problems **Unconstrained Optimization**

UNIT -3
Techniques: Introduction, Direct search method - Random, Univariate and Pattern search methods, Rosenbrock's method of rotating co-ordinates, Descent methods - Steepest Decent methods-Quasi-Newton's and Variable metric method, Examples.

UNIT -4
Geometric Programming: Introduction, Unconstrained minimization problems, solution of unconstrained problem from arithmetic-geometric inequality point of view, Constrained minimization problems, Generalized polynomial optimization, Applications of geometric problems, Introduction to stochastic optimization.

UNIT-5
Novel methods for Optimization: Introduction to simulated annealing, selection of simulated annealing parameters, simulated annealing algorithm; Genetic Algorithm (GA), Design of GA, Key concepts of GA, Neural Networks, A frame work for Neural Network models, Construction of Neural Network algorithm, Examples of simulated algorithm, genetic annealing and Neural Network method.

Books:

1. Engineering Optimization — S. S. Rao — New Age International,1996
2. Applied Optimal Design — E. J. Haug and J.S. Arora — Wiley, New York, 2006
3. Optimization for Engineering Design — Kalyanmoy Deb — Prentice Hall of India, 2012
4. Optimization — G.V. Reklaites, A. Ravindran and K.M. Rogsdeth — Wiley, New York, 2006
5. Genetic Algorithms and Engineering Optimization — Mitsuo Gen, Runwei Cheng — John Wiley & Sons, 2000

MMET-202 ADVANCED MECHANICS OF SOLIDS

L	T	P
3	1	-

UNIT-1
Analysis of stress and strain, Constitutive relationships, failure theories, Torsion of non-circular sections.

UNIT-2
Plane stress and plain strain problems, Review of fatigue analysis, Introduction to fracture mechanics, Inelastic behaviour, Viscoelasticity.

UNIT-3
Structure and behaviour of polymers, Behavior of unidirectional composites and orthotropic lamina.

UNIT-4
Failure theories for fibre composites, development of various structures in composites.

UNIT-5
Computer based analysis and solutions to problems in mechanics of solids.

Books:

1	Theory of Elasticity (Foundations of Engineering Mechanics)	A. I. Lurie	Springer Science & Business Media, 2010
2	Fracture Mechanics: Fundamentals and Applications	T. L. Anderson	CRC Press, 2005
3	Mechanical Behaviour of Materials: Engineering Methods for Deformation, fracture and Fatigue	Dowling, Norman E	Prentice Hall, 2013
4	Engineering Mechanics of Solids	E. P. Popov	Prentice Hall of India, 1998
5	Advanced Fracture Mechanics	Kanninen, Melvin F, Popelar, Carl H and C.H. Popelar	Oxford University, 1985

MMET-203 PRODUCTION TECHNOLOGY

L	T	P
3	1	-

UNIT-1

Welding Technology: Welding comparison with other fabrication processes, Classification, Fusion and pressure welding, Weldability of metals, Metallurgy of welding, Weld design, Stress distribution and temperature fields in the welds, Recent developments in welding viz.

UNIT-2

Diffusion, Friction, Electron beam and Induction welding, Cladding, Metallizing, Surfacing and Fabrication, Welding defects and inspection of welds, Thermal cutting of metals and its use in fabrication of process machines, Cutting of cast iron, stainless steel and non-ferrous metals.

UNIT -3

Metal Forming: Classification of forming process, Stress, strain and strain rules, laws, Yield criterion and flow rules, Friction and lubrication in metal forming processes, Indirect compression processes e.g., Drawing and Extrusion processes, Direct compression processes e.g., forming and rolling.

UNIT-4

Theory of deep drawing, Load bounding techniques and upper bound estimates of field theory, Bending and forming, High-energy rate forming techniques and their applications, Recent advances in metal forming.

UNIT-5

Metal Cutting: Tool geometry and signature, Theory of orthogonal and oblique metal cutting, Tool wear and lubrication, Theoretical evaluation of temperature fields at shear zone and tool-chip interface, Dynamics of metal cutting and machine tool stability, A critical review of theories of dynamic cutting machining at super high speeds, recent advances in cutting tool and science of metal cutting.

Books:

1. Fundamentals of Metal Machining	G. Boothroyd	TMH, 1980
2. Metal Forming Analysis	Avitzur	TMH, 1968
3. Metal Cutting Principle	M. C. Shaw	MIT Press, 2005
4. Theory of Plastic Deformation and Metal Working	V. Masterov and V. Berkovsky	MIR Publishers, 1988
5. Metal Cutting	E. M. Trent	Butterworth – Heinemann, 2000

MMES-201 SEMINAR

L	T	P	Credit
-	-	4	4

The student will select a topic of seminar in emerging areas of Mechanical Engineering and study the same independently. The topic of the seminar should not be the part of the curriculum. Each student is required to give a seminar talk on the same before the committee constituted by the head of the dept. as per the guidelines decided by the department from time to time.

MMEP-301 PROJECT

L	T	P	Credit
-	-	4	4

The student will work on some practical problems under the supervision of the guide /guides. A fair report of the project work is to be submitted in triplicate at the end of the semester.

MMED-301 DISSERTATION (Starts)

L	T	P	Credit
-	-	8	8

The Dissertation work should be of Research nature only and it should be started during the third semester. The following work should be completed during the semester.

- Literature Survey
- Problem Formulation

Around 35% of the Thesis work should be completed in this semester. The remaining 65% work will be carried out in the fourth semester. Each student is required to submit a detailed report about the work done on topic of Thesis as per the guidelines decided by the department. The Thesis work is to be evaluated through Presentations and Viva-Voce during the semester and at the end of semester as per the guidelines decided by the department from time to time.

MMED-401 DISSERTATION

(Continued from III Semester)

L	T	P	Credit
-	-	24	24

Each student is required to submit a detailed Thesis report about the work done (III Sem + IV Sem) on topic of Dissertation as per the guidelines decided by the department. The Dissertation work is to be evaluated through presentations and Viva-Voce during the semester and Final evaluation will be done at the end of semester as per the guidelines decided by the department from time to time.

SYLLABUS

M.Tech. (Mechanical Engineering)
Elective-I Subjects

MMET-211 PRODUCT DESIGN AND DEVELOPMENT

L	T	P
3	1	-

UNIT-1

Stages in design process: Introduction to various stages of the design process, formulation of problem, generation of alternatives, evaluation, guided redesign, case study.

Product life cycle: New product introduction, early introduction, increased product life, life cycle management tools, system integration, QFD, house of quality, Pugh's method, Pahl and Beitz method case studies.

UNIT-2

Value engineering: Introduction, nature and measurement of value, value analysis job plan, creativity and techniques of creativity, value analysis test, case studies.

Concurrent/reverse engineering: Introduction, basic principles, components, benefits of concurrent engineering, concept of reverse engineering.

UNIT-3

Material selection: Materials in design, the evaluation of engineering materials, design tools and material data, function, material, shape and process, material selection strategy, attribute limits, selection process, computer aided material selection, case studies.

Process selection: Introduction, process classification, shaping, joining and finishing, systematic process selection, ranking, process cost, computer aided process selection.

UNIT-4

Design for manufacturing and assembly: Design for manufacturing and assembly (DFMA), reasons for not implementing DFMA, advantages of DFMA with case studies, design features and requirements with regard to assembly, production, design for manufacture in relation to any two manufacturing processes, Machining and injection moulding, need, objectives.

Design for "X": Introduction, design for safety, packaging and storage, quality, reliability, energy conservation, environment aesthetics, ergonomics, maintenance, recyclability and disposal, case studies.

UNIT-5

Patents, liability and ethics: Introduction, protecting your design, patents, copyright, basic tools of design production, liability issues in product design, ethical considerations, examples/case studies.

Books:

1.	Product Design and Development	Karl T. Ulrich, Steven D. Eppinger	McGraw Hill, 2003
2.	Integrated Product and Process Development	John M. Usher, Utpal Roy and H. R. Parasaei	Tata McGraw Hill, 1998
3.	Product Design for Manufacture and Assembly	G. Boothroyd. P. Dewhurst and W. Knight	Marcel Dekker, 2010
4.	Product Design and Manufacture	A.K. Chitale and R. C. Gupta	PHI, 2013
5.	Selection of Materials and Manufacturing Processes for Engineering Design	Mahmood M. Farag	Prentice Hall, 1997

MMET-212 MANUFACTURING SYSTEM ANALYSIS

L	T	P
3	1	-

UNIT-1
Basic concept of manufacturing, manufacturing problems, Systems approach to manufacturing problems, Principle of modeling in mathematical and physical form, Types of model, Simulation in modeling, Sources of system error.

UNIT-2
Stability of linear and non-linear system, Adaptive control, System optimization techniques, Product design and part configuration project scheduling by PERT, GERT, flow graph, Productive maintenance.

UNIT-3

Automation of production, Computer Aided Design, Computerised layout planning, Automated process planning, Automatic operation planning.

UNIT-4
Automatic and Computer Integrated Manufacturing.Automated assembly and Testing information systems for manufacturing.

UNIT-5
Fundamentals of information system, data bank, On-line production management systems, Parts oriented production information system, Production information and management systems.

Books:

1. Manufacturing Process & system	Ostwald	Willey India Pvt. Ltd., 2008
2. Materials & Process in Manufacturing	E. Paul Degarmo, J. T. Black, R. A. Kosher	Prentice Hall of India, 2011
3. Manufacturing Systems Design and Analysis	Wu B.	Kluwer Academic Publishers, 2009
4. Queuing Theory in Manufacturing Systems Analysis and Design	Papadopoulos H T	Chapman and Hall, 1993
5. Performance Analysis of Manufacturing Systems	Altiok Tayfur	Springer-Verlag, 1997

MMET-213 COMPUTATIONAL FLUID DYNAMICS AND HEAT TRANSFER

L	T	P
3	1	-

UNIT-1
Introduction, Conservation equation, Mass Momentum and Energy equations, Convective form of the equation and general description.

UNIT-2
Clarification into various types of equation, Parabolic, Elliptic, Boundary and initial conditions, Overview of numerical methods.

UNIT-3
Finite difference methods; Different means for formulating finite difference equations, Taylor series expansion, Integration over element, Local function method; Finite volume methods; Central, upwind and hybrid formulations and comparison for convection-diffusion problem, Treatment of boundary conditions; Boundary layer treatment; Variable property, Interface and free surface treatment, Accuracy of F.D. method.

UNIT-4
Solution of finite difference equations; Iterative methods; Matrix inversion methods, ADI method, Operator splitting, Fast Fourier Transform applications.

UNIT-5
Phase change problems, Rayleigh- Ritz, Galerkin and Least square methods; Interpolation functions, One and two dimensional elements, Applications. Phase change problems; Different approaches for moving boundary; Variable time step method, Enthalpy method.

Books:

1. Computational Methods for Fluid Dynamics — Ferziger Joel H — Springer-Verlag, 1999
2. Principles of Heat Transfer — Kaviany M — Wiley-International, 2001
3. Radiative Heat Transfer — Modest Michael — Academic Press, 2013
4. An Introduction to Mass and Heat Transfer — Middleman Stanley — John Wiley, 2007
5. Numerical Heat Transfer and Fluid Flow — Suhas V. Patankar — CRC Press, 1980

MMET-214 INTERNAL COMBUSTION ENGINES

L	T	P
3	1	-

UNIT-1
Classification, Construction, Valve arrangements, Fuels, Properties of fuels, Rating of fuels.

UNIT-2
Alternative fuels, Fuel air cycle, Actual cycles, Combustion in SI engines, Combustion in CI engines.

UNIT-3
Effect of engine variables, Combustion chambers, Carburation and fuel injection,.

UNIT-4
Knocking, Engine cooling, Friction and lubrication, Supercharging, Turbocharging,

UNIT-5
Boost control, Testing and performance, Pollution due to engines.

Books:

1. Internal Combustion Engines: Applied Thermo Sciences — Ferguson Colin R. John Wiley, 2001
2. Fundamentals of Internal Combustion Engines — H. N. Gupta — Prentice Hall, 2012
3. Internal Combustion Engines — S. K. Agrawal — New Age international, 2012
4. Engineering Fundamentals of the Internal Combustion Engine — W. W. Pulkrabek — Prentice Hall of India, 2006
5. Internal Combustion Engine — V. Ganesan — TMH, 2008

MMET-321 THEORY OF ELASTICITY & PLASTICITY

L	T	P
3	1	-

UNIT-1

Theory of Elasticity: Analysis of stress and strain, equilibrium, Compatibility and constitutive equations, Plane stress and plane strain problems, General equation in Polar co-ordinates, Rotating discs and stresses in circular discs, Stress function in terms of harmonic and complex functions.

UNIT-2

Equation of equilibrium of a deformed body in curvilinear co-ordinates, Principle of superposition and principle of virtual work, Torsion of thin tubes, Bending of cantilevers, Uniformly and continuous loaded beams, Bending of circular, elliptical and rectangular cross-section bars, Axi-symmetric formulation and deformation of solids of revolution.

UNIT-3

Theory of Plasticity: Nature of engineering plasticity, Differential equations of equilibrium, 3D stress analysis, infinitesimal deformation, finite deformation, Von Mises', Tresca's and anisotropic yield criteria, halgh-Westergard stress space representation of yield criteria.

UNIT-4

Experimental verification of yield criteria, Subsequent yield surfaces, Elastic and plastic stress-strain relations and stress strain rate equations, Prandtle-Reuaa equations, Generalized plastic stress strain relations, Anisotropy and instability.

UNIT-5

Plane plastic flow, Slip-line field theory, Application of slip line field theory to plane strain metal forming processes, Plane plastic stress and pseudo plane stress analysis and its applications, Extremum principle for rigid perfectly plastic material, surfaces of stress and velocity discontinuity, Upper bound and lower bound theorems and applications.

Books:

1. Theory of Elasticity (Foundations of Engineering Mechanics)	A. I. Lurie	Springer, 2010
2. Contact Problems in the Classical Theory of Elasticity	G. M. Gladwell	Kluwer Academy Publisher, 1980
3. Applied Plasticity	J. Chakrabarty	Springer-Verlag, 2010
4. The Mathematical Theory of Plasticity	R. Hill	Oxford University, 2003
5. Theory of Elasticity for Scientists and Engineers	Teodor M. Atanackovic, Ardeshir Guran	Springer Science & Business Media, 2000

MMET-322 ADVANCED WELDING TECHNOLOGY

L	T	P
3	1	-

UNIT-1

Welding Metallurgy: Welding as compared with other fabrication processes, Classification of welding processes; Heat affected zone and its characteristics; Effects of alloying elements on weldability, Weldability of steels, stainless steel, cast iron, and aluminum and titanium alloys, Weld testing standards, Hydrogen embrittlement, Lammellar tearing, residual stresses and its measurement, heat transfer and solidification, Analysis of stresses in welded structures, Pre and post welding heat treatments, Metallurgical aspects of joining, Conditions of soldering, Brazing and welding of materials.

UNIT-2

Weld Design & Quality Control: Principles of sound weld design, Welding joint design, Welding defects; Testing of weldament, Material joining characteristics, Welding positions, Allowable strength of welds under steady loads, Weld throat thickness; Weld quality, Discontinuities in welds, their causes and remedies and quality conflicts.

UNIT-3

Modern Trends in Welding: Friction welding, Explosive welding, Diffusion bonding, High frequency induction welding, Ultrasonic welding, Electron beam welding, Plasma arc welding, Laser welding.

UNIT-4

Mechanisation in Welding: Mechanisation of flat/circular joints, Thin/thick sheets (resistance/arc weld), Mechanisation of I beams (arc weld), Longitudinal circumferential SA welding (roller blocks, column booms, flux supports), Circular/spherical welding joints (rotating tables positioners), Manufacture of welding longitudinal welded pipes by induction, TIG, Plasma and SA welding of spiral welded pipes.

UNIT-5

Robotics in Welding: Robot design and applications in welding, Programming of welding robots, tolerances for assemblies for robot welding, New generation of welding robots, Self alignment by current arc variation, Robots for car body welding, Microelectronic welding and soldering, Efficiency of robotics in welding.

Books:

1. Advanced Welding Processes — Nikodaco & Shansky — MIR Publications, 1980
2. Welding Technology and Design — VM Radhakrishnan — New Age International, 2005
3. Source Book of Innovative welding Processes — M.M. Schwariz — Americal Society of Metals (Ohio), 2005
4. Advanced Welding Systems, Vol. I, II, III — J. Cornu — Jaico Publishers, 1998
5. Manufacturing Technology (Foundry, Forming and Welding) — P.N. Rao — Tata McGraw Hill, 2001

MMET-323 CNC, FMS & CIM

L	T	P
3	1	-

UNIT-1

Introduction to CNC Machine Tools: Development of CNC Technology-Principles and classification of CNC machines, Advantages & economic benefits, Types of control, CNC controllers, Characteristics, Interpolators, Applications, DNC concept.

CNC Programming: Co-ordinate System, Fundamentals of APT programming, Manual part programming-structure of part programme, G & M Codes, developing simple part programmes, Parametric programming, CAM packages for CNC machines -IDEAS, Unigraphics, Pro Engineer, CATIA, ESPIRIT, MasterCAM etc., and use of standard controllers-FANUC, Heidenhain and Sinumeric control system.

UNIT-2

Tooling for CNC Machines: Cutting tool materials, Carbide inserts classification; Qualified, semi-qualified and preset tooling, Cooling fed tooling system, Quick change tooling system, Tooling system for machining centre and turning center, tool holders, Tool assemblies, Tool magazines, ATC mechanisms, Tool management.

UNIT-3

Robotics and Material Handling Systems: Introduction to robotic technology, and applications, Robot anatomy, material handling function, Types of material handling equipment, Conveyer systems, Automated guided vehicle systems, Automated storage/retrieval systems, Work-in-process storage, Interfacing handling and storage with manufacturing.

UNIT--4

Group Technology and Flexible Manufacturing System: group Technology-part families, Parts classification and coding, Production flow analysis, Machine Cell Design, Benefits of Group Technology, Flexible manufacturing systems-Introduction, FMS workstations, Computer control system, Planning for FMS, Applications and benefits.

UNIT-5

Computer Integrated Manufacturing: Introduction, Evaluation of CIM, CIM hardware and software, Requirements of computer to be used in CIM system, Database requirements, Concurrent engineering-Principles, design and development environment, advance modeling techniques.

Books:

1.	Computer Numerical Control Machines	P. Radahkrishnan	New Central Book Agency, 1992
2.	CNC Machines	M.S. Sehrawat and J.S. Narang	Dhanpat Rai and Co., 2014
3.	CNC Programming Handbook	Smid Peter	Industrial Press Inc., 2003
4.	Computer Integrated Manufacturing	Paul Ranky	Prentice Hall of India, 1999
5.	CAD/CAM: Computer-Aided Design and Manufacturing	Groover	Pearson Education India, 2006

MMET-324 RENEWABLE ENERGY SYSTEMS

L	T	P
3	1	-

UNIT-1

Introduction: Energy and Development; Energy demand and availability; Energy crisis; Conventional and Non-conventional energy; Renewable and Non-renewable energy resources; Environmental impacts of conventional energy usage; Basic concepts of heat and fluid flow useful for energy systems.

UNIT-2

Solar Energy Systems: Solar radiations data; Solar energy collection, Storage and utilization; Solar water heating; air heating; Power generation; Refrigeration and Air-conditioning; Solar Energy system Economics.

UNIT-3

Micro and Small Hydro Energy Systems: Resource assessment of micro and small hydro power; Micro, mini and small hydro power systems; Economics; Pump and turbine; Special engines for low heads; Velocity head turbines; Hydrams; Water mill; Tidal power.

UNIT-4

Bio mass Energy Systems: Availability of bio mass-agro, forest, animal, municipal and other residues; Bio mass conversion technologies; Cooking fuels; Biogas; producer gas; Power alcohol from biomass; Power generation; Internal engine modifications and performance; system economics.

UNIT-5

Wind Energy Systems: Wind data; Horizontal and vertical axis wind mills; Wind farms; Economics of wind energy.

Integrated Energy Systems: Concept of integration of conventional and non-conventional energy resources and systems; Integrated energy system design and economics.

Books:

1. Energy Efficient Buildings in India — Mili Majumdar — Tata Energy Research Institute, 2001
2. Understanding Renewable Energy Systems — Volker Quaschning — Earthscan, 2005
3. Renewable Energy Systems — Simmoes Marcelo Godoy — CRC Press, 2004
4. Renewable Energy Resources — John Twidell — Taylor and Francis, 2006
5. Renewable Energy Sources and Their Environmental Impact — Abbasi & Abbasi — Prentice Hall of India, 2000

SYLLABUS
M.Tech. Semester III
Electives-III

MMET-331 TOTAL QUALITY MANAGEMENT

L	T	P
3	1	-

UNIT-1
Introduction, definition of quality, dimensions of quality, quality planning, quality costs – analysis techniques for quality costs, basic concepts of total quality management, historical review, principles of TQM, leadership – concepts, role of senior management, quality council, quality statements, strategic planning, Dening philosophy, barriers to TQM implementation.

UNIT-2
TQM principles, customer satisfaction – customer perception of quality, customer complaints, service quality, customer retention, employee involvement – motivation empowerment, teams, recognition and reward, performance appraisals, benefits, continuous process improvement – Juran Trilogy, PDSA cycle, 5S, Kaizen, supplier partnership – partnering, sourcing, supplier selection, supplier rating, relationship development, performance measures – basic concepts, strategy, performance measure.

UNIT-3
Statistical process control (SPC), the seven tools of quality, statistical fundamentals – measures of central tendency and dispersion, population and sample, normal curve, control charts for variables and attributes, process capability, concepts of six sigma, new seven management tools.

UNIT-4
TQM tools, benchmarking – reasons to benchmark, benchmarking process, quality function deployment (QFD) – house of quality, QFD process, benefits, Taguchi quality loss function, total productive maintenance (TPM) – concepts, improvement needs, FMEA – stages of FMEA.

UNIT-5
Quality system, need for ISO 9000 and other quality systems, ISO 9000:2000 quality system – elements, implementation of quality systems, documentation, quality and auditing, QS9000, ISO14000 – concepts, requirements and benefits.

Books:

1. Total Quality Management — Dale H. Besterfield — Pearson Education Asia, 1999
2. The Management and Control of Quality — James R. Evans and William M. Lidsay — South Western (Thomson Learning), 2002
3. Total Quality Management — Feigenbaum A. V. — McGraw-Hill, 1991
4. Total Quality Management Butterworth — Oakland J. S. — Hcinemann Ltd., Oxford, 1989
5. Quality Management – Concepts and Tasks — Narayana V. and Srinivasan N. S. — New Age International, 1996

MMET-332 INDUSTRIAL DESIGN & ERGONOMICS

L	T	P
3	1	-

UNIT-1

Introduction to Ergonomics and Industrial Design: An approach to industrial design-elements of design, Structure for industrial design in engineering; Application in modern manufacturing systems; General approach to the man-machine relationship, Work station design, Working position.

UNIT-2

Control and Displays: Shapes and sizes of various controls and displays- Multiple displays and control situations; design of major controls in automobiles, machine tools etc.; Design of furniture; Redesign of instruments.

UNIT-3

Ergonomics and Production: Ergonomics and product design, ergonomics in automated systems; Expert systems for ergonomic design; Anthropometrics data and its applications in ergonomic design; Limitations of anthropometric data, Use of computerized database; Case study.

UNIT-4

Visual Effects of Line and Colour: The mechanics of seeing; Psychology of seeing; General influence of line and form; Colour and light; Colour and objects; Colour and the eye; Colour consistency; Colour terms; Reaction to colour and colour continuation; Colour on engineering equipments.

UNIT-5

Aesthetic Concepts: Concept of unity; Concept of order with variety; Concept of purpose style and environment; Aesthetic expressions; Style, Components of style; House style; Observation style in capital goods; Case study.

Industrial Design in Practice: General design; Specifying Design equipments; Rating the importance of industrial design; Industrial design in design process.

Books:

1. Industrial design for Engineers — W.H. Mayall — London Hiffee Books Ltd., 1967
2. Introduction to Ergonomics — R.C. Bridger — McGraw Hill, 2008
3. Human Factor Engineering — Sanders & McComlick — TMH, 1987
4. Industrial ergonomics: case studies — Babur Mustafa Pulat, David C. Alexander — McGraw-Hill, 1991
5. Industrial Engineering and Ergonomics — Christopher M. Schlick — Springer Science & Business Media, 2009

MMET-333 MANAGEMENT INFORMATION SYSTEMS

L	T	P
3	1	-

UNIT-1
Introduction; Meaning and definition of management information systems (MIS); Systems approach; Role of MIS in facing increasing complexity in business and management.

UNIT-2
Conceptual information systems design; defining the problem; setting system objectives; Establishing system constraints; Determining information needs; Determining information sources; Developing alternative conceptual designs; Documenting the conceptual designs.

UNIT-3
Detailing information systems design; Informing and involving the organization; Project management of MIS; Identifying dominant and tradeoff criteria; Subsystem definition and sources.

UNIT-4
Evaluation of information systems; Basic information systems; Financial information systems; Production and operations information systems; Marketing information systems; Personal information system etc.

UNIT-5
Information systems for decision making; Programmed and non-programmed decisions; Components of decision support systems, Strategic and project planning.
Enterprise wise information systems; Integration with ERP systems; Real-time organizations; Integration with external organizations; Virtual organizations; data warehousing; Data mining; OLAP (OnLine Analytical Processing) Systems, Business analytics. Issues in ethics, crime and security.

Books:

1.	Management Information Systems	O' Brien, J	Tata McGraw Hill, 2004
2.	Management Information Systems	W. S. Jawedker	Tata McGraw Hill, 2006
3.	Management Information Systems	S. Sadagopan	Prentice Hall of India, 1997
4.	An Information System for Modern Management	R.G. Mudrick	Pearson Education, 2012
5.	Management Information Systems	M. Jaiswal	Oxford University Press, 2010

MMET-334 ENVIRONMENTAL POLLUTION & ITS CONTROL

L	T	P
3	1	-

UNIT-1
Introduction: Nature and extent of pollution problems; Types of pollution.

UNIT-2
Air Pollution: General nature of air pollution; Air pollutants; Sources of air pollutants; Pollination from stationary sources and its control; Pollution from mobile sources and its control.

UNIT-3
Thermal Pollution: Introduction; Effects of thermal pollution on ecology; Thermal plume, regions of plume; Parameters relevant to thermal plume and their limits; Mechanics of condenser water discharge from thermal power plants; Modelling of heated water discharge.

UNIT-4
Global Atmospheric Change: Introduction; Simple global temperature models; Green House effects, Green house gases; CO_2 and its estimates.

UNIT-5
Equilibrium temperature increase caused by CO_2, Chloroform carbons and warming and Ozone depletion impacts of CFC's, changes in stratospheric ozone.

Books:

1. Environmental Pollution And Protection — Garg, Bansal, Tiwana — Deep and Deep Publis., 1995
2. Environmental Pollution- Hazards And Control — R. D. Gupta — Concept Publishing Company, 2006
3. Environmental Pollution Compliance — H. C. Sharma — CBS Publishers, 2011
4. Global Effects of Environmental Pollution — American Association For The Advancement — Kluwer Academy Publisher, 2007
5. Environmental Pollution and Control — J. Jeffrey Peirce, P Aarne Vesilind, Ruth Weiner — Butterworth-Heinemann, 1998