VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination – 2018-19
M.Tech PRODUCTION ENGINEERING (MPE)
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

I SEMESTER

Sl. No	Course	Course Code	CourseTitle	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	18MPE11	Mathematics	04	--	03	40	60	100	4
2	PCC	18MPE12	Theory of Metal Cutting	04	--	03	40	60	100	4
3	PCC	18MPE13	Advanced Foundry Technology	04	--	03	40	60	100	4
4	PCC	18MPE14	Surface Treatment & Finishing	04	--	03	40	60	100	4
5	PCC	18MPE15	Computer Integrated Manufacturing & Automation	04	--	03	40	60	100	4
6	PCC	18MPEL16	Laboratory	-	04	03	40	60	100	2
7	PCC	18RMI17	Research Methodology and IPR	02	--	03	40	60	100	2
			TOTAL	**22**	**04**	**21**	**280**	**420**	**700**	**24**

Note: PCC: Professional core, PEC: Professional Elective.

Internship: All the students have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed credit shall be counted forthe same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as failed and have to complete during the subsequent University examination after satisfying the internship requirements.

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II SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	18MPE21	Industrial Robotics	04	--	03	40	60	100	4
2	PCC	18MPE22	Non Traditional Machining Processes	04	--	03	40	60	100	4
3	PCC	18MPE23	Tool Engineering	04	--	03	40	60	100	4
4	PEC	18MPE24X	Professional elective 1	04	--	03	40	60	100	4
5	PEC	18MPE25X	Professional elective 2	04	--	03	40	60	100	4
6	PCC	18MPEL26	Laboratory	--	04	03	40	60	100	2
7	PCC	18MPE27	Technical Seminar	--	02	--	100	--	100	2
TOTAL				**20**	**06**	**18**	**340**	**360**	**700**	**24**

Note: PCC: Professional core, PEC: Professional Elective.

Professional Elective 1		**Professional Elective 2**	
Course Code under 18MPE24X	**Course title**	**Course Code under 18MPE25X**	**Course title**
18MPE241	Advanced Joining Processes	18MPE251	Supply chain management
18MPE242	Non-Destructive Testing	18MPE252	Agile Manufacturing
18MPE243	Smart Materials & Structures	18MPE253	Total Quality Management

Note:

1. Technical Seminar:CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a senior faculty of the department. Participation in the seminar by all postgraduate students of the same and other semesters of the programme shall be mandatory.

The CIE marks awarded for Technical Seminar, shall be based on the evaluation of Seminar Report, Presentation skill and Question and Answer session in the ratio 50:25:25.

2. Internship: All the students shall have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed credit shall be counted in the same semester.Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as failed and have to complete during the subsequent University examination after satisfying the internship requirements.

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III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	18MPE31	Theory of Metal Forming	04	--	03	40	60	100	4
2	PEC	18MPE32X	Professional elective3	04	--	03	40	60	100	4
3	PEC	18MPE33X	Professional elective 4	04	--	03	40	60	100	4
4	Project	18MPE34	Evaluation of Project phase -1	--	02	--	100	--	100	2
5	Intenship	18MPEI35	Internship	(Completed during the intervening vacation of I and II semesters and /or II and III semesters.)		03	40	60	100	6
TOTAL				12	02	12	**260**	**240**	**500**	**20**

Note: PCC: Professional core, PEC: Professional Elective.

Professional elective 3		Professional elective 4	
Course Code under 18MPE32X	**Course title**	**Course Code under 18MPE33X**	**Course title**
18MPE321	Advanced Materials & Processing	18MPE331	Nano Technology
18MPE322	Simulation & Modeling of Manufacturing Systems	18MPE332	Applied Probability & Statistics
18MPE323	Composite Materials	18MPE333	Quality & Reliability Engineering

Note:

1. Project Phase-1: Students in consultation with the guide/co-guide if any, shall pursue literature survey and complete the preliminary requirements of selected Project work. Each student shall prepare relevant introductory project document, and present a seminar.
CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25.
SEE (University examination) shall be as per the University norms.

2. Internship: Those, who have not pursued /completed the internship shall be declared as failed and have to complete during subsequent University examinations after satisfying the internship requirements.
Internship SEE (University examination) shall be as per the University norms.

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IV SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks Viva voce	Total Marks	
1	Project	18MPE41	Project work phase -2	--	04	03	40	60	100	20
			TOTAL	--	**04**	**03**	**40**	**60**	**100**	**20**

Note:

1. Project Phase-2:

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a Senior faculty of the department. The CIE marks awarded for project work phase -2, shall be based on the evaluation of Project Report subjected to plagiarism check, Project Presentation skill and Question and Answer session in the ratio 50:25:25.

SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.

SEMESTER – I
THEORY OF METAL CUTTING

Subject Code :18MPE12	**CIE MARKS : 40**
Number of Lecture Hours/Week :04	**SEE Marks : 60**
Total Number of Lecture Hours :50	**Exam Hours :03**

MODULE- 1

Mechanics Of Metal Cutting: Mechanism of chip formation, Orthogonal & Oblique cutting, types of chips, built-up edge, Determination of shear plane angle, forces on the chips, forces in orthogonal cutting, Merchant circle diagram and analysis, Theory of Lee & Shaffer, co-efficient of friction, power & energy relationship, velocity relationship, shear-strain, factors affecting forces and power, problems

Geometry Of Cutting Tools: Single point and multi point cutting tools, tools nomenclature, tool point reference systems, tool signature, Recommended tool angles, Effect of cutting parameters on tool geometry

MODULE- 2

Tool Materials And Their Properties: Characteristics of tool materials, types of tool materials – carbon tool steels, high speed steels, cast alloys, cemented carbides, ceramics, diamonds, SIALON, CBN, UCON, recommended cutting speeds for the above tools, discussion on die steels, air, water, oil hardening of tools and their applications

Tool Wear, Tool Life: Mechanisms of tool wear, Sudden & gradual wear, crater wear, flank wear, tool failure criteria, tool life equations, effect of process parameters on tool life, tool life tests, conventional & accelerated tool wear measurement, machinability index

MODULE- 3

Measurement Of Cutting Forces: Reasons for measuring cutting forces, Classification of cutting force dynamometers – mechanical, hydraulic, pneumatic, optical, inductance, piezoelectric, and strain gage type dynamometers,

Dynamometers For Machine Tools: Dynamometers for lathe, drilling, grinding and milling, Calibration of dynamometers

MODULE- 4

Thermal Aspects In Metal Cutting: Heat sources in metal cutting, temperature in chip formation, temperature distribution, and experimental determination of tool temperatures.

Cutting Fluids: Basic actions of cutting fluids, properties of cutting fluids, selection of cutting fluids, application of cutting fluids, filtration of fluids, recommended cutting fluids.

MODULE- 5

Economics Of Machining: Introduction, elements of total production cost, optimum cutting speed and tool life for minimum cost, optimum cutting speed and tool life for maximum production, problems.

Advanced Machining Techniques: Cryo machining & high speed machining. Causes of vibration and chatter in machining, and their remedy

Text Books:

1. Metal Cutting Principles - M.C. Shaw - Oxford Publication – 1985.
2. Fundamentals of metal cutting & Machine Tools-by B.L.Juneja& G.S–Sekhar - Wiley Eastern.
3. Metal Cutting - V.C.Venkatesh&S.Chandrasekhanan - Pantice Hall – 1991.
4. Metal Cutting - Dr. B.J.Ranganath -Vikas Publications

ADVANCED FOUNDRY TECHNOLOGY

Subject Code :18MPE13 **CIE MARKS : 40**
Number of Lecture Hours/Week :04 **SEE Marks : 60**
Total Number of Lecture Hours :50 **Exam Hours :03**

MODULE 1

Solidification of Casting: Concept of solidification of metals. Homogenous and heterogeneous nucleation. Growth mechanism. Solidification of pure metals and alloys. Mechanism of columnar and dendritic growth. Coring or Segregation. Solidification time and Chvorinov's rule. Concept of progressive and directional solidifications.

MODULE 2

Principles of Casting and Risering: Purpose of the gating system. Components of the gating System and its functions. Design of the gating System. Different types of gates. Gating ratio and its functions. Definition and functions of the riser. Types of risers and their application. Design of the riser - its shape. Size and location. Use of insulating material and exothermic compounds in risers.

Design of Casting: Factors to be considered in casting design. Design consideration in pattern making, moulding techniques and core making and assembly. Cooling stresses and hot spots in casting and modification in casting geometry to overcome them.

Casting Quality Control: Casting defects and factors responsible for them. Different inspection and testing methods to evaluate the casting. Quality control activities in a foundry. Salvaging methods of defective casting.

MODULE 3

Furnace Technology: Study of various furnaces used in foundry, construction and operation of crucible and hearth furnaces. Resistance, Arc and Induction furnaces-their construction. Operation and application. Heat treatment furnaces and drying ovens used in foundry.

Gray Cast - Iron Foundry Practice: Chemical Composition and structure of gray cast iron. Moulding, gating and risering techniques. Melting of gray cast iron in Cupola and induction furnace. Inoculation of gray cast iron. Application of gray cast iron castings.

Malleable Cast Iron: Chemical composition and structure of White-heart and black-heart malleable cast iron. Melting malleabilisation heat treatment and application of malleable cast iron.

Ductile Cast Iron: Chemical composition and structure of ductile cast iron. Melting and spherodisation treatment. Inoculation of 'ductj)e iron Properties and application of ductiles iron casting.

MODULE 4

Steel Casting Practice: Common steel casting, their composition,structure and properties. Melting and refining of steel. Gating andrisering of steel castings cleaning of steel castings.

Aluminium Foundry Practice: Composition, properties and application of common aluminium alloy casting. Melting and casting of AI-alloys. Gating and risering of AI-alloy casting.

MODULE 5

Copper alloy Foundry Practice: General characteristics of common cast copper alloys. Melting and casting of copper alloys. Gating and risering of cu-alloy castings.

REFERENCE BOOKS:

1. **Principle of metal casting** - Heine, et. al - Tata-McGraw-HiII Publication - 2003.
2. **A test book of FoundryTechnology** - Lal, M. Khanna, P.O - DhanpatRai & Sons Publication.
3. **Foundry Technology** - Beelely, P.R. – Butterworth.

SURFACE TREATMENT & FINISHING

Subject Code: 18MPE14 **CIE MARKS: 40**
Number of Lecture Hours/Week: 04 **SEE Marks : 60**
Total Number of Lecture Hours: 50 **Exam Hours: 03**

Module – 1
Fundamentals of Electro plating, galvanizing, Hot dip metal coating, thin coating, thin coating, chromium plating, Nickel plating.

Module – 2
Vacuum coating, FVD & CVD metal spraying - Methods, surface preparation, mechanical Properties of sprayed metals, plasma coating.

Module – 3
Plastic coating of metal - PVC coating Spherodising process details, phosphate coating - mechanism of formation.Testing of surface coating-methods.

Module – 4
Heat treatment methods, Annealing, Normalizing, Tempering, Case hardening methods, flame hardening sub zero treatment Heat treatment methods for gears, spindles, cutting tools.

Module – 5
Advanced coating technologies: Hard facing, electro deposition technique, nanocoatings, coating characterization

REFERENCE BOOKS:
1. **Surface preparations & finishes for Metals** - James A Murphy - McGraw Hill.
2. **Principles of metal surface treatment and protection** - Pergamon Press Gabe, David Russell - Description, Oxford ; New York - 2d ed., 1978.
3. **Handbook of metal treatment and testing** - John wiley & sons.
4. **Heat Treatment of Metals** – Zakrov - MlR Publications
5. **Metals Hand Book** – ASM.

COMPUTER INTEGRATED MANUFACTURING & AUTOMATION

Subject Code :18MPE15	**CIE MARKS : 40**
Number of Lecture Hours/Week :04	**SEE Marks : 60**
Total Number of Lecture Hours :50	**Exam Hours :03**

MODULE- I

Introduction To Cim: Manufacturing - Types, Manufacturing Systems, CIM Definition, CIM wheel, CIM components, Evolution of CIM, needs of CIM, Benefits of CIM.

High Volume Production System: Introduction Automated flow line-symbols, objectives, Work part transport-continuous, Intermittent, synchronous, Pallet fixtures, Transfer Mechanism-Linear-Walking beam, roller chain drive, Rotary-rack and pinion, Ratchet & Pawl, Geneva wheel,

MODULE- 2

Analysis Of Automated Flow Line & Line Balancing: General terminology and analysis, Analysis of Transfer Lines without storage-upper bound approach, lower bound approach and problems, Analysis of Transfer lines with storage buffer, Effect of storage, buffer capacity with example problem, Partial automation-with numerical problem example, Manual Assembly lines line balancing problem

MODULE- 3

Automated Process Planning: Group Technology, Part families, Part classification and coding, Production flow analysis, Machine cell design, Applications and Benefits of Group Technology, Structure of a Process Planning, Process Planning function, CAPP - Methods of CAPP, CAD based Process Planning,

MODULE- 4

Monitoring And Quality Control: Types of production monitoring system, process control & strategies, direct digital control - Supervisory computer control - computer aided quality control - objectives of CAQC, QC and CIM, contact, non-contact inspection methods, CMM and Flexible Inspection systems

MODULE- 5

Flexible Manufacturing Systems: FMS concept, Components of FMS, FMS Layouts, FMS planning and implementation. Tool Management systems-Tool monitoring, Work holding devices- Modular fixturing, flexible fixturing,, flexibility, application and benefits of FMS, automated material handling system –AGVs, Guidance methods, AS/RS.

Text Books:

1. Mikell P. Groover, Automation, Production system & Computer Integrated Manufacturing, Prentice Hall India Learning Private Limited, 3rdEdition, 2008.
2. Kant Vajpayee. S., Principles of Computer Integrated Manufacturing, Prentice Hall of India, 1999.

Reference Books:

1. James A. Rehg& Henry W Kraebber, Computer Integrated Manufacturing, Pearson Prentice Hall, 2005.
2. YoremKoren, Computer Control of Manufacturing Systems, Mc. Graw Hill, 1983.
3. P. Radhakrishnan, S. Subramanyan and V. Raju, CAD / CAM / CIM, New Age International Publishers, 2008.

Laboratory Exercises

18 MPEL 16

Perform any Eight / Ten experiments:

1. Determination of Chip reduction co-efficient (reciprocal of chip thickness ratio) during single point turning.
2. Forces measurements during orthogonal turning.
3. Estimation of Power required during orthogonal turning.
4. Torque and Thrust measurement during drilling.
5. Determination of cutting forces during milling using Milling tool dynamometer
6. Measurement of Chip tool Interface temperature during turning using thermocouple technique.
7. Study the variation of surface roughness with different speed and feed during plain milling operation on flat surface.
8. Study of capstan lathe and its tooling and prepare a tool layout & job as per given drawing.
9. To prepare metallic samples for metallographic examination and to study the principle & construction of the Metallurgical Microscope.
10. Study of Microstructure and Hardening of steel in different medium and cooling rates.
11. Effect of Carbon percentage on the hardness of Steel.
12. CNC milling- Writing and execution of part program for contour milling.

REFRENCE BOOKS

1. **Metal Cutting Principles** - M.C. Shaw - Oxford Publication – 1985.
2. **Fundamentals of metal cutting & Machine Tools** - by B.L.Juneja & G.S – Sekhar - Wiley Eastern.
3. **Metal Cutting** - V.C.Venkatesh & S.Chandrasekhanan - Pantice Hall – 1991.
4. **Metal Cutting** - Dr. B.J.Ranganath -Vikas Publications.

SEMESTER II

INDUSTRIAL ROBOTICS

Subject Code: 18MPE21 **CIE MARKS: 40**
Number of Lecture Hours/Week: 04 **SEE Marks : 60**
Total Number of Lecture Hours: 50 **Exam Hours: 03**

Module – 1

FUNDAMENTAL CONCEPTS OF ROBOTICS: History, present status and future trends, Robotics. Robot, Definition. Robotics Systems and Robot Anatomy, Specification of Robotics. Resolution, Repeatability and Accuracy of a Manipulator

ROBOT DRIVES: Power transmission systems and control Robot drive mechanisms, hydraulicelectric-pneumatic drives. Mechanical transmission method – Rotary-to-Rotary motion conversion. Rotary-to-linear motion conversion end effectors – types-gripping problem, Remote-Centered compliance, Devices-Control of Actuators in Robotic Mechanisms.

Module – 2

SENSORS AND INTELLIGENT ROBOTS: Sensory devices – Non-optical-Position sensors – Optical position sensors – velocity sensors – proximity sensors: Contact and non-contact type-Touch and slip sensors – Force and Torque Sensors – AI and Robotics.

Module – 3

COMPUTER VISION FOR ROBOTICS SYSTEMS: Robot vision systems – Imaging components – Image representation – Hardware aspects-Picture coding – Object recognition and CategorizationVisual inspection – software considerations – applications – commercial – Robotics vision systems.

COMPUTER CONSIDERATIONS FOR ROBOTIC SYSTEMS: Computer architecture for robots, hardware, Computational elements in robotic applications – Robot programming – sample programs path planning – Robot's computer system.

Module – 4

TRANSFORMATIONS AND KINEMATICS: Homogeneous Co-ordinates – Co-ordinate Reference Frames – Homogeneous Transformations for the manipulator – the forward and inverse problem of manipulator kinematics – Motion generation – Manipulator dynamics – Jacobian in terms of D.H.Matrices controller architecture.

Module – 5

ROBOT CELL DESIGN AND CONTROL: Specifications of Commercial Robots – Robot Design and Process specifications – motor selection in the design of a robotic joint – Robot Cell layouts – Economic and Social aspects of robotics.

APPLICATIONS OF ROBOTS: Capabilities of Robots – Robotics Applications – Obstacle avoidance – Robotics in India – The future of Robotics

TEXT BOOKS:

1. **Robotics Engineering An integrated approach** - Richard D Klafter, Thomas A Chmielewski, Michael Negin – Prentice Hall of India Pvt. Ltd. - Eastern Economy Edition, 1989.

2. **Robotics: Control Sensing, Vision, intelligence** - Fu KS Gomaler R C, Lee C S G - McGraw Hill Book Co. - 1987.

REFERENCE BOOKS:

1**. Handbook of Industrial Robotics** - Shuman Y. Nof - John Wiley & Sons, New York - 1985.
2. **Robotics Technology and Flexible Automation** - Deb SR - McGraw Hill BookCo. - 1994.

NON-TRADITIONAL MACHINING PROCESSES

Subject Code: 18MPE22 **CIE MARKS: 40**
Number of Lecture Hours/Week: 04 **SEE Marks : 60**
Total Number of Lecture Hours: 50 **Exam Hours: 03**

Module 1
Introduction: Need for non-traditional machining processes. Processes selection c1assification on – comparative study of different processes.

Mechanical Process: Ultrasonic Machining-Definition-Mechanism of metal elements of the process- Tool feed mechanism. Theories of mechanics of causing effect of parameter applications.

Module 2
Abrasive Jet Machining: Principles - parameters of the process applications-advantages and advantages.

Thermal Metal Removal Process: Electric discharge machining Principle of operation – mechanism of meta removal basic EDM circuitry-spark erosion Analysis of relaxation type of circuit material removal rate in relaxation circuits. Applications.

Module 3
Electro Chemical and Chemical Processes: Electro chemical machining (ECM) Classification ECM process-principle of ECM Chemistry of the ECM parameters of the processes-determination of the metal removal rate - dynamics of ECM process, Electro Chemical Grinding-Electro Chemical holding Electrochemical deburring.

Module 4
Plasma arc Machining: Introduction-Plasma-Generation of Plasma and equipment Mechanism of metals removal, PAN parameters-process characteristics - type of torches applications.
Electron Beam Machining (EBM): Introduction-Equipment for production of Electron beam - Theory of electron beam machining , applications.
Laser Beam Machining (LBM): Introduction-principle of generation of lasers Equipment and Machining procedure-Types of Lasers-Process characteristics-advantages and limitations-applications
Ion Beam Machining: Introduction-Mechanism of metal removal and associated equipment-process characteristics applications

Module 5
High Velocity Forming Process: introduction - development of specific process selection-comparison of conventional and high velocity forming methods - Types of high velocity forming methods- explosion forming process-elector hydraulics forming magnetic pulse forming.

REFERENCE BOOKS:

1. **New technology Institution of Engineers** - Bhattacharya - India
2. **Production Technology** - HMT - Tata McGraw Hill - ISBN-10; 0070964432
3. **Modern Machining Process** - P.C Pandy& H.S. Shan - Tata McGraw Hill - ISBN: 0070965536 - Publishing Date: Feb-80
4. **Metals Hand Book** - ASM - Vol-3.
5. **High Velocity Forming of Metals** - F.M Wilson - ASTMEPretice Hall.
6. **Modern Manufacturing Method** - Adithan- New Age International (p) Limited - ISBN**:** 8122408176, 2007.
7. **Modern Machining Processes** - P.K. Mishra - Narosa Publishing House, New Delhi - 1997.

TOOL ENGINEERING

Subject Code 18MPE23 **CIE MARKS : 40**
Number of Lecture Hours/Week :04 **SEE Marks : 60**
Total Number of Lecture Hours :50 **Exam Hours :03**

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MODULE- I

Cutting Tool Materials

Introduction and desirable properties ,Carbon and Medium-Alloy Steels ,High-Speed Steels ,Cast-Cobalt Alloys ,Carbides ,Coated Tools, Alumina-Based Ceramics ,Cubic Boron Nitride, Silicon-Nitride Based Ceramics ,Diamond ,Reinforced Tool Materials ,Cutting-Tool Reconditioning.

Design of Cutting Tools-Basic Requirements ,Mechanics and Geometry of Chip Formation , General Considerations for Metal Cutting ,Design of single point Cutting Tools , Design of Milling Cutters ,Design of Drills and Drilling , Design of Reamers, Design of Taps, Design of Inserts , Determining Shank Size for Single-point Carbide Tools,

MODULE- 2

Gauges and Gauge Design-Limits fits and tolerances, Geometrical tolerances-specification and measurement., Types of gauges ,Gauge design, gauge tolerances.

Work Holding Devices- Basic requirements of work holding devices, Location: Principles, methods and devices, Clamping : Principles, methods and devices

MODULE- 3

Drill Jigs -Definition and types of Drill Jigs ,Chip Formation in Drilling ,General Considerations in the Design of Drill Jigs, Drill Bushings ,Drill Jigs.

Design of Fixtures-Fixtures and Economics , Types of Fixtures , Milling Fixtures , Boring Fixtures , Broaching Fixtures , Lathe Fixtures.

MODULE- 4

Design of Press Tools-Introduction to press tools and related terminology, effect of clearances, theory of deformation, stages of cutting operation, center of pressure, strap strip layout , die and punch design, design of simple, compound and progressive dies, methods of mounting punches and dies, design of drawing dies, bend allowances, bending and forming dies..

MODULE- 5

Dies and moulds - Bending: Types,Parts and functions of bending die, Definition, calculations and factors affecting bend radii, bend allowance and spring back, Method to compute bending pressure, Types, sketch, working and applications of bending dies, Drawing dies-types and method to determine blank size for drawing operation, Types, sketch, working and applications of drawing dies (embossing, curling, bulging, coining, swaging and hole flanging).

Text Books

1.JOSHI P .H, "Jigs & Fixtures", New Delhi -Tata McGraw Hill Pub. Co. Ltd., 11th print 1999.
2.D. Eugene Ostergaard,"Basic die design", McGraw-Hill, 1963
3.P.C. Sharma, "A Text Book Of Production Engineering", S. Chand Publisher, 2010

Reference Books:

1. ASTME, "Fundamentals of Tool Design", Prentice Hall of India, 1983.
2. Donaldson, "Tool Design", Tata-McGraw Hill, 3rd Edition, 2000.
3. An Introduction to Jig & Tool Design -KEMPSTER M.H.A.- Bristol- ELBS 3rd Ed.1974.
4. Die Design Hand Book -SMITH A. DAVID.SME 3rd edition, 1990.

ADVANCED JOINING PROCESSES

Subject Code 18MPE241 **CIE MARKS : 40**
Number of Lecture Hours/Week :04 **SEE Marks : 60**
Total Number of Lecture Hours :50 **Exam Hours :03**

Module -1

Distortion-methods to avoid distortion, Stresses in joint design
Electro Slag .Welding Electron Beam Welding, Plasma arc Welding, Laser Beam Welding, Explosion Welding, Diffusion Welding, Ultrasonic Welding, Friction welding and Thermit welding.

Module – 2

Welding and cladding of dissimilar materials, overlaying and surfacing.
Advanced soldering and brazing processes -different types.Welding of plastics.

Module – 3

Inspection of Welds: Destructive techniques like Tensile, Bend, Nick break, Impact & Hardness. Non-Destructive techniques like 'X' rays, Ultrasonic, Magnetic particle, Dye Penetrant, Gamma ray inspection.
Welding Symbols- Need for, Representing the welds, Basic weld symbols, Location of Weld, Supplementary symbols, Dimensions of welds, Examples

Module – 4

Welding Design - Introduction, Principles of sound welding design, Welding joint design. Welding positions, Allowable strengths of welds, under steady loads.
Quality Control in Welding - Introduction, Quality assurance v/s Quality control, Weld quality, Discontinuities in welds, their causes and remedies and Quality conflicts.

Module – 5

Computer-Aided Welding Design - Introduction, welding analysis, Engineering design v/s welding design, perspectives in welding design, solution to the welding design problems.
Computer-Aided Welding Analysis: Computer-aided welding analysis, computer-aided welding design, use of interactive computer graphics, cautions and conclusions.

REFERENCE BOOKS:

1. Welding Engineering Handbook - A.W.S.
2. Welding Engineering - Rossi - McGraw Hill.
3. Advanced Welding processes - Nikodaco&Shansky - MIR Publications.
4. Welding Technology - O.P. Khanna
5. Welding for Engineers - Udin, Funk &Wulf

NON DESTRUCTIVE TESTING

Subject Code: 18MPE242	**CIE MARKS: 40**
Number of Lecture Hours/Week: 04	**SEE Marks : 60**
Total Number of Lecture Hours: 50	**Exam Hours: 03**

Module – 1

Introduction to ND Testing: Selection of ND methods, visual inspection, leak testing, Liquid penetration inspection, its advantages and limitation.

Module – 2

Magnetic Particle Inspection: Methods of generating magnetic field, types of magnetic particles and suspension liquids steps in inspection – application and limitations

Eddy Current Inspection: principles, operation variables, procedure, inspection coils, and detectable discounts by the method.

Module – 3

Ultrasonic inspection: Basic equipment characteristics of ultrasonic waves, variables inspection, inspection methods pulse echo A,B,C scans transmission, resonance techniques, transducer elements couplets, search units, contact types and immersion types inspection standards-standard reference blocks.

Module – 4

Radiography Inspection: principles, radiation source X-rays and gamma rays, X-ray-tube, radio graphic films, neutron radiography, Thermal inspection principles, equipment inspection methods applications.

Module – 5

Optical Holography: Basics of Holography, recording and reconstruction - Acoustical Holography: systems and techniques applications.Indian standards for NDT.

Microwave Inspection: Microwave holography, applications and limitations.

REFERENCE BOOKS:

1. **Non Destructive Testing** - Mc Gonnagle JJ – Garden and reach New York.
2. **Non Destructive Evolution and Quality Control -** volume 17 of metals hand book 9 edition Asia internal 1989.
3. **The Testing instruction of Engineering materials** - Davis H.E Troxel G.E wiskovil C.T - McGraw hill

SMART MATERIALS & STRUCTURES

Subject Code: 18MPE243 **CIE MARKS: 40**
Number of Lecture Hours/Week: 04 **SEE Marks : 60**
Total Number of Lecture Hours: 50 **Exam Hours: 03**

MODULE 1
Overview of Smart Materials, Structures and Products Technologies.

Smart Materials (Physical Properties) Piezoelectric Materials, Electrostrictive Materials, Magnetostrictive Materials, Magnetoelectric Materials. Magnetorheological Fluids, Electrorheological Fluids, Shape Memory Materials, Fiber-Optic Sensors.

MODULE 2
Smart Sensor, Actuator and Transducer Technologies:
Smart Sensors: Accelerometers; Force Sensors; Load Cells; Torque Sensors; Pressure Sensors; Microphones; Impact Hammers; MEMS Sensors; Sensor Arrays Smart Actuators: Displacement Actuators; Force Actuators; Power Actuators; Vibration Dampers;Shakers; Fluidic Pumps; MotorsSmart Transducers: Ultrasonic Transducers; Sonic Transducers.

MODULE 3
Measurement, Signal Processing, Drive and control Techniques
Quasi-Static and Dynamic Measurement Methods; Signal Conditioning Devices; Constant Voltage, Constant Current and Pulse Drive Methods; Calibration Methods; Structural Dynamics and Identification Techniques; Passive, Semi-Active and Active Control; Feedback and Feed forward Control Strategies.

MODULE 4
Design, Analysis, Manufacturing : Case studies incorporating design, analysis, manufacturing and application issues involved in integrating smart materials and devices with signal processing and control capabilities to engineering smart structures and products.

MODULE 5
Applications of Engineering Smart Structures and Products
Emphasis on structures, automation and precision manufacturing equipment, automotives, consumer products, sporting products, computer and telecommunications products, as well as medical and dental tools and equipment.

TEXT BOOKS:

1. **Smart Materials and Structures** - M. V. Gandhi and B. So Thompson - Chapman & Hall, London; New York - 1992 (ISBN: 0412370107).
2. **Smart Structures and Materials** - B. Cui shaw - Artech House, Boston, - 1996 (ISBN :0890066817).
3. **Smart Structures: Analysis and Design** - V. Srinivasan - Cambridge University Press, Cambridge; New York - 2001 (ISBN: 0521650267).
4. **Materials, Properties, Applications** Electroceramics - A. J. Moulson and J. M. Herbert, - John Wiley & Sons,Chichester, West Sussex; New York - 2nd Edition, 2003 (ISBN: 0471497479).
5. **Materials and Amplifiers** Sensories: Force, Strain, Pressure, Acceleration and Acoustic Emission Sensors - G. Gautschi, Piezoelectric - Springer, Berlin; New York – 2002 (ISBN: 3540422595).
6. **Piezoelectric Actuators and Ultrasonic Motors** - K. Uchino - Kluwer Academic Publishers, Boston - 1997 (ISBN: 0792398114).

REFERENCE BOOKS:

1. **Handbook of Giant Magnetostrictive Materials** - G. Engdahl - Academic Press, San Diego, Calif.; London - 2000 (ISBN: 012238640X).
2. **Shape Memory Materials** - K. Otsuka and C. M. Wayman - Cambridge University Press, Cambridge; New York - 1998(ISBN: 052144487X).
3. **Fiber Optic Sensors: An Introduction for Engineers and Scientists** - Eric Udd - John Wiley & Sons, New York - 1991 (ISBN:0471830070).
4. **Vibration Control of Active Structures: An Introduction** - Andre Preumont - Kluwer Academic Publishers, Dordrecht; Boston - 2nd Edition, 2002 (ISBN: 1402004966).

SUPPLY CHAIN MANAGEMENT

Subject Code: 18MPE251 **CIE MARKS: 40**
Number of Lecture Hours/Week: 04 **SEE Marks : 60**
Total Number of Lecture Hours: 50 **Exam Hours: 03**

Module-1

Building a Strategic Frame Work to Analyze Supply Chains: Supply chain stages and decision phases process view of a supply chain. Supply chain flows. Examples of supply chains, Competitive and supply chain strategies. Achieving strategic fit. Expanding strategic scope. Drivers of supply chain performance. Framework for structuring drivers – Inventory, Transportation, Facilities, Information. Obstacles to achieving fit.
Designing the Supply Chain Network: Distribution Networking – Role, Design. Supply Chain Network (SCN) – Role, Factors, Framework for Design Decisions.

Module-2

Facility Location and Network Design: Models for facility location and capacity allocation. Impact of uncertainty on SCN .
Planning and Managing Inventories in a Supply Chain: Review of inventory concepts. Trade promotions, managing multi-echelon cycle inventory, safety inventory determination. Impact of supply uncertainty aggregation and replenishment policies on safety inventory. Optimum level of product availability; importance factors. Managerial levers to improve supply chain profitability.

Module-3

Sourcing, Transportation and Pricing Products: Role of sourcing, supplier – scoring & assessment, selection and contracts. Design collaboration.
Sourcing, Transportation and Pricing Products: Role of transportation, Factors affecting transportation decisions. Modes of transportation and their performance characteristics. Designing transportation network. Trade - off in transportation design. Tailored transportation, Routing and scheduling in transportation. International transportation. Analytical problems. Role Revenue Management in the supply chain.

Module-4

Coordination and Technology in the Supply Chain: Co-ordination in a supply chain: Bullwhip effect. Obstacles to coordination. Managerial levers to achieve co-ordination, Building strategic partnerships.

Module-5

Coordination and Technology in the Supply Chain: The role of IT supply Chain, The Supply Chain IT framework, CRM, Internal SCM, SRM. The role of E-business in a supply chain, The E-business framework, E-business in practice.
Emerging Concepts: Reverse Logistics; Reasons, Activities, Role. RFID Systems; Components, applications, implementation. Lean supply chains, Implementation of Six

Sigma in Supply Chains.

Reference books:

1. **Supply Chain Management**– Strategy, Planning & Operation. Sunil Chopra & Peter Meindl; Pearson Education Asia, ISBN: 81-7808-272-1. – 2001
2. **Supply Chain Redesign** – Transforming Supply Chains into Integrated Value Systems -Robert B Handfield, Ernest L Nichols - Jr., 2002, Pearson Education Inc, ISBN: 81-297-0113-8
3. **Modeling the Supply Chain** -Jeremy F Shapiro, Duxbury -Thomson Learning - 2002, ISBN 0-534-37363.
4. **Designing & Managing the Supply Chain** -David Simchi Levi, Philip Kaminsky& Edith Simchi Levi - McGraw Hill.
5. **Going Backwards Reverse Logistics Trends and Practices** -Dr. Dale S. Rogers,Dr. Ronald S. Tibben-Lembke, University of Nevada, Reno, Center for Logistics Management.

AGILE MANUFACTURING

Subject Code: 18MPE252 **CIE MARKS: 40**
Number of Lecture Hours/Week: 04 **SEE Marks : 60**
Total Number of Lecture Hours: 50 **Exam Hours: 03**

Module 1

Introduction - What is agile Manufacturing? - Competitive environment of the future the business case for agile manufacturing conceptual frame work for agile manufacturing.

Module 2

Four Core Concepts: Strategy driven approach - integrating organization, people technology interdisciplinary design methodology.

Module 3

Agile Manufacturing and Change Management: The change implications. Post failures in advanced manufacturing, changes on the way, traditional managernent accounting, paradigm, investment appraisal, product costing - performance, measurement and control systems, Traditiosal organization, control technological and design paradigms traditional problems in workplace- organizational issues - role of technology.

Module 4

Agile Manufacturing Enterprise Design: Agile manufacturing - enterprise design.. system concepts as the basic manufacturing theory - joint technical & organizational design and a model for the design of agile manufacturing enterprise, enterprise design process insights into design processes, what is interdisciplinary design, Main issues - simple design example.

Module 5

Skill & Knowledge Enhancing Technologies for Agile Manufacturing: Skill and Knowledge enhancing Technologies - scheduling - technology design strategic-Design Concepts. Design and Skill of Knowledge enhancing Technologies for machine tool systems - Historical overview, Lessons, problems and Future development.

REFERENCE BOOKS:

1. **Agile manufacturing - Forging new Frontiers** - Paul T. Kidd - Addison Wesley Publication -1994.
2. **Agile Manufacturing – Proceedings of International Conference** - Dr. M.P Chowdiah (Editor) – TataMcGraw Hill Publications - 1996.
3. **On agile manufacturing** - Tata McGraw Hill Publications -1996
4. **Agile manufacturing - Forging Neat Furniture's** - Paul T Kidd – Addition Wesley Pub – 1994.
5. **World Class Manufacturing** - Paul T Kidd - Washington: National - 1994

TOTAL QUALITY MANAGEMENT

Subject Code: 18MPE253	**CIE MARKS: 40**
Number of Lecture Hours/Week: 04	**SEE Marks : 60**
Total Number of Lecture Hours: 50	**Exam Hours: 03**

Module- 1

PRINCIPLES AND PRACTICE: Definition of TQM , basic approach, Obstacles to TQM, TQM Framework, benefits of TQM

BUSINESS EVOLUTION: Customer Satisfaction, four fitness of Customer Satisfaction, Evolution of Customer Satisfaction Methodology, Leadership vs Empowerment, Four Practical Revolutions in Management thinking , Four Levels of Practice.

Module- 2

CUSTOMER FOCUS: Change in the Work Concept: Market-in, Philosophy-in and Philosophy-out, Evolution of Customer Focus and Its Challenges, Three Stages of Customer Focus, Customer Concerns, Integration of Concerns, Individualizing Customers

Module- 3

CONTINUOUS IMPROVEMENT: Management by process, WV Model of Continuous Improvement, Three types of improvements, Continuous Improvement of Processes for All Types of Work, Continuous Improvement verses breakthrough, Continuous Improvement and the Scientific Method.

Module- 4

MANAGING EXISTING PROCESSES: Process Discovery and Management: Thinking In Terms of Process, Process Discovery, steps of Process Discovery, benefits of Process Discovery, process control and process improvement, The 7 QC Tools.

PROACTIVE IMPROVEMENT: Proactive Improvement concept, Kawakita's Five Principles, Language Data and Use of Semantics, Comparison of Affective and Report language, Five principles of Customer Visitation, The purpose of Proactive Improvement to Develop New Products, Transforming voice of customer into customer requirements.

Module- 5

TOTAL PARTICIPATION: Employee Involvement – Motivation, employee surveys, empowerment, teams, suggestion system, recognition and reward, gain sharing, performance appraisal, unions and employee involvement, three sets of skills of leader ship ,Team work Skill , Some Fundamentals , Some Types of Teams .QC Circles.

INITITATION STRAGIES AND MOBILIZATION : CEO involvement and the importance of CEO, A General Model for Mobilization, Hoshin Management, Hoshin Management and Its Parts, Proactive , Reactive, and Control phases in Management

Text Books

1. "Four Practical Revolutions in Management: systems for creating unique organizational capability" -Shoji Shiba and David Walden,– Productivity Press & Center for Quality Management, (USA) , 2001, Special Indian Edition,ISBN-9781563273889/9781563272172/ 9781563272318
2. "Total Quality Management"- Besterfield, Pearson Education, 2011. ISBN, 817758412X, 9788177584127

Reference Books:

1. "Management for Total Quality" -N Logothetis- Prentice Hall of India, New Delhi, 2003, ISBN-81-203-1137-X
2. "Total Quality Management"-H D Ramachandra and K R Phanesh-2006 edition.

Laboratory Exercises

18 MPEL 26

- Study of pick and place Robot- basic components, configuration, and work volume.
- Experiments with Robot. Kit for minimum four assembly activities and programming.
- Programming of robots by manual, lead through and off line methods.
- Programming languages for stacking of objects in increasing or decreasing size. Palletizing operations, assembly and inspection operation etc.
- To become acquainted with the operation of a revolute-type 6 DOF robot. To program a robotic system using a teaching pendant and a high level programming language. Emphasis is made on the constraints associated when positioning and orienting an object within a 3-D space. The practical includes point-to-point tasks and continuous robot motion.

SEMESTER III

THEORY OF METAL FORMING

Subject Code: 18MPE31 **CIE MARKS: 40**
Number of Lecture Hours/Week: 04 **SEE Marks : 60**
Total Number of Lecture Hours: 50 **Exam Hours: 03**

MODULE 1
Introduction to Forming process: Introduction to metal forming, Effect of temperature on forming process-hot working, cold working. Effect of Metallurgical structure, Effect of speed of deformation work of Plastic deformation, Friction in forming operation

.**MODULE 2**
Forging: Classification, various stages during forging, Forging equipment, brief description, deformation in compression, forging defects. Residual stresses in forging.

MODULE 3
Rolling of Metals: Classification, forces and geometrical relationships in rolling.

Variables in Rolling: Deformation in rolling, Defects in rolled products, Residual stresses in rolled products. Torque and Horsepower.

MODULE 4
Extrusion: Classification, Extrusion equipment, variables in extrusion, Deformation in extrusion, Extrusion defects, Work done in extrusion.

Drawing: Principles of Rod and wire drawing, variables in wire drawing, Residual stresses in rod, wire and tube drawing, Defects in Rod and wire drawing.

MODULE 5
Sheet Metal Forming: Introduction, Forming methods, shearing and Blanking, Bending, stretch forming, Deep drawing, redrawing operations, Defects in formed products.

REFERENCE BOOKS:

1. **Mechanical MetalIurgy** - Dieter G.E. - Mc Graw Hill Publications.
2. **Principles of Metal Working -** R.Rowe - Amold London – 1965.
3. **Metals Handbook** – ASM - Volume II -.ASM
4. **Fundamentals of working of Metals -** Sach G. - Pergamon Press.

ADVANCED MATERIALS & PROCESSING

Subject Code: 18MPE321 **CIE MARKS: 40**
Number of Lecture Hours/Week: 04 **SEE Marks : 60**
Total Number of Lecture Hours: 50 **Exam Hours: 03**

MODULE 1
Classification and characteristics: Metals, Ceramics, Polymers and composites.

General properties and structure: Atoms, molecules bonds in solids, Crystalline - Defects in Metallic structure, Dislocations and plastic deformation - Strengthening mechanism - grain size, dislocation - Cold work, precipitation hardening, dispersion hardening - phase reactions, fatigue and Creep behavior.

MODULE 2
Ferrous Alloys: iron carbon equilibrium diagrams - Steels and cast irons - properties, structure, composition and applications transformation hardening in steels - TIT diagrams - Heat treatment processes - Effect of alloying elements - High alloy steels, Stainless steel types, tool Steels, Manganese steels, heat resistant steels, HSLA, Maraging steels.

MODULE 3
Non Ferrous alloys: AlIoys of copper, Aluminum, nickel, magnesium, titanium, lead, tin, Zinc - composition, heat treatment, structure, properties and application.

MODULE 4
Polymers and polymerizations: Structure and properties of thermoplastics and thermo sets – Engineering Applications - property modifications - Mechanical and thermal behavior – processing methods.

Ceramics : Nature and structure of Ceramics - Refractory Abrasives glasses - glass ceramics - Advanced ceramics processing methods.

MODULE 5
Composites : Definition - classification and characteristics of composite materials - Volume fraction - laminated composites particulate composites, fibrous composites - Types of reinforcements, their shape and size - production and properties of fiber reinforced plastics, Metal Matrix composites and ceramic matrix composites - Applications.

Processing of Polymers: composites, ceramics - thermal spraying - Ion beam machining diamond coating techniques-tribological Applications.

REFERENCE BOOKS:

1. **Engineering Metallurgy** - Raymond and Higgens - ELBS/EA
2. **Introduction to Material Science and Engineering** - James.F.Shackleford - Mc Millan, NY - 7th edition.
3. **Powder Metallurgy-Metals Hand Book** -ASM, USA - Vol.7, 1974.
4. **Composite Materials - Science and Engineering** - Chawla K.K. , Springer - Verlag, Newyork - 2nd edition, 1998.
5. **Cast Metal Matrix Composites** ASM Metals Hand Book - P.K. Rohagti - VI5.
6. **Elements of Material science and Engineering** - Van Vlack L.H. - Addison Wesley, NY - 1989.

SIMULATION MODELLING OF MANUFACTURING SYSTEMS

Subject Code: 18MPE322 **CIE MARKS: 40**
Number of Lecture Hours/Week: 04 **SEE Marks : 60**
Total Number of Lecture Hours: 50 **Exam Hours: 03**

Module-1

Principle of Computer Modelling and Simulation: Monte Carlo simulation. Nature of computer- modeling and simulation. Limitations of simulation, areas of applications.**System and Environment:** Components of a system -discrete and continuous systems, Models of a system -a variety of modeling approaches. **Simulation Software:** Selection of simulation software, simulation packages.

Module-2

Discrete Event Simulation: Concepts in discrete event simulation, manual simulation using event scheduling, single channel queue, too server queue, simulation of inventory problem.

Statistical Models in Simulation: Discrete distributions, continuous distributions.

Module-3

Random Number Generation: Techniques for generating random numbers- Mid square method -the mod product method -Constant multiplier technique -Additive congruential method -Linear congruential method -Tests for random numbers -The Kolmogorov-Smimov test -the Chi-square test.*** IvicaCmkovic, Ulfaskluna and AnnitaborsenDohlgvist Publisher Artechhouse.

Module-4

Random Variable Generation: Inversion transforms technique-exponential distribution. uniform distribution, weibul distribution, continuous distribution, generating approximate normal variates-Erlang distribution.

Module-5

Empirical Discrete Distribution: Discrete uniform -distribution poisson distribution -geometric distribution -acceptance -rejection technique for Poisson distribution gamma distribution.

Design and Evalution of Simulation Experiments: variance reduction techniques - antithetic variables, variables-verification and validation of simulation models.

TEXT BOOKS:

1. **Discrete Event System Simulation** - Jerry Banks & .John S Carson II - Prentice Hall Inc.-1984.
2. **Systems Simulation** - Gordan. G. - Prentice Hall India Ltd - 1991.

REFERENCE BOOKS:

1. **System Simulation with Digital Computer** - NusingDeo - Prentice Hall of India - 1979.
2. **Computer Simulation and Modeling** - Francis Neelamkovil - John Wilely& Sons - 1987.
3. **Simulation Modeling with Pascal** - RathM.Davis& Robert M O Keefe - Prentice Hall Inc. - 1989.

COMPOSITE MATERIALS

Subject Code: 18MPE323 **CIE MARKS: 40**
Number of Lecture Hours/Week: 04 **SEE Marks : 60**
Total Number of Lecture Hours: 50 **Exam Hours: 03**

MODULE 1
Introduction to Composite Materials: Definition, Classification, Types of matrices & reinforcements, characteristics & selection, Fiber composites, laminated composites, particulate composites, prepegs, sandwich construction.

MODULE 2
Micro Mechanical Analysis of a Lamina: Introduction, Evaluation of the four elastic moduli – Rule of mixture, Macro mechanics of a lamina: Hooke's law for different types of materials, number of elastic constants, Laminate code, Failure criterion.

MODULE 3
Manufacturing: Lay Up and Curing – open and closed mould processing – Hand lay up techniques Bag moulding and filament winding. Pultrusion, Pulforming, Thermoforming, Injection moulding, Cutting, Machining and joining, tooling, Quality assurance Introduction, material qualification, types of defects, NDT methods.

MODULE 4
Fabrication of Composites: Cutting, machining, drilling, mechanical fasteners & addesive bonding joining computer aided design manufacturing tooling fabrication equipment

Design of Fibre Reinforced Composite Structures: Introduction, Composite structural design, Design criteria, Laminate design, Mathematical analysis of the laminate, Design of composite stiffeners.

MODULE 5
Application Developments – Aircrafts, missiles, space hardware, automobile, electrical and electronics, marine, recreational and sports equipment-future potential of composites.

Metal Matrix Composites: Re-inforcement materials, types, Characteristics & Selection, base metals-selection, applications. Powder metullury technique, liquid metallurgy technique

TEXT BOOKS:

1. **Composite Materials Handbook** - Mein Schwartz - Mc Graw Hill Book Company - 1984.
2. **Mechanics of Composite Materials** - Autar K.Kaw - CRC Press New York - 1st edi, 1997.

NANO TECHNOLOGY

Subject Code: 18MPE331 **CIE MARKS: 40**
Number of Lecture Hours/Week: 04 **SEE Marks : 60**
Total Number of Lecture Hours: 50 **Exam Hours: 03**

MODULE- 1

Metal Based Nanocomposites - Metal-Oxide or Metal-Ceramic composites, Different aspects of their preparation techniques and their final properties and functionality. Metal-metal nanocomposites, some simple preparation techniques and their new electrical and magnetic properties.

MODULE- 2

Design Of Super Hard Materials- Super hard nano composites, its designing and improvements of mechanical properties.

MODULE- 3

Mechanics Of Polymer Nanocomposites- Interfacial adhesion and characterization, factors influencing the performance of nano composites, physical and functional properties.

MODULE- 4

Polymer-Carbon Nanotubes Based Composites- Processing methods and characterization using SEM, XRD, TEM.

MODULE- 5

Characterization Of Polymer Nanotubes Based Composites -Mechanical, Electrical and Thermal Properties and their applications - Polymer / nanofillers (metallic nanopowders) systems, Rheological measurements, processing characteristics
TESTING OF NANOCOMPOSITES- Thermal analysis such as TGA, TMA, DSC, DMTA Biggest Obstacle to Business Breakthrough, Integration of Ideas.

Text Books:

1. Edward L. Wolf, "Nanophysics and Nanotechnology -An Introduction to Modern Concepts in Nano science" Second Edition, John Wiley & Sons, 2006.
2. K.W. Kolasinski, ―Surface Science: Foundations of Catalysis and Nano science‖, Wiley, 2002.
3. G.A Ozin and A.C. Arsenault ―Nano chemistry: A chemical approach to nanomaterials‖, Royal Society of Chemistry, 2005.
4. Nanostructures and Nanomaterials synthesis, properties and applications, G. Cao, Imperaialcollege press 2004.

Reference Books

1. Vladimir P. Torchilin (2006) Nanoparticulates as Drug Carriers, Imperial College Press.
2. M Reza Mozafari (2007) Nanomaterials and Nano systems for Biomedical Applications, Springer.
3. Nanotechnology–Basic Science & Emerging Technologies, Chapman & Hall/CRC 2002

4. Nanomaterials /Nanotechnologies and Design: An introduction for engineers and architects, Michele F. Ashby, P.J. Ferreria, D.L.Schodek.

APPLIED PROBABILITY AND STATISTICS

Subject Code: 18MPE332 **CIE MARKS: 40**
Number of Lecture Hours/Week: 04 **SEE Marks : 60**
Total Number of Lecture Hours: 50 **Exam Hours: 03**

MODULE 1
Introduction to statistics: Statistical Thinking, Collecting data, Statistical Modeling Frame work, measure of central tendency and variance, Importance of Data summary and Display, Tabular and Graphical display.

MODULE 2
Discrete Random Variables and Probability distribution: Discrete Random variables, Probability distributions and Probability mass functions, Cumulative distribution functions, Mean and Variance of a discrete random variable, discrete uniform distribution, Binominal distribution, Hyper Geometric distribution, Poisson distribution, Applications.

MODULE 3
Continuous Random Variables and Probability Distributions: Continuous random variables, Probability distributions and probability density functions, cumulative distribution functions, Mean and Variance of a continuous random variable, uniform distribution, Normal distribution, Normal approximation to Binominal and Poisson distribution, Exponential distribution.

MODULE 4
Testing of Hypothesis: Estimation theory, Hypothesis testing, Inference on the mean of a population (variance known and unknown), Inference on the variance of a normal population, Inference on a population proportion, Testing for Goodness of Fit, Inference for a difference in Means, Variances known, Inference for a difference in means of two normal distributions, Variances unknown, Inference on the Variances of two normal populations, Inference on two population proportions.

MODULE 5
Simple Linear Regressions and Correlation: Simple Linear Regression, Properties of Least square Estimators and Estimation of variances, Transformations to a straight line, Correlation.

Multiple linear regressions : Multiple linear regressions model, least square estimation of parameters, Matrix approach to multiple linear regression, properties of least square estimators and estimation of variance.

TEXT BOOKS:

1. Applied statistics and Probability for Engineers – Douglas C Montgomery, George C Runger, 2nd Edn, John Wiley and Sons, ISBN-0-471-17027-5, 1999.
2. Statistics for Management, Richard I Levin, David S Rubin, 6th Edn, Prentice Hall India, ISBN-81-203-0893-X.

REFERENCES:

1. **Probability and Statistics in Engineering -** William W Hines, Douglas C Montgomery - John Wiley and Sons - 2nd Edn,.
2. **Business Statistics for Management and Economics** - Daniel, Terrell - Houghton Mifflin Company - 6th Edn, ISBN-0-395-62835-0.
3. **Probability and Statistics** - by Walpole & Mayer - MacMillan Publishing Company - 1989.

QUALITY AND RELIABILITY ENGINEERING

Subject Code: 18MPE333 **CIE MARKS: 40**
Number of Lecture Hours/Week: 04 **SEE Marks : 60**
Total Number of Lecture Hours: 50 **Exam Hours: 03**

MODULE- 1
Basic Concepts: Definitions of quality and Reliability, Parameters and Characteristics, Quality control, statistical Quality Control, Reliability concepts.
Concepts in Probability and Statistics : Events, Sample Space, Probability rules, Conditional probability,Dependent and Independent Events, Application of Probability concepts in Quality Control, Problems

MODULE- 2
Statistical Aspects and Probability Distributions : Statistical Tools in Quality Control, The concept of Variation,Graphical Tools for data representation and analysis, Discrete and Continuous Distributions, Normal, Poisson,Binomial, Weibull Distribution, Problems
CONTROL CHARTS: Variable charts X chart, R chart, s chart, Attribute charts, P chart, NP chart, C chart.

MODULE- 3
Failure Data Analysis : Introduction, Failure Data, Quantitative measures, MTTF, MTBF, Bathtub Curve, MeanLife, Life Testing, Problems, Introduction to Failure Mode and Effect Analysis.
Acceptance Sampling: Fundamentals of acceptance sampling, types of acceptance sampling, O.C Curve, AQL,LTPD, AOQL.

MODULE- 4
System Reliability:Series, parallel and mixed configuration, Block diagram concept, r- out-of-n structure solvingproblems using mathematical models.
Maintainability and Availability: Introduction, Formulas, Techniques available to improve maintainability andavailability trade-off among reliability, maintainability and availability, Simple problems

MODULE- 5
Reliability Improvement and Allocation:Difficulty in achieving reliability, Methods for improving reliabilityduring design, Different techniques available to improve reliability, redundancy and improvement factors evaluation.

Text Books:
1.The Assurances Sciences - Halpern, Seigmund - Prentice Hall International, New Jersey, U.S.A - 1978.
2.Quality Planning and Analysis - Juran, J.M and Gryna, F.M. - Tata McGraw Hill publishing Coimpany Ltd.,New Delhi, India – 1982.
3.Logistics Engineering and Management - Blanchard, Bejamin S. - Prentice Hall International, New Jersey,U.S.A – 1986.

4.Maintainability and Reliability Handbook of Reliability Engineering and Management - Kraus, John WEditors – Ireson. W.G. and Cooms, C.F. - McGraw Hill Book Company Inc. U.S.A – 1988.
5.Concepts in Reliability Engineering - Srinathm K.S. - Affiliated East-West Press Private Limited, NewDelhi, India -1985.