VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI.

Scheme of Teaching and Examinations and Syllabus

M.Tech Production Engineering (MPE)

(Effective from Academic year 2020 - 21)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations – 2020 - 21
M.Tech Production Engineering (MPE)
Choice Based Credit System (CBCS) and Outcome Based Education(OBE)

I SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Examination				Credits
				Theory	Practical	Skill Development Activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	20MPE11	**MATHEMATICAL METHODS IN ENGG**	03	--	02	03	40	60	100	4
2	PCC	20MPE12	Theory of Metal Cutting	03	--	02	03	40	60	100	4
3	PCC	20MPE13	Advanced Foundry Technology	03	--	02	03	40	60	100	4
4	PCC	20MPE14	Surface Treatment & Finishing	03	--	02	03	40	60	100	4
5	PCC	20MPE15	Computer Integrated Manufacturing & Automation	03	--	02	03	40	60	100	4
6	PCC	20MPEL16	Laboratory - I	--	04	--	03	40	60	100	2
7	PCC	20RMI17	Research Methodology and IPR	01	--	02	03	40	60	100	2
			TOTAL	**17**	**04**	**12**	**21**	**280**	**420**	**700**	**24**

Note: PCC: Professional core.

Skill development activities:
Students and course instructor/s to involve either individually or in groups to interact together to enhance the learning and application skills.
The students should interact with industry (small, medium and large), understand their problems or foresee what can be undertaken for study in the form of research/ testing / projects, and for creative and innovative methods to solve the identified problem.
The students shall
(1) Gain confidence in modelling of systems and algorithms.
(2) Work on different software/s (tools) to Simulate, analyse and authenticate the output to interpret and conclude. Operate the simulated system under changed parameter conditions to study the system with respect to thermal study, transient and steady state operations, etc.
(3) Handle advanced instruments to enhance technical talent.
(4) Involve in case studies and field visits/ field work.
(5) Accustom with the use of standards/codes etc., to narrow the gap between academia and industry.
All activities should enhance student's abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise, etc.

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 internship credit shall be counted for 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 fail in internship course and have to complete the same during the subsequent University examination after satisfying the internship requirements.

Note: (i) Four credit courses are designed for 50 hours Teaching – Learning process.
(ii) Three credit courses are designed for 40 hours Teaching – Learning process.
(iii) Two credit courses are designed for 25 hours Teaching – Learning process.

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II SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits
				Theory	Practical/ Seminar	Skill Development Activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	20MPE21	Industrial Robotics	03	--	02	03	40	60	100	4
2	PCC	20MPE22	Non Traditional Machining Processes	03	--	02	03	40	60	100	4
3	PCC	20MPE23	Tool Engineering	03	--	02	03	40	60	100	4
4	PEC	20MPE24X	Professional elective 1	04	--	--	03	40	60	100	4
5	PEC	20MPE25X	Professional elective 2	04	--	--	03	40	60	100	4
6	PCC	20MPEL26	Laboratory – II	--	04	--	03	40	60	100	2
7	PCC	20MPE27	Technical Seminar	--	02	--	--	100	--	100	2
TOTAL				**17**	**06**	**06**	**18**	**340**	**360**	**700**	**24**

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

Professional Elective 1		**Professional Elective 2**	
Course Code under 20MPE24X	**Course title**	**Course Code under 20MPE25X**	**Course title**
20MPE241	Advanced Joining Processes	20MPE251	Supply chain management
20MPE242	Non-Destructive Testing	20MPE252	Agile Manufacturing
20MPE243	Smart Materials & Structures	20MPE253	Total Quality Management
20MPE244	Project Management	20MPE254	Human Resources 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 programme shall be mandatory.

The CIE marks awarded for Technical Seminar, shall be based on the evaluation of Seminar Report, Presentation skill and performance in 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 internship 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 fail in internship course and have to complete the same 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/ Mini–Project/ Internship	Skill Development activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	20MPE31	Theory of Metal Forming	03	--	02	03	40	60	100	4
2	PEC	20MPE32X	Professional elective 3	03	--	--	03	40	60	100	3
3	PEC	20MPE33X	Professional elective 4	03	--	--	03	40	60	100	3
4	Project	20MPE34	Project Work phase -1	--	02	--	--	100	--	100	2
5	PCC	20MPE35	Mini-Project	--	02	--	--	100	--	100	2
6	Internship	20MPEI36	Internship	(Completed during the intervening vacation of I and II semesters and /or II and III semesters.)			03	40	60	100	6
TOTAL				**09**	**04**	**02**	**12**	**360**	**240**	**600**	**20**

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

Professional elective 3		**Professional elective 4**	
Course Code under	**Course title**	**Course Code under**	**Course title**
20MPE321	Advanced Materials & Processing	20MPE331	Nano Technology
20MPE322	Simulation &Modelling of Manufacturing Systems	20MPE332	Applied Probability & Statistics
20MPE323	Composite Materials	20MPE333	Quality & Reliability Engineering
20MPE324	Product Data Management	20MPE334	Organizational Behaviour

Note:

1. Project Work 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 performance in 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 fail in internship course and have to complete the same 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	Duration in hours	CIE Marks	SEE Marks Viva voce	Total Marks	
				L	P					
1	Project	20MPE41	Project work phase -2	--	04	03	40	60	100	20
			TOTAL	--	**04**	**03**	**40**	**60**	**100**	**20**

Note:

1. Project Work 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 performance in 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.

MATHEMATICAL METHODS IN ENGG. (common to MPT, MPE, MPD, MEM, MPM, MPY, & MSE)			
Course Code	**20MPE11**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Errors and Simple Mathematical modeling: Error definition, round off errors and truncation errors. Mathematical modeling and Engineering problem solving: Simple mathematical model, Conservation Laws of Engineering.

Engineering Applications on :

i) Deflection of Beams
ii) Whirling of shafts
iii) Terminal velocity of a freely falling body

(RBT Levels: L1 & L2) (Text Book:1) **10Hrs**

Module-2

System of Linear Algebraic Equations And Eigen Value Problems: Gauss-Jordan Method, Cholesky Method, Partition method, Givens method for symmetric matrices, (RBT Levels: L1 & L2) (Text Book:3) **10Hrs**

Module-3

Roots of Equations: Muller's method , Graeffe's roots squaring method.

Numerical solutions of ordinary differential equations: Introduction, Picard`s method of successive approximation, first order simultaneous equations by Picard`s & Runge Kutta methods. & second order equations by Picard`s & Runge Kutta methods. (RBT Levels: L2 & L3) (Text Book:3) **10Hrs**

Module-4

Partial Differential Equations: Numerical solution of one dimensional wave equation, Heat equation,(Schmidt`s explicit formula)& Laplace equation(Gauss-Seidel process) by finite difference schemes. Illustrative examples on each method, (RBT Levels: L2 & L3) (Text Book:2). **10Hrs**

Module-5

Sampling theory: Testing of hypothesis: Chi square test and F-test. Analysis of Variance (ANOVA): one way classification, Design of experiments, RBD.

(RBT Levels: L2 & L3) (Ref. Book:1). **10Hrs**

Course Outcomes:

On completion of this course, students are able to:

1. Acquire the idea of significant figures, types of errors during numerical computation.
2. Understand statistical and probabilistic concepts required to test the hypothesis and designing the experiments using RBD.
3. Learn various numerical methods to solve system of linear equations.
4. Understand the roots of algebraic/transcendental equations and solve PDE's numerically.
5. Analyze and solve PDE's related to wave equation arising in vibration analysis.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks

1. Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers," 7th Ed., cGraw-Hill Edition, 2015

2. Theory of ordinary differential equations, Coddington E., Levinson N., McGraw-Hill publishing Company, TMH Edition, 9th Reprint, 1987..

3. M K Jain, S.R.K Iyengar, R K. Jain, Numerical methods for Scientific and engg computation, New Age International, 2003.

Reference books:

1.R.E, Walpole, R.H.Myres, S.L.Myres and Keying Ye, "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson, 2012

2.Dr. B.S. Grewal, "Numerical Methods in Engineering and Science", Khanna Publishers, 1999.

3.K Shankar Rao, "Introduction to Partial Differential Equations" Prentice - Hall of India Pvt. Lt. , 1995 Edition

4. C. Ray Wylie and Louis C Barrett, "Advanced Engineering Mathematics". 6th edition, McGraw-Hill, 1995.

THEORY OF METAL CUTTING

	20MPE12	CIE Marks	40
Course Code	3:0:2	SEE Marks	60
Teaching Hours/Week (L:P:SDA)	04	Exam Hours	03
Credits			

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, coefficient 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. **10 Hrs**

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.

10 Hrs

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.

10 Hrs

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.

10 Hrs

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.

10 Hrs

Course outcomes:

At the end of the course the student will be able to:

1. Understand and analyze the fundamentals of different cutting tool and materials.
2. Understand and analyze Mechanics of metal cutting.
3. Understand and analyze cutting force and its measurements using dynamometers and temperature distrubution during metal cutting.
4. Understand and analyze tool wear and tool life- mechanisms and effects.
5. Understand and analyze the Thermal Aspects and selection of cutting fluids and Optimum cutting speed and cost. techniques.

Question paper pattern:

Textbooks

(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.

ADVANCED FOUNDRY TECHNOLOGY			
Course Code	**20MPE13**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	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.

10 Hrs

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.

10 Hrs

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.

10 Hrs

Module-4

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

10 Hrs

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. **10 Hrs**
Course outcomes: At the end of the course the student will be able to: 1. Understand the Solidification process, Gates and Risers types and design 2. Design simple casting design and learn casting defects 3. Understand constructional features and working of different foundry furnaces 4. Understand Ferrous and Aluminum metals and alloys 5. Understand Foundry Mechanization and Modernization
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■
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			
Course Code	20MPE14	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

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

10 Hrs

Module-2

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

10 Hrs

Module-3

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

10 Hrs

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, nano coatings, coating characterization.

10 Hrs

Course outcomes:

At the end of the course the student will be able to:

1. To understand the principles of operations, tests to evaluate mechanical and tribological properties.
2. To understand the principles of failure analysis and examination of failed components.
3. To understand the strain rate testing, test machine requirements and specimens measurements.
4. To understand and describe the different types of coating and working principles.
5. To learn and understand different heat treatment processes and their effect on finishing

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.■

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.

COMPUTER INTEGRATED MANUFACTURING & AUTOMATION			
Course Code	20MPE15	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

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.

10 Hrs

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.

10 Hrs

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.

10 Hrs

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.

10 Hrs

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.

10 Hrs

Course outcomes:

At the end of the course the student will be able to:

1. Understand the effect of manufacturing automation strategies.
2. Analyze computer aided quality control methods and techniques.
3. Analyse CIM planning system and computer network for manufacturing.
4. Understand and analyse the flow lines and transfer mechanisms.
5. Understand and analyse Automated material Handling Storage system.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ■

Textbooks

(1) Mikell P. Groover, Automation, Production system & Computer IntegratedManufacturing, Prentice Hall India Learning Private Limited,3rdEdition, 2008.

(2) Kant Vajpayee. S., Principles of Computer Integrated Manufacturing, Prentice Hallof India, 1999.

Reference Books

(1) James A. Rehg& Henry W Kraebber, Computer Integrated Manufacturing, PearsonPrentice 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 AgeInternational Publishers, 2008.

LABORATORY - I			
Course Code	20MPEL16	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	0:4:0	SEE Marks	60
Credits	02	Exam Hours	03

Sl. NO	**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.

Question paper pattern:

The SEE questions will be set for **100** marks:

1. Two experiments for **80** marks.
2. Viva voce for **20** marks.

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.

RESEARCH METHODOLOGY AND IPR			
Course Code	20RMI17	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	1:0:2	SEE Marks	60
Credits	02	Exam Hours	03

Module-1

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.

Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration. **05Hrs**

Module-2

Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. **05Hrs**

Module-3

Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.

Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale.

Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method. **05Hrs**

Module-4
Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. **Chi-square Test:** Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests. **05Hrs**
Module-5
Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports. **Intellectual Property:** The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,The Protection of Plant Varieties and Farmers' Rights Act, 2001,The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO. **05Hrs**
Course outcomes: At the end of the course the student will be able to: • Discuss research methodology and the technique of defining a research problem • Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review. • Explain various research designs, sampling designs, measurement and scaling techniques and also different methods of data collections. • Explain several parametric tests of hypotheses, Chi-square test, art of interpretation and writing research reports • Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR.

Question paper pattern: • The question paper will have ten questions. • Each full question is for 20 marks. • There will be 2full questions (with a maximum of four sub questions in one full question) from each module. • Each full question with sub questions will cover the contents under a module. • Students will have to answer 5 full questions, selecting one full question from each module. ■
Textbooks
(1) Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg,New Age International,4th Edition, 2018.
(2) Research Methodology a step-by-step guide for beginners. (For the topic Reviewing the literature under module 2), RanjitKumar,SAGE Publications,3rd Edition, 2011.
(3) Study Material (For the topic Intellectual Property under module 5), Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013.
Reference Books
(1) Research Methods: the concise knowledge base, Trochim, Atomic Dog Publishing, 2005.
(2) Conducting Research Literature Reviews: From the Internet to Paper, Fink A, Sage Publications, 2009.

*** END OF I SEMESTER ***

INDUSTRIAL ROBOTICS			
Course Code	20MPE21	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	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.

10 Hrs

Module-2

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

10 Hrs

Module-3

COMPUTER VISION FOR ROBOTICS SYSTEMS: Robot vision systems – Imaging components – Image representation – Hardware aspects-Picture coding – Object recognition and Categorization Visual 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.

10 Hrs

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.

10 Hrs

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.

10 Hrs

Course outcomes:

At the end of the course the student will be able to:

1. Upon completion of this course, the students can able to apply the basic engineering.
2. To learn about knowledge for the design of robotics.
3. Will understand robot kinematics and robot programming.
4. Will understand application of Robots.
5. To learn about force and torque sensing.
6. To learn about application of robot.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks

(1) **Robotics Engineering An integrated approach** - Richard D Klafter, Thomas AChmielewski, 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			
Course Code	**20MPE22**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	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.

10 Hrs

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.

10 Hrs

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.

10 Hrs

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.

10 Hrs

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.**10 Hrs**

Course outcomes:

At the end of the course the student will be able to:

1. Compare conventional and non-conventional manufacturing process and understand the mechanism of USM and AJM.
2. Understand EDM concept and operating characteristic.
3. Distinguish ECM with other operations and various application and understand the usage of various chemical and maskants in CHM.
4. Understand the generation of plasma, electron beam, laser and their machining characteristics.
5. Understand the formation of ion beam and this application and various high velocity forming process.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

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

TOOL ENGINEERING			
Course Code	20MPE23	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

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.

10 Hrs

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.

10 Hrs

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.

10 Hrs

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.

10 Hrs

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).

10 Hrs

Course outcomes:
At the end of the course the student will be able to:
1. Understand the tool design concept and design the single point cutting tool.
2. Design the mill cutters, broach and clamping devices.
3. Understand the application of jigs and fixtures, gauges and design them.
4. Understand the concept of press tools and its dies.
5. Design forming dies and understand the classification and application of automats.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks

(1) 1.JOSHI P .H, "Jigs & Fixtures", New Delhi -Tata McGraw Hill Pub. Co. Ltd., 11th
print 1999.

(2) 2.D. Eugene Ostergaard,"Basic die design", McGraw-Hill, 1963

Reference Books

(1)1. ASTME, "Fundamentals of Tool Design", Prentice Hall of India, 1983.

(2) 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.

ADVANCED JOINING PROCESSES			
Course Code	20MPE241	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	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.

10 Hrs

Module-2

Welding and cladding of dissimilar materials, overlaying and surfacing.

Advanced soldering and brazing processes - different types. Welding of plastics.

10 Hrs

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.

10 Hrs

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.

10 Hrs

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.

10 Hrs

Course outcomes:

At the end of the course the student will be able to:

1. Introduce the various advanced welding techniques which make them interested to choose a career in the field of welding.
2. Understand the advanced welding practices in Industries and their comparative merits and demerits.
3. Select the right kind of welding techniques for joining raw materials of various thicknesses.
4. Select appropriate welding technique suitable for joining various types of metals.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Reference Books

(1) Welding Engineering Handbook - A.W.S.

(2) Welding Engineering - Rossi - McGraw Hill.

(3)Advanced Welding processes - Nikodaco&Shansky - MIR Publications.

NON DESTRUCTIVE TESTING			
Course Code	20MPE242	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

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

10 Hrs

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.

10 Hrs

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.

10 Hrs

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.

10 Hrs

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.

10 Hrs

Course outcomes:

At the end of the course the student will be able to:

1. Distinguish the destructive and non-destructive testing and find effectiveness.
2. Find the surface defect using liquid penetrant and magnetic particle test and eddy current test.
3. Learn the mechanism of flaw detection using ultrasonic wave system.
4. Understand the operations of microwave and radiography inspection system.
5. Understand the basics of holography and interferometry and its application in defect detection.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

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 9edition Asia internal 1989.

(3) **The Testing instruction of Engineering materials** - Davis H.E Troxel G.E wiskovilC.T - McGraw hill

SMART MATERIALS & STRUCTURES			
Course Code	20MPE243	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	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.

10 Hrs

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.

10 Hrs

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.

10 Hrs

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.

10 Hrs

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.

10 Hrs

Course outcomes:
At the end of the course the student will be able to:

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks

(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 (ISBN0890066817).
Reference Books
(1) **Handbook of Giant Magnetostrictive Materials** - G. Engdahl - Academic Press, SanDiego, Calif.; London - 2000 (ISBN: 012238640X).
(2) **Shape Memory Materials** - K. Otsuka and C. M. Wayman - Cambridge UniversityPress, Cambridge; New York - 1998(ISBN: 052144487X).
(3) **Fiber Optic Sensors: An Introduction for Engineers and Scientists** - Eric Udd – JohnWiley & Sons, New York - 1991 (ISBN:0471830070).

PROJECT MANAGEMENT			
Course Code	20MPE244	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction: Identification of Investment Opportunities, Market and Demand Analysis – Technical Analysis -Investment Outlay. **. 10Hrs**

Module-2

Means of Financing- Profitability and Breakeven Analysis -Cash Flows of Projects -Tax factor in investment Analysis -Interest Compounding and Discounting. **10Hrs**

Module-3

Appraisal Criteria and Selection of Investment-cost of capital analysis of Risk -Financial Projection, social Cost Benefit Analysis. **. 10Hrs**

Module-4

Manpower Management in Projects- Functional Approach to Manpower Management, - the Element of decision Process Project Team Concepts - Field Autonomy- Policies Governing Projects. . . **10Hrs**

Module-5

Networks Techniques in Project Management-PERT/CPM Analysis - Administrative aspects of Capital Investment. . **10Hrs**

Course outcomes:

At the end of the course the student will be able to:

1. Understand the relation between investment opportunities, market, and demand analyses.
2. Analyse the project cash flow, interest and tax factor.
3. Understand the cost capital analysis of risk, financial project, social cost and benefit analysis.
4. Understand the man power management and project team concept.
5. Optimise the project management by PERT and CPM.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Reference Books

1. Projects - appraisal, preparation, budgeting and implementation – Prasannachandra - Tata MCgraw hill

2. Handbook of Project Management - Dennis lock.

3. Project Management - Dennis lock - Gower Publishing Ltd - 8th Revised edition.

SUPPLY CHAIN MANAGEMENT			
Course Code	20MPE251	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	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.

10Hrs

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.

10Hrs

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.

10Hrs

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.**10Hrs**

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.

10Hrs

Course outcomes:

At the end of the course the student will be able to:

1. To understand issues & challenges in implementing & developing lean manufacturing techniques from TPS & its contribution for improving organizational performance.
2. Apply lean techniques to bring competitive business culture for improving organization performance .
3. Analyze how lean techniques can be applied to manufacturing & service industry
4. Developing lean management strategy for Supply chain management.
5. Analyzing how lean technique can create value generation for organization

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

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.

AGILE MANUFACTURING			
Course Code	20MPE252	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	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.

10Hrs

Module-2

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

10Hrs

Module-3

Agile Manufacturing and Change Management: The change implications. Post failures in advanced manufacturing, changes on the way, traditional managenent 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.

10Hrs

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.**10Hrs**

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.

. 10Hrs

Course outcomes:

At the end of the course the student will be able to:

1. Learn the concepts of Lean, Flexibility, and Agility as applied in automotive manufacturing and supply chain management ·
2. Learn Strategies/Methodologies relating to such topics as Production Planning and Control, Factory Dynamics ·
3. Learn Best Business Practices in automotive manufacturing and supply chain management ·
4. Acquire the ability to apply tools like Production Line Diagnostics and Value Stream Mapping

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ■

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

TOTAL QUALITY MANAGEMENT			
Course Code	**20MPE253**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	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.

10Hrs

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.

10Hrs

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.

10Hrs

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.**10Hrs**

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.**10Hrs**

Course outcomes:

At the end of the course the student will be able to:

1. Learn the principles and practices of TQM.
2. Know the evolution and challenges made in industries by TQM.
3. Understand the models to solve the problems and improving the circumstances.
4. Learn the quality tools implemented in industries and its performances
5. Know the involvement of employees and the changes by management.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting

Textbook/ Textbooks

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

HUMAN RESOURCES MANAGEMENT			
Course Code	20MPE254	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

HRM in perspective, competitive challenges, uses of HR information, Demographics and employee concerns, social issues, diversity in. HRM,

Relationship of Job Requirements and HRM functions, Job Analysis, Job Description, Job Design, Designing work for groups, flexible work schedules, Industrial engineering and ergonomic consideration, HR Planning, Effective HRP, Forecasting and balancing supply and demand of HR, recruiting from inside and outside, Recruiting protected class, Recruiting older people. **10 Hrs**

Module-2

Selection, Matching people and job, sources of information about job candidate, The US Employee Polygraph Protection Act, graphology, Medical examination, Drug test, Interview methods Guidelines for interviewers, appropriate and inappropriate interview questions, selection decision. **10 Hrs**

Module-3

Developing effectiveness in HR, Investment in Training, System approach, Conducting the .needs assessment, designing training programs, trainee readiness and motivation, principles of learning, characteristics of trainees, training methods for non-managerial employees, OJT, Technology for training, training methods for MDP, Evaluating, benchmarking HR training. **10 Hrs**

Module-4

Career development and Appraisal, identifying career opportunity and requirements, gauging employee potential, career development initiative, Mentor check list, career development for women and minorities, dual career couples, personal career development, Behavioural methods of appraisal, balanced score card, personal score card appraisal interviews; performance diagnosis. **10 Hrs**

Module-5

International HRM, Managing across borders, International staffing, Skills of a global manager, content of training program. Non-verbal communications, developing local resources, compensation of host country employees, managers and expatriate managers. Case studies on appraisal system, developing a training session, evaluating a given training program. preparation of structured and unstructured interviews. **10 Hrs**

Course outcomes:

At the end of the course the student will be able to:

1. Understand the basic concepts of HRM, Functions and role of HRM.
2. Know methodology of job selection process implemented in various sectors.
3. Analyse the effectiveness in training, evaluating and benchmarking HR training.
4. Understand the career development concept and methods of personal appraisal.
5. Understand International activities of HRM, Staffing, communication, appraisal training and interview system.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Reference Books

1. Principles of personnel management – Flippo – McGraw Hill.

2. Personnel principles and policies for modern manpower – Yoder Prentice Hall India.

3. Personnel/Human Resource Management – Terry Leap & Michael CrinocollierMacmillan publishers.

LABORATORY - II			
Course Code	20MPEL26	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	0:4:0	SEE Marks	60
Credits	02	Exam Hours	03

Sl. NO	Experiments
1	Study of pick and place Robot- basic components, configuration, and work volume.
2	Experiments with Robot. Kit for minimum four assembly activities and programming.
3	Programming of robots by manual, lead through and off line methods.
4	Programming languages for stacking of objects in increasing or decreasing size. Palletizing operations, assembly and inspection operation etc.
5	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.

Question paper pattern:

The SEE questions will be set for **100** marks:

1. Two experiments for **80** marks.
2. Viva voce for **20** marks.

TECHNICAL SEMINAR			
Course Code	20MPE27	CIE Marks	100
Number of contact Hours/week	0:0:2	SEE Marks	--
Credits	02	Exam Hours	--

Course objectives:

The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas.

Each student, under the guidance of a Faculty, is required to

- Choose, preferably through peer reviewed journals, a recent topic of his/her interest relevant to the Course of Specialization.
- Carryout literature survey, organize the Course topics in a systematic order.
- Prepare the report with own sentences.
- Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
- Present the seminar topic orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit two copies of the typed report with a list of references.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculties from the department with the senior most acting as the Chairperson.

Marks distribution for CIE of the course 20MPE27 seminar:

Seminar Report: 30 marks

Presentation skill:50 marks

Question and Answer:20 marks

*** END OF II SEMESTER***

THEORY OF METAL FORMING			
Course Code	20MPE31	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	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.

10 Hrs

Module-2

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

10 Hrs

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.

10 Hrs

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.

10 Hrs

Module-5

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

10 Hrs

Course outcomes:

At the end of the course the student will be able to:

1. Understand the basics of metal forming.
2. Recognize the importance of metal forging using different geometrical shapes and various defects.
3. Understanding the concept of rolling ,types of rolling mills and processes and its defects
4. To understand the concepts of extrusion and drawing and their applications.
5. To understand the types of sheet metal forming processes and HERF

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ■

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

ADVANCED MATERIALS & PROCESSING			
Course Code	20MPE321	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	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.

08 Hrs

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.

10 Hrs

Module-3

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

08 Hrs

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.

08 Hrs

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.

08 Hrs

Course outcomes:

At the end of the course the student will be able to:

1. Classify materials and physical characteristics.
2. Understand iron carbon equilibrium diagram, TTT diagram, heat treatment process of various steels.
3. Understand alloys of various nonferrous metals.
4. Understand polymers, ceramics and their mechanical – thermal properties.
5. Identify the composites and their structure and Understand applications of ceramics.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ■

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.

SIMULATION MODELLING OF MANUFACTURING SYSTEMS			
Course Code	20MPE322	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	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.

08 Hrs

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.

08 Hrs

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.

08 Hrs

Module-4

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

08 Hrs

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.

08 Hrs

Course outcomes:

At the end of the course the student will be able to:

1. Describe the role of important elements of discrete event simulation and modeling paradigm.
2. Conceptualize real world situations related to systems development decisions, originating from source requirements and goals.
3. Develop skills to apply simulation software to construct and execute goal-driven system models.
4. Interpret the model and apply the results to resolve critical issues in a real world environment.
5. Understand the Empirical Discrete Distribution, Design and Evalution of Simulation Experiments.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ■

Textbook/ Textbooks

(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			
Course Code	20MPE323	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	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.

08 Hrs

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.

08 Hrs

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.

08 Hrs

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.

08 Hrs

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.

08 Hrs

Course outcomes:

At the end of the course the student will be able to:

1. Identify, describe and evaluate the properties of fibre reinforcements, polymer matrix materials and commercial composites.
2. Develop competency in one or more common composite manufacturing techniques, and be able to select the appropriate technique for manufacture of fibre-reinforced composite products.
3. Analyse the elastic properties and simulate the mechanical performance of composite laminates; and understand and predict the failure behaviour of fibre-reinforced composites
4. Apply knowledge of composite mechanical performance and manufacturing methods to a composites design project
5. Critique and synthesise literature and apply the knowledge gained from the course in the design and application of fibre-reinforced composites

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ■

Textbooks

(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.

PRODUCT DATA MANAGEMENT			
Course Code	20MPE324	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Module-1

Product Data Management : Product life cycle, Complexity in Product Development, General Description of PDM
Basic functionality of PDM: Information architecture, PDM System architecture, Applications used in PDM systems. Trends in PDM. . **08 Hrs**

Module-2

Document Management Systems: Document management and PDM, Document life cycle, Content Management, Document management and related technologies, Document management resources on the Internet. **08 Hrs**

Module-3

Workflow Management in PDM: Structure Management, Engineering Change Management, Release Management, Version Management, Configuration Management. . **08 Hrs**

Module-4

Creating Product Structures: Part centric approach, CAD centric approach, Product Structure configuration, Managing Product Structures, PDM Tools: Matrix One, Team Center, Windchill. Enovia, PDM resources on the Internet. . **08 Hrs**

Module-5

PDM Implementation Case Studies: Sun Microsystems, Inc., Mentor Graphics Corporation, Ericsson Radio Systems AB, Ericsson Mobile Communications AB, ABB Automation Technology Products, SaabTech Electronics AB. . **08 Hrs**

Course outcomes:
At the end of the course the student will be able to:

1. Explain the concepts, tools and techniques for managing product data.
2. Analyze various processes in the product data management frameworks.
3. Evaluate risks in large and complex workflow management environments.
4. Develop product data management plans for various types of organizations.
5. Understand The Sun Microsystems, Inc., Mentor Graphics Corporation and ABB.

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Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ■

Textbooks

(1)Computer Integrated Design and Manufacturing - David Bed worth. Mark Henderson &. Philips Wolfe - McGraw Hill Inc
(2)Visual Modeling with Rational Rose and UML - Terry Quatrain - Addison Wesley
Reference Books
(1)Wind-chill - RS.O Reference manuals - 2000..

NANO TECHNOLOGY			
Course Code	20MPE331	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	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. Metalmetal nanocomposites, some simple preparation techniques and their new electrical and magnetic properties.

08 Hrs

Module-2

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

08 Hrs

Module-3

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

08 Hrs

Module-4

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

08 Hrs

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.

08 Hrs

Course outcomes:

At the end of the course the student will be able to:

1. Explain the fundamental principles of nanotechnology and their application to biomedical engineering.
2. Apply engineering and physics concepts to the nano-scale and non-continuum domain.
3. Identify and compare state-of-the-art nanofabrication methods and perform a critical analysis of the research literature.
4. Design processing conditions to engineer functional nano materials.
5. Evaluate current constraints, such as regulatory, ethical, political, social and economical, encountered when solving problems in living systems

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ■

Textbooks

(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.

Reference Books

(1) Vladimir P. Torchilin (2006) Nanoparticulates as Drug Carriers, Imperial CollegePress.

(2) M Reza Mozafari (2007) Nanomaterials and Nano systems for BiomedicalApplications, Springer.

(3)Nanotechnology–Basic Science & Emerging Technologies, Chapman & Hall/CRC 2002

APPLIED PROBABILITY AND STATISTICS			
Course Code	20MPE332	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	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.

08 Hrs

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.

08 Hrs

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.

08 Hrs

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.

08 Hrs

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.

08 Hrs

Course outcomes:
At the end of the course the student will be able to:

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ■

Textbooks
(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.
Reference Books
(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			
Course Code	20MPE333	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	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.

08 Hrs

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.

08 Hrs

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.

08 Hrs

Module-4

System Reliability:Series, parallel and mixed configuration, Block diagram concept, r- outof-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.

08 Hrs

Module-5

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

08 Hrs

Course outcomes:

At the end of the course the student will be able to:

1. Understand the quality and basic probability concept.
2. Construct the control chart for variables.
3. Construct the control chart for attributes and analyse failure data.
4. Construct OC curve for determining the probability of lot acceptance.
5. Understand the basic concept of reliability and calculate maintainability and availability of resources.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ■

Textbooks

(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.

ORGANISATIONAL BEHAVIOUR			
Course Code	20MPE334	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Module-1

Orgnanizational Behavior – Definition, Need for studying Organizational Behavior, Disciplines involved in the study of Organizational Behavior, -Contributing disciplines and area like psychology, social psychology, economics, anthropology etc. Application of Organizational Behavior in Business. . . **08 Hrs**

Module-2

Individual behaviour – personality, perception, learning, attitudes inter-personal behaviour – Group and inter-group behaviour.
. **08 Hrs**

Module-3

Group Dynamics – Formal and Informal Group, Group Norms, Group Cohesiveness, Group Behaviour and Group Decision – making.
. **08 Hrs**

Module-4

Motivation and morale, leadership-nature, styles and approaches, development of leadership including laboratory training. Power and Authority – Definition of Power – Types of Power. **08 Hrs**

Module-5

Management of change- Conflict Management- Organisation Health, Development and Effectiveness. Management of culture, Cross Cultural Management. **08 Hrs**

Course outcomes:

At the end of the course the student will be able to:

1. Define organisational behaviour, analyse discipline and area of application in business.
2. Understand personality, interpersonal and intergroup behaviour.
3. Understand group types, norms and decision making.
4. Understand nature and development of leadership and types of power.
5. Learn the management of conflict, development, effectiveness and cross cultural management

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ■

Textbooks

(1) Organizational Behaviour, Nelson & Quick, Cengage learning.

(2) Organizational Behaviour, S. Fayyaz Ahamed and others, Atlantic publisher

PROJECT WORK PHASE – 1			
Course Code	20MPE34	CIE Marks	100
Number of contact Hours/Week	2	SEE Marks	--
Credits	02	Exam Hours	--

Course objectives:

- Support independent learning.
- Guide to select and utilize adequate information from varied resources maintaining ethics.
- Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- Develop interactive, communication, organisation, time management, and presentation skills.
- Impart flexibility and adaptability.
- Inspire independent and team working.
- Expand intellectual capacity, credibility, judgement, intuition.
- Adhere to punctuality, setting and meeting deadlines.
- Instil responsibilities to oneself and others.
- Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Phase-1 Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work.

Seminar: Each student, under the guidance of a Faculty, is required to

- Present the seminar on the selected project orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit two copies of the typed report with a list of references.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Course outcomes:

At the end of the course the student will be able to:

- Demonstrate a sound technical knowledge of their selected project topic.
- Undertake problem identification, formulation, and solution.
- Design engineering solutions to complex problems utilising a systems approach.
- Communicate with engineers and the community at large in written an oral forms.
- Demonstrate the knowledge, skills and attitudes of a professional engineer.

Continuous Internal Evaluation

CIE marks for the project report (50 marks), seminar (30 marks) and question and answer (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.

MINI PROJECT			
Course Code	20MPE35	CIE Marks	40
Number of contact Hours/Week	2	SEE Marks	60
Credits	02	Exam Hours/Batch	03

Course objectives:

- To support independent learning and innovative attitude.
- To guide to select and utilize adequate information from varied resources upholding ethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- To develop interactive, communication, organisation, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instil responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Mini-Project: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

Course outcomes:

At the end of the course the student will be able to:

- Present the mini-project and be able to defend it.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
- Habituated to critical thinking and use problem solving skills.
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it.

CIE procedure for Mini - Project:

The CIE marks awarded for Mini - Project, shall be based on the evaluation of Mini - Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25.The marks awarded for Mini - Project report shall be the same for all the batch mates.

Semester End Examination

SEE marks for the mini-project shall be awarded based on the evaluation of Mini-Project Report, Presentation skill and Question and Answer session in the ratio 50:25:25 by the examiners appointed by the University.

INTERNSHIP / PROFESSIONAL PRACTICE			
Course Code	20MPEI36	CIE Marks	40
Number of contact Hours/Week	2	SEE Marks	60
Credits	06	Exam Hours	03

Course objectives:

Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,

To put theory into practice.

To expand thinking and broaden the knowledge and skills acquired through course work in the field.

To relate to, interact with, and learn from current professionals in the field.

To gain a greater understanding of the duties and responsibilities of a professional.

To understand and adhere to professional standards in the field.

To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality.

To identify personal strengths and weaknesses.

To develop the initiative and motivation to be a self-starter and work independently. ■

Internship/Professional practice: Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.

Seminar: Each student, is required to

- Present the seminar on the internship orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit the report duly certified by the external guide.
- The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. ■

Course outcomes:

At the end of the course the student will be able to:

- Gain practical experience within industry in which the internship is done.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learned to classroom work.
- Develop a greater understanding about career options while more clearly defining personal career goals.
- Experience the activities and functions of professionals.
- Develop and refine oral and written communication skills.
- Identify areas for future knowledge and skill development.
- Expand intellectual capacity, credibility, judgment, intuition.
- Acquire the knowledge of administration, marketing, finance and economics. ■

Continuous Internal Evaluation CIE marks for the Internship/Professional practice report (20 marks), seminar (10 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with
Semester End Examination SEE marks for the internship report (30 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University. ■

PROJECT WORK PHASE -2			
Course Code	20MPE41	CIE Marks	40
Number of contact Hours/Week	4	SEE Marks	60
Credits	20	Exam Hours	03

Course objectives:

- To support independent learning.
- To guide to select and utilize adequate information from varied resources maintaining ethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- To develop interactive, communication, organisation, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instil responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. ■

Project Work Phase - II: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism. ■

Course outcomes:

At the end of the course the student will be able to:

- Present the project and be able to defend it.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
- Habituated to critical thinking and use problem solving skills
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it. ■

Continuous Internal Evaluation:

Project Report: 20 marks. The basis for awarding the marks shall be the involvement of the student in the project and in the preparation of project report. To be awarded by the internal guide in consultation with external guide if any.

Project Presentation: 10 marks.

The Project Presentation marks of the Project Work Phase -II shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.

Question and Answer: 10 marks.

The student shall be evaluated based on the ability in the Question and Answer session for 10 marks.

Semester End Examination

SEE marks for the project report (30 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University. ■