

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

I SEMESTER										
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	18MPT11	MATHEMATICAL METHODS IN ENGINEERING	04	--	03	40	60	100	4
2	PCC	18MPT12	Quality & Reliability Engineering	04	--	03	40	60	100	4
3	PCC	18MPT13	Quantitative Techniques in Decision Making	04	--	03	40	60	100	4
4	PCC	18MPT14	Operations Management	04	--	03	40	60	100	4
5	PCC	18MPT15	Theory of Metal Cutting	04	--	03	40	60	100	4
6	PCC	18MPTL16	Laboratory - I	-	04	03	40	60	100	2
7	PCC	18RMI17	Research Methodology and IPR	02	--	03	40	60	100	2
TOTAL				22	04	21	280	420	700	24

Note: PCC: Professional Core Course, PEC: Professional Elective Course.

Internship: All the students have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed credit shall be counted 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 failed and have to complete during the subsequent University examination after satisfying the internship requirements.

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II SEMESTER										
Sl. No	Course	Course Code		Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	18MPT21	Non-Traditional Machining Processes	04	--	03	40	60	100	4
2	PCC	18MPT22	Agile Manufacturing	04	--	03	40	60	100	4
3	PCC	18MPT23	Computer Integrated Manufacturing & Automation	04	--	03	40	60	100	4
4	PEC	18MPT24X	Professional elective 1	04	--	03	40	60	100	4
5	PEC	18MPT25X	Professional elective 2	04	--	03	40	60	100	4
6	PCC	18MPTL26	Laboratory -II	--	04	03	40	60	100	2
7	PCC	18MPT27	Technical Seminar	--	02	--	100	--	100	2
TOTAL				20	06	18	340	360	700	24

Note: PCC: Professional Core Course, PEC: Professional Elective Course.

Professional Elective 1			Professional Elective 2		
Course Code under 18XXX24X	Course title	Course Code under 18XXX25X	Course title		
18MPT241	Applied Micro-Economics	18MPT251	Non-Destructive Testing		
18MPT242	Product Data Management	18MPT252	Simulation & Modelling of Manufacturing Systems		
18MPT243	Surface Treatment & Finishing	18MPT253	Industrial Robotics		

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III SEMESTER										
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	18MPT31	Advanced Manufacturing Practices	04	--	03	40	60	100	4
2	PEC	18MPT32X	Professional elective 3	04	--	03	40	60	100	4
3	PEC	18MPT33X	Professional elective 4	04	--	03	40	60	100	4
4	Project	18MPT34	Evaluation of Project phase -1	--	02	--	100	--	100	2
5	Internship	18MPTI35	Internship	(Completed during the intervening vacation of I and II semesters and /or II and III semesters.)		03	40	60	100	6
TOTAL				12	02	12	260	240	500	20
Note: PCC: Professional Core Course, PEC: Professional Elective Course.										
Professional elective 3					Professional elective 4					
Course Code under 18XXX32X		Course title			Course Code under 18XXX33X		Course title			
18MPT321		Industrial Design & Ergonomics			18MPT331		Project Management			
18MPT322		Human Resource Management			18MPT332		Composite Materials			
18MPT323		Advanced Fluid Power Systems			18MPT333		Advanced Materials & Processing			
Note:										
1. Project Phase-1: Students in consultation with the guide/co-guide if any, shall pursue literature survey and complete the preliminary requirements of selected Project work. Each student shall prepare relevant introductory project document, and present a seminar. CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25.										
SEE (University examination) shall be as per the University norms.										
2. Internship: Those, who have not pursued /completed the internship shall be declared as failed and have to complete during subsequent University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.										

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IV SEMESTER										
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work/ Assignment	Duration in hours	CIE Marks	SEE Marks Viva voce	Total Marks	
1	Project	18MPT41	Project work phase -2	--	04	03	40	60	100	20
TOTAL				--	04	03	40	60	100	20
Note: 1. Project Phase-2:										
CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a Senior faculty of the department. The CIE marks awarded for project work phase -2, shall be based on the evaluation of Project Report subjected to plagiarism check, Project Presentation skill and Question and Answer session in the ratio 50:25:25.										
SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.										

I SEMESTER

18MPT11 MATHEMATICS

Syllabus for Mathematics

QUALITY AND RELIABILITY ENGINEERING

Sub Code	: 18MPT12	CIE Marks	: 40
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	SEE Marks	: 60

MODULE 1

Basic Concepts: Definitions of quality, Quality of design, Quality of conformance, and Quality of performance, Dimensions of quality, Quality characteristics, Quality control, Statistical quality control and cost of quality.

Fundamentals of Probability and Statistics: Events, Sample space, Probability rules, Dependent and Independent events, Statistical tools in quality control, Concept of variation, Graphical tools for data representation and analysis, Discrete and continuous probability distributions and their applications in quality control, numerical problems 10Hrs

MODULE 2

Control charts for Variables: Variation, Causes of variation, Objectives of control charts, Choice of variable, Subgroup size and subgrouping, frequency of sampling, control limits. Process capability analysis, Relationship of a process in control to specification limits, Variable charts - X bar chart, R chart, σ chart, revision of control limits and RPI, Introduction to cusum chart and moving range charts, numerical problems 10 Hrs

MODULE 3

Control charts for Attributes: Control charts for fraction nonconforming (p chart, np chart) and nonconformities (c chart and u chart) with variable and constant sample size, Choice between variables and attributes control charts, revision of control limits, numerical problems
Failure Data Analysis : Introduction, Failure Data, Quantitative measures, MTTF, MTBF, Bathtub Curve, Mean Life, Life Testing, numerical problems, Introduction to Failure Mode and Effect Analysis 10 Hrs

MODULE 4

Acceptance Sampling: Fundamentals of acceptance sampling, Sampling methods, OC Curves and their characteristics, AQL, IQL, LTPD, AOQ/AOQL. Types of acceptance sampling-Single, Double, Multiple, and Sequential sampling plans, Average Total Inspection, comparison amongst sampling plans, numerical problems 10 Hrs

MODULE 5

System Reliability: Definition, Series, parallel and mixed configuration, Block diagram concept, r-out-of-n structure solving problems using mathematical models. Difficulty in achieving reliability, Methods for improving reliability during design, Different techniques available to improve reliability, Reliability-Cost trade off, Prediction and Analysis, numerical problems

Maintainability and Availability: Introduction, Techniques available to improve maintainability and availability, trade-off among reliability, maintainability and availability, Simple problems 10 Hrs

TEXT BOOKS:

1. Statistical Quality Control – Montgomery D.C. John Wiley & Sons, Inc
2. Statistical Quality Control – Grant and Leavenworth

REFERENCE BOOKS:

1. Quality Planning and Analysis - Juran, J.M and Gryna, F.M. - Tata McGraw Hill publishing Coimpany Ltd., New Delhi, India – 1982.
2. Concepts in Reliability Engineering – Srinath K.S. - Affiliated East-West Press Private Limited, New Delhi, India -1985.
3. Statistical Quality Control – R C Gupta, Khanna Publishers,

QUANTITATIVE TECHNIQUES IN DECISION-MAKING

Sub Code	: 18MPT 13	CIE Marks	: 40
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	SEE Marks	: 60

MODULE 1

Introduction: Statistics and managerial decisions, statistical data and Operations Research techniques.

Fundamentals of Statistics and Probability: Presentation and Analysis of Statistical Data, Measures of central tendency and location, Measure of dispersion, Skewness and Kurtosis: Numerical Problems, Introduction to Probability and basic rules of probability. 10 Hrs

MODULE 2

Decision Making under Uncertainty: Alternative criteria for decision under uncertainty, Bayesian approach and Incremental analysis.

Linear Programming Problem: Formulation of LPPs, Solution of LPPs by graphical method.

Solution of LPP by simplex method: Concept of duality and solution of dual problems, Solution of LPP by dual simplex method and Sensitivity analysis. 10 Hrs

MODULE 3

Transportation and Assignment Problems: Structure of transportation problem and various methods to find IBFS, Optimality test of transportation problems by MODI method, Solution of degeneracy and unbalanced transportation problems, Assignment problems and solution by Hungarian method and Traveling Salesman problem. 10 Hrs

MODULE 4

Theory of Games: Two person zero sum game, Minimax & Maximin strategies, Solution of game by dominance rules, arithmetic and algebraic methods, Solution of game by graphical method and method of matrices, Solution of game by Linear programming approach and approximate method to solve game problems.

Waiting Line: Basic structure of queuing systems and characteristics, Expressions for M/M/1 queuing model. 10 Hrs

MODULE 5

Network Analysis: PERT and CPM, Network construction and determination of critical path, Calculation of ES, EF, LS, LF, TF, FF and IF, Crashing of a project, Scheduling of a project and resource levelling.

Simulation of Management Systems: Simulation and Monte Carlo method, Waiting line and inventory simulation models 10 Hrs

TEXT BOOKS:

1. **Quantitative Techniques for Managerial Decisions** – U K Srivastava, G V Shenoy, and S C Sharma, - New Age International (P) Ltd., Publishers
2. **Operations Research:** P K Gupta and D S Heera – S Chand & Company Ltd.

REFERENCE BOOKS:

1. **Operations Research** - H. A. Taha- Prentice Hall of India
2. **Introduction to Operations Research** - Hillier and Liberman- McGraw Hill International
3. **Operations Research** – S. D Sharma, Kedar Nath Ram Nath & Company Ltd.

OPERATIONS MANAGEMENT

Sub Code	: 18MPT14	CIE Marks : 40
No. of Lecture Hrs/week	: 04	Exam Hours : 03
Total Lecture Hours	: 50	SEE Marks : 60

MODULE 1

Understanding Operations: Introduction to operations management, manufacturing trends in India, Service as a part of operations management, operations as a key functional area, operations management: a systems perspective, operations management functions, challenges in operations management.

Operational strategy: relevance of operations strategy, strategy formulation process, measure for operational excellence, options for strategic decisions in operations, break even analysis, cost versus flexibility trade off in operations strategy, related problems. 10 Hrs.

MODULE 2

Process and capacity analysis: process flow charting, planning premises and process implications, analyzing processes, business process Re Engineering, defining capacity, measure of capacity, time horizon in capacity planning, capacity planning framework, alternatives for capacity augmentation, decision tree for capacity planning, related problems.

Design of manufacturing process: Determinant of process characteristics in operations, types of process and operations systems, process product matrix, layout planning, types of layouts, performance measure for layout design, design of process layouts, design of product layouts, approaches to layout design, technology issues in process design, complexity in operations management, related problems. 10 Hrs.

MODULE 3

Inventory planning and control: inventory planning for independent demand items, types of inventory, cost of inventory, inventory control for deterministic demand items, handling uncertainty in demand, inventory control systems, selective control of inventory, inventory planning for single period demand, related problems. 10 Hrs

MODULE 4

Demand forecasting: forecasting time horizon, design of forecasting system, developing forecasting logic, sources of data, and models for forecasting, extrapolative methods using time series, causal methods of forecasting, accuracy of forecasts, using forecasting system, related problems.

Aggregate production planning: planning hierarchies in operations, aggregate production planning, need, frame work for aggregate planning, alternatives for managing supply, basic strategies for aggregate production planning, aggregate production planning methods, OR tools for production planning, Master production scheduling, related problems. 10 Hrs

MODULE 5

Resource planning: Dependent demand attributes, planning a framework, MRP Logic, MRP system, CRP, DRP, MRP II, ERP, Resources planning in services, related problems.

Scheduling of operations: need for scheduling, loading of machines, scheduling context, scheduling flow shops, scheduling of job shops, input output control, operational control issues in mass

production systems, operations planning and control based on the theory of constraints, related problems. 10 Hrs

TEXT BOOKS:

1. **Operations Management: Theory and Practice-** B. Madhavan, Pearson Education India
2. **Production and Operations Management:** R. Pannerselam- Prentice Hall of India Pvt., Ltd.

REFERENCE BOOKS:

1. **Operations Management for Competitive Advantages:** Chase and Aquilano, TMH Publications
2. **Operations Management:** William Stevenson TMH Publications
3. **Operations Management:** Robert Russell and Bernard Taylor, Pearson Publisher

THEORY OF METAL CUTTING

Sub Code	: 18 MPT 15	CIE Marks	: 40
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	SEE Marks	: 60

MODULE 1

Geometry of Cutting Tools: Single point and multi point cutting tools like drills, milling cutters, tool nomenclature, tool point reference systems, tool angle specification systems – ISO and ASA systems, Chip breakers Indexable inserts, tool holders for indexable inserts, Recommended tool angles, Effect of cutting parameters on tool geometry.

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, and their applications. 10 Hrs

MODULE 2

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. 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 lathe, drilling, and milling.

Thermal Aspects in Metal Cutting Process: Heat sources in metal cutting and temperature distribution in metal cutting, Measurements of chip – tool interface temperature – thermocouple technique and calorimeter technique. 10 Hrs

MODULE 4

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, problems on tool life. 10 Hrs

MODULE 5

Cutting Fluids: Basic actions of cutting fluids (mechanisms), Function and requirements of cutting fluids; Methods of application of cutting fluids, Types of commonly used cutting fluids, chemical coolants, effect of additives, selection of cutting fluids.

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. 10 Hrs

TEXT BOOKS

1. **Fundamentals of metal cutting & Machine Tools** - B.L.Juneja & G.S – Sekhar - Wiley Eastern.
2. **Metal Cutting Principles** - M.C. Shaw - Oxford Publication

REFERENCE BOOKS

1. **Metal Cutting** - V.C.Venkatesh & S.Chandrasekhanan - Pantice Hall
2. **Metal Cutting** - Dr. B.J.Ranganath -Vikas Publications.
3. **Theory of Metal Cutting** - Black – McGraw Hill

LABORATORY- I

Sub Code	: 18 MPTL 16	CIE Marks	: 40
No. of Practical Hrs./week	: 04	Exam Hours	: 03
Total Practical Hrs	: 50	SEE Marks	: 60

The following Exercises are to be conducted

01. To become familiar with the use of a kinematics graphics simulator in order to perform robot motion and programming.
02. To use trajectory planning concepts on the model of a single-link robotic manipulator.
03. To familiarize students with the use of a vision system.
04. Simulation of Cutting/Milling operations on a computer using CAM packages.
05. To simulate a manufacturing system using discrete-event simulation techniques. To enable students to have a Systems-Wide View of manufacturing systems. A 3-D graphics manufacturing-oriented simulation software on a PC-type computer should be used. A simple manufacturing system is modelled first and the effects of local changes examined.. Then, students make changes to the manufacturing system in order to increase throughput, reduce in-process inventories, and so on. The effects of resource failure and repair times are also examined.

REFERENCE BOOKS:

1. **CAD/CAM** -Zimmers& Grover – PHI.
2. **CAD/CAM/CIM** - P.Radhakrishna - New Age International
3. **Automation, Production systems & CAM** - M.P. Grover - Prentice Hall

4. **CAD/CAM** -Zeid – Mc-Graw Hill
5. **CAD/CAM** - P.N.Rao - TMH
6. **Robotics for Engineering** - Koren.Y - Mc-Graw Hill
7. **Robot vision & Sensory Controls** - Rooks B. - North Holland (ed) vol-3

18RMI17 RESEARCH METHODOLOGY AND IPR

Syllabus for RESEARCH METHODOLOGY AND IPR

Semester-II

NON-TRADITIONAL MACHINING PROCESS

Sub Code	: 18 MPT 21	CIE Marks	: 40
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	SEE Marks	: 60

Module – 1

Introduction: Need for non-traditional machining processes, Classification, Comparison between conventional and non-conventional machining, Process selection.

Mechanical Process: Ultrasonic machining (USM): Introduction, Elements of the process, Mechanism of material removal, Essentials of Equipment, Tool materials, Cutting tool system design: Magnetostriction assembly, Tool cone (Concentrator), & Exponential concentrator of circular cross section & rectangular cross section, Hollow cylindrical concentrator, Effect of process parameters, Limitations, Applications.

Abrasive Jet Machining: Principles, Equipment details, Process variables, Material removal rate, Applications, Advantages & Disadvantages. 10 Hrs

Module – 2

Thermal Metal Removal Process: Electric Discharge Machining (EDM): Principle of operation, Mechanism of metal removal, Basic EDM circuitry, Spark erosion generators, Electrode feed control, Analysis of relaxation type of circuit, Material removal rate using relaxation circuit, critical resistance, Electric parameters in R-C Circuit, Dielectric fluids, Flushing, Electrodes for spark erosion, Selection of electrode material, Surface finish, Machining accuracy, Applications. 10 Hrs

Module – 3

Electro Chemical and Chemical Processes: Electro Chemical Machining (ECM): Principle of ECM, Elements of ECM process, Chemistry of the ECM, Process parameters, Determination of the metal removal rate; Accuracy, Surface finish, Dynamics of ECM process, Hydrodynamics of ECM process, Tool Design, Advantages and disadvantages, Applications. Electro Chemical Grinding, Electro Chemical honing and Electro chemical deburring.

Chemical Machining: Fundamental principle, Elements of the process – Maskants, Etchants, Advantages and disadvantages, Applications. 10 Hrs

Module – 4

Plasma Arc Machining (PAM): Introduction, Plasma, Nonthermal Generation of Plasma, Equipment, Mechanism of metal removal, PAM parameters, Process characteristics, Type of torches, Applications.

Electron Beam Machining (EBM): Introduction, Equipment for production of Electron beam, Theory of electron beam machining- thermal & non thermal types, Process characteristics, applications.

Laser Beam Machining (LBM): Introduction, Principle of generation of lasers, Equipment and Machining procedure, Types of Lasers, Process characteristics, Advantages and limitations, Applications. 10 Hrs

Module – 5

Ion Beam Machining (IBM): Introduction, Principle of IBM, Mechanism of metal removal and associated equipment, Process characteristics, Advantages and limitations, Applications.

High Velocity Forming Processes (HERF): Introduction, Development of specific process, Selection, Comparison of conventional and high velocity forming methods, Types of high velocity forming methods: Explosion forming process, Electro hydraulics forming, Magnetic pulse forming. 10 Hrs

TEXT BOOKS:

1. **New technology: Institution of Engineers** - Bhattacharya - India
2. **Modern Machining Process** - P.C Pandey & H.S. Shan - Tata McGraw Hill

REFERENCE BOOKS:

1. **Production Technology** - HMT - Tata McGraw Hill
2. **Modern Manufacturing Method** - Adithan - New Age International (p) Limited
3. **Modern Machining Processes** - P.K. Mishra - Narosa Publishing House

AGILE MANUFACTURING

Sub Code	: 18 MPT 22	CIE Marks	: 40
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	SEE Marks	: 60

MODULE 1

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

2. **Four Core Concepts:** Strategy driven approach - integrating organization, people technology interdisciplinary design methodology. 10Hrs

MODULE 3

3. **Agile Manufacturing and Change Management:** The change implications. Post failures in advanced manufacturing, changes on the way, traditional management accounting, paradigm, investment appraisal, product costing - performance, measurement and control systems, Traditional organization, control technological and design paradigms traditional problems in workplace- organizational issues - role of technology. 10Hrs

MODULE 4

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

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

TEXT BOOKS:

1. **Agile manufacturing - Forging new Frontiers** - Paul T. Kidd - Addison Wesley Publication
2. **Agile Manufacturing – Proceedings of International Conference** - Dr. M.P Chowdiah (Editor) – TataMcGraw Hill Publications

REFERENCE BOOKS:

1. **On Agile manufacturing** - Tata McGraw Hill Publications
2. **Agile manufacturing - Forging Neat Furniture's** - Paul T Kidd – Addition Wesley Pub

3. World Class Manufacturing - Paul T Kidd - Washington: National - 1994

COMPUTER INTEGRATED MANUFACTURING & AUTOMATION

Sub Code	: 18MPT 23	CIE Marks	: 40
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	SEE Marks	: 60

MODULE 1

Production development through CIM: Computers in Industrial manufacturing, Product cycle & Production development cycle, Introduction of CAD/CAM & CIM, sequential and concurrent engineering, soft and hard prototyping.

Computer Process Monitoring: Process control methods, direct digital control, supervisory computer control, steady state optimal control, on line search strategies, adaptive control. 10 Hrs

MODULE 2

Computer Aided Quality Control: The computer in Q.C, automated inspection principles and methods, Contact inspection methods, non-contact inspection methods, machine vision system, optical inspection method, sensors, coordinate, measuring machine, Computer-Aided testing, Integration of CAQL with CAD/CAM. 10 Hrs

MODULE 3

Computer Integrated Manufacturing: Fundamentals of CAD/CAM, Computerized Manufacturing planning systems, shop floor control & automatic identification techniques. Computer Network for manufacturing, and the future automated factor. 10 Hrs

MODULE 4

Detroit type of Automation: Flow lines, Transfer Mechanisms, work pattern transfer, Different methods, & Problems.

Analysis of Automated flow lines: Analysis of transfer lines without storage with storage buffer single stage, Double stage, Multistage with problems, Automated assembly systems, Design for automated assembly, parts feeding devices, analysis of Multi station assembly machine, Analysis of Single stage assembly machine, 10 Hrs

MODULE 5

Automated material Handling Storage: Material functions, types of material handling equipment, analysis of material handling systems, design of system, conveyor system, automated guided vehicle systems, automated storage/retrieval systems, caroused storage systems work in process storage, interfacing handling & storage with manufacturing. 10 Hrs

TEXT BOOKS:

1. CAD/CAM -Zimmers& Grover – PHI
2. CAD/CAM/CIM - P.Radhakrishna - New Age International - 2nd edition.

REFERENCE BOOKS:

1. CAD/CAM -Zeid – Mc-Graw Hill
2. CAD/CAM - P.N.Rao - TMH
3. Robotics for Engineering - Koren.Y - Mc-Graw Hill

Professional Elective-1

APPLIED MICRO-ECONOMICS

Sub Code	: 18 MPT 241	CIE Marks	: 40
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	SEE Marks	: 60

MODULE 1

Introduction: Circular Flow of Economic Activity, Nature of the firm Concept of Economic Profit.

Demand Theory and Analysis: Individual and Market Demand, price Elasticity, income elasticity and cross Elasticity. 10Hrs

MODULE 2

Production Theory and Analysis: Production Function, Production with one variable Input and two inputs, Economies of Scale and Scope, Estimation of Production Function. 10Hrs

MODULE 3

Cost Theory and Analysis: The Economic Cost Concept, Opportunity Costs, Explicit & Implicit, Marginal, Incremental and Sunk Cost Function, Short and Long run cost Functions, Profit Contribution Analysis Numerical Problems. 10Hrs

MODULE 4

Market Structure: Perfect Competition and Monopoly, Monopolistic Competition, Oligopoly: Numerical Problems. Barriers to Entry. 10Hrs

MODULE 5

Pricing Decisions: Pricing of Multiple Products, Price Discrimination, Product Bundling Peak Load Pricing and Cost Plus Pricing, Pricing and Employment of Inputs. Numerical Problems. 10Hrs

TEXT BOOKS:

1. H C Peterson and W C Lewis, Managerial Economics, PHI, New Delhi.
2. Samuelson W F, and S G Marks, Managerial Economics, Dryden Press, FortWorth.

REFERENCE BOOKS:

1. Managerial Economics, William F Samuelson and Stephen G Marks, John Wiley & Sons.
2. Managerial Economics and Strategy, Jeffrey M Perloff, Pearson
3. Managerial Economics, H L Ahuja, S Chand Publications

PRODUCT DATA MANAGEMENT

Subject Code	: 18 MPT 242	CIE Marks	: 40
No. of Lecture Hours/Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours	: 50	SEE Marks	: 60

Module – 1

Introduction: Introduction to PDM-present market constraints need for collaboration- Internet and developments in server-client computing. 10Hrs

Module – 2

Components of PDM: Components of a typical PDM set-up hardware and software- document management creation and viewing of documents -creating parts-version control of parts and documents –case studies. 10Hrs

Module – 3

Projects and Roles: Creation of projects and roles -life cycle of a product- life cycle management - automating information flow -work flows-Creation of work flow templates -life cycle -work flow integration -case studies. 10Hrs

Module – 4

Configuration Management: Base lines-product structure configuration management -case studies.

Change Management: Change issue -change request-change investigation- change proposal-change activity-case studies. 10Hrs

Module – 5

Generic Products and Variants: Products configuration comparison between sales configuration mild products generic-generic product modeling in configuration modeler-use of order generator for variant creation -registering of variants in product register-case studies. 10Hrs

TEXT BOOKS:

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.

SURFACE TREATMENT & FINISHING

Sub Code	: 18 MPT 243	CIE Marks	: 40
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	SEE Marks	: 60

MODULE 1

Fundamentals of Electro plating, galvanizing, Hot dip metal coating, thin coating, thin coating, chromium plating, Nickel plating. **Vacuum coating**, FVD & CVD metal spraying - Methods, surface preparation, mechanical 10Hrs

MODULE 2

Properties of sprayed metals, plasma coating. Plastic coating of metal - PVC coating Spherodising process details, phosphate coating - mechanism of formation. 10Hrs

MODULE 3

Testing of surface coating-methods.**Heat treatment methods**, Annealing, Normalizing, Tempering, Case hardening methods, flame hardening sub zero treatment. 10Hrs

MODULE 4

Heat treatment methods for gears, spindles, cutting tools. 10Hrs

MODULE 5

Advanced coating technologies: Hard facing, electro deposition technique, Nano-coatings, coating characterization 10Hrs

TEXT 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

REFERENCE BOOKS:

1. **Handbook of metal treatment and testing** - John wiley& sons.
2. **Heat Treatment of Metals** – Zakrov - MIR Publications.
3. **Metals Hand Book** – ASM.

Professional Elective-2

NON-DESTRUCTIVE TESTING

Sub Code	: 18 MPT 251	CIE Marks	: 40
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	SEE Marks	: 60

Module – 1

1. **Introduction:** Definition, concept of NDT, comparison between destructive and non destructive testing, purposes of NDT, classification of NDT methods, advantages, disadvantages, application of NDT in industries, visual inspection, pressure and leak testing.
2. **Liquid Penetrant Inspection:** Basic processing steps of LPI, penetrant testing materials, penetrant dwell time, developers, material smear and its removal, advantages, disadvantages & applications. 10 Hrs

Module – 2

3. **Magnetic particle inspection:** Basic principle of MPI, Processing steps of MPI, Methods of generating magnetic fields, types of magnetic particles and suspension liquids, advantages, disadvantages and applications.
4. **Eddy current inspection:** Basic principle of eddy current inspection, operating variables, procedure, inspection coils, and detectable discontinuities by the method of eddy current inspection, advantages, disadvantages and applications. 10 Hrs

Module – 3

5. **Ultrasonic inspection:** Principle of ultrasonic inspection, basic equipment, characteristics of ultrasonic waves, variables in inspection, inspection methods - scanning systems, pulse echo A-scan, B-scan, and C-scans, contact and immersion methods, transducer elements, couplants, search units, reference blocks, applications. 10 Hrs

Module – 4

6. **Microwave inspection:** Principle of microwave inspection, basic equipment & inspection procedure, advantages, disadvantages and applications.
7. **Radiography inspection:** Principle of radiographic inspection, radiation sources, X-rays and Gamma-rays, X-ray tubes, Radiographic films, screens and filters, image intensifiers, penetrameters, image quality, radiographic sensitivity, neutron radiography, safety aspects related to testing, applications 10 Hrs

Module – 5

8. **Holographic Inspection:** Basic principle of optical holography, The basic hologram, recording and reconstruction, interferometric holography, methods of storing for interferometric holography, basic principle of acoustic holography, systems and techniques, advantages, disadvantages, and applications of holography. 10 Hrs

TEXT BOOKS:

1. **Non Destructive Testing** - Mc Gonnagle J J – Garden and Reach, New York.
2. **Non Destructive Inspection and Quality Control** – Metals Hand Book Vol.11
American Society of Metals

REFERENCE BOOKS:

1. **The Testing and Inspection of Engineering materials** - Davis H.E, Troxel G.E, Wiskovil C.T - McGraw Hill.
2. **Non Destructive Evaluation and Quality Control** - volume 17 of metals hand book 9 edition Asia internal 1989.
3. **The Testing instruction of Engineering materials** - Davis H.E Troxel G.E wiskovil C.T - McGraw hill.

SIMULATION AND MODELING OF MANUFACTURING SYSTEMS

Sub Code	: 18 MPT 252	CIE Marks	: 40
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	SEE Marks	: 60

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. 10Hrs

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. 10Hrs

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. 10Hrs

Module – 4

Random Variable Generation: Inversion transforms technique-exponential distribution. uniform distribution, weibul distribution, continuous distribution, generating approximate normal variates-Erlang distribution. 10Hrs

Module – 5

Empirical Discrete Distribution: Discrete uniform -distribution poisson distribution -geometric distribution -acceptance -rejection technique for Poisson distribution gamma distribution. **Design and Evaluation of Simulation Experiments:** variance reduction techniques -antithetic variables, variables-verification and validation of simulation models. **Simulation Software:** Selection of simulation software, simulation packages. 10Hrs

TEXT BOOKS:

1. **Discrete Event System Simulation** - Jerry Banks & John S Carson II - Prentice Hall Inc
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 Wiley& Sons - 1987.
3. **Simulation Modeling with Pascal** - RathM.Davis& Robert M O Keefe - Prentice Hall Inc. - 1989.

INDUSTRIAL ROBOTICS

Sub Code	: 18 MPT 253	CIE Marks	40
No. of Lecture Hrs/week	: 04	Exam Hours	03
Total Lecture Hrs	: 50	SEE Marks	60

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, hydraulic-electric-pneumatic drives. Mechanical transmission method – Rotary-to-Rotary motion conversion. Rotary-to-linear motion conversion end effectors – types-grip pind problem Remote-Centered compliance Devices-Control of Actuators in Robotic Mechanisms. 10Hrs

Module – 2

SENSORS AND INTELLIGENT ROBOTS: Sensory devices – Non-optical-Position sensors – Optical position sensors – velocity sensors – proximity sensors: Contact and non-contact type-Touch and slip sensors – Force and Torque Sensors – AI and Robotics. **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. 10Hrs

Module – 3

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. 10Hrs

Module – 4

TRANSFORMATIONS AND KINEMATICS: Homogeneous Co-ordinates – Co-ordinate Reference Frames – Homogeneous Transformations for the manipulator – the forward and inverse probleme of manipulator kinematics – Motion generation – Manipulator dynamics – Jacobian in terms of D.H.Matrices controller architecture. 10Hrs

Module – 5

ROBOT CELL DESIGN AND CONTROL: Specifications of Commerical 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 10Hrs

TEXT BOOKS:

1. **Robotics Engineering An integrated approach** - Richard D Klafter, Thomas A Chmielewski, Michael Negin – Prentice Hall of India Pvt. Ltd.
2. **Robotics: Control Sensing, Vision, intelligence** - Fu KS Gomaler R C, Lee C S G - McGraw Hill

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.

LABORATORY- II

Sub Code	: 18 MPTL 26	CIE Marks	: 40
No. of Practical Hrs./week	: 04	Exam Hours	: 03
Total Practical Hrs	: 50	SEE Marks	: 60

The following Exercises are to be conducted (Perform any 8 to 10 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.

REFERENCE BOOKS

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

Semester-III**ADVANCED MANUFACTURING PRACTICES**

Sub Code	: 18MPT 31	CIE Marks	: 40
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	SEE Marks	: 60

MODULE 1

Need of CPC for a company, what CPC can do, CPC-getting the right tool.

JIT – Introduction – The spread of JIT Movement, some definitions of JIT, core Japanese practices of JIT, Creating continuous Flow Manufacture, Enabling JIT to occur, Basic elements of JIT, Benefits of JIT.

Just in Time Production – Primary purpose, profit through cost reduction, Elimination of over production, Quality control, Quality Assurance, Respect for Humanity, Flexible work Force, JIT Production Adapting to changing production Quantities, process layout for shortened lead Times, Standardization of operation, Automation.

Sequence and scheduling used by suppliers: Monthly and daily Information. Sequenced withdrawal system by sequenced schedule table, problems and counter measures in applying the Kanban system to sub contractors.

10 Hrs

MODULE 2

Toyota Production System-The philosophy of TPS, Basic Frame work of TPS, Kanbans.

Determining the Number of Kanbans in Toyota Production System.

- a) Kanban Number under Constant Quantity Withdrawal System.
- b) Constant Cycle, Non-constant Quantity Withdrawal System.

Supplier Kanban and the Sequence Schedule for Use by Suppliers.

- a) Later Replenishment System by Kanban.
- a) Sequenced Withdrawal System.
- b) Circulation of the Supplier Kanban within Toyota.

Production Smoothing in TPS

Production Planning

Production Smoothing

Adaptability to Demand Fluctuations

Sequencing Method for the Mixed Model Assembly Line to Realize Smoothed Production of Goal.

10 Hrs

MODULE 3

Just-in-Time Production with Total Quality Control just in time concept, cutting lot sizes, cutting set-up times, cutting purchase order costs, the JIT cause-Effect chain, Scrap/Quality Improvements, Motivational effects, Responsibility effects, small Group improvement Activities, withdrawal of Buffer Inventory, the total Quality Control Concept.

10 Hrs

MODULE 4

Total Quality Control-Introduction-Total Quality Control concepts, responsibility, learning from the west, TQC concepts categorized, Goals, Habit of improvement, perfection, Basics, process control, Easy to see Quality control as facilitator, small lot sizes, Housekeeping, Less than full capacity scheduling, Daily machine checking, Techniques and Aids, Exposure of problems, Fool proof Devices, Tools of Analysis, QC Circles, TQC in Japanese-owned US Electronics plant, TQC in Japanese-owned Automotive plants.

10 Hrs

MODULE 5

Plant Configurations: Introduction-ultimate plant configuration, job shop Fabrication, Frame Welding, Forming Frame parts from Tubing, Dedicated production lines, overlapped production, the daily schedule, Forward Linkage by means of Kanban, physical merger of processes, Adjacency, mixed Models, Automated production Lines, Pseudo Robots, Robots, CAD and Manufacturing, Conveyors and stacker Cranes, Automatic Quality Monitoring.

10 Hrs

TEXT BOOKS:

1. **Japanese Manufacturing Techniques** - Richard Schonberger - Pearson Higher Education
2. **Just In Time Manufacturing** – Kargoanker (manual).

REFERENCE BOOKS:

1. **An Integrated Approach To Just In Time** - Yasuhiro Monden - Toyota Production system.
2. **Lean Thinking** - James Womack - Simon & Schuster Adult - ISBN: 0743249275, 2003.
3. **The machine that changed the World** - James P. Womack, Daniel T Jones, and Daniel Roos - The story of Lean production – by– Harper Perennial edition published -1991.

Professional Elective 3

INDUSTRIAL DESIGN AND ERGONOMICS

Sub Code	: 18 MPT 321	CIE Marks	: 40
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	SEE Marks	: 60

MODULE 1

Introduction: An approach to industrial design - elements of design structure for industrial design in engineering application in modern manufacturing systems.

Ergonomics and Industrial Design: Introduction - general approach to the man-machine relationship-workstation design-working position.

10 Hrs

MODULE 2

Control and Displays: shapes and sizes of various controls and displays-multiple displays and control situations - design of major controls in automobiles, machine tools etc., - design of furniture - design of instruments. 10 Hrs

MODULE 3

Ergonomics and Production: Ergonomics and product design ergonomics in automated systems-expert systems for ergonomic design, Anthropomorphic data and its applications in ergonomic design limitations of anthropomorphic data - use of computerized database. 10 Hrs

MODULE 4

Visual Effects of Line and Form: The mechanics of seeing psychology of seeing, general influences of lined and form.

Colour: colour and light - colour and objects - colour and the eye colour consistency - colour terms - reactions to colour and colour continuation - colour on engineering equipments. 10 Hrs

MODULE 5

Aesthetic Concepts: Concept of unity - concept of order with variety - concept of purpose style and environment - Aesthetic expressions. Style-components of style - house style, observations style in capital goods.

Industrial Design in Practice: General design - specifying design equipments - rating the importance of industrial design – industrial design in the design process. 10 Hrs

TEXT BOOKS:

1. **Industrial design for Engineers** - Mayall W.H. - LondonCliffie Books Ltd.
2. **Applied Ergonomics Hand Book** - Brien Shakel (Edited) - Butterworth Scientific,

HUMAN RESOURCE MANAGEMENT

Sub Code	: 18 MPT 322	CIE Marks	: 40
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	SEE Marks	: 60

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, Behavioral 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

TEXT BOOKS:

1. **Managing Human Resources** - Wayne F Cascio - Tata McGraw Hill, New Delhi
2. **Managing Human Resources** - George Bohlander and Scot Snell - Thompson South western.

REFERENCE BOOKS:

1. **Human Resource Management** - Biswajeet Pattanayak - Prentice Hall of India Pvt. Ltd.
2. **Human Resource Management** - K. Ashwathappa,
3. **Personnel Management** - C.B. Memoria - Himalaya Publishing.

ADVANCED FLUID POWER SYSTEMS

Sub Code	: 18 MPT323	CIE Marks	: 40
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	SEE Marks	: 60

MODULE 1

Introduction: Pascal Law, Advantages of Fluid Power, Applications of Fluid Power, Components of a Fluid Power.

Hydraulic Power Unit: Introduction, Pumping Theory, Pump Classification, Gear Pumps, (Vane Pumps- simple, balanced & pressure compensated vane pump, Vane design) Piston Pumps- Radial, Axial (Bent axis & Swash plate), Pump Performance, Pump Noise, Ripple in pumps.

Hydraulic Actuators: Linear actuator- cylinders, Mechanics of Hydraulic cylinder loading, limited rotation hydraulic actuator, cylinder cushioning, Gear, Vane & Piston motor, Motor performance, Hydrostatic transmission 10 Hrs

MODULE 2**Power Controlling Elements – Valves :**

- i) Directional Control Valves – Classification, 2/2, 3/2, 4/2 & 4/3 ways Dcv's, Different Centre configurations in 4/3 way valves, actuation of DCV's, Indirect actuation, Valve Lap – Lap during Stationary and during switching.
- ii) Pressure Control Valves: Classification, opening & Closing Pressure difference, Cracking Pressure, Pressure Relief Valve – Simple & Compound type, Pressure reducing valve, sequence, unloading & Counter balance valve, Pressure switches.
- iii) Flow Control valves – Fixed throttle, Variable throttle, Pressure Compensation principles, pressure compensated Flow control valve – Reducing & Relief type.
- iv) Check valve, Pilot operated check valve. 10 Hrs

MODULE 3

Hydraulic Circuit Design & Analysis: Control of Single & double acting cylinder, Regeneration circuit, cylinder sequencing & Synchronizing circuit. Speed control of cylinder & Motors, Analysis of Hydraulic system with frictional losses, Accumulators & accumulator circuits.

Pneumatic System: Introduction, – Generation of compressed air, air receiver, servicing FRL unit, Air filter, pressure regulation, lubricator, Pneumatic cylinder & air motor – different types of cylinder, cushion assembly. Cylinder performance.

Pneumatic Valve: Directional control valves, impulse valve, Quick exhaust valve, shuttle valve, Twin pressure valve, Time delay valve. 10 Hrs

MODULE 4

Pneumatic Circuit & Logic Circuits:- Control of single and double acting cylinder, impulse operation, speed control, sequencing, Pneumatic Vacuum system AND,OR, NOT, NAND, NOR, YES Function, Logic circuits design using shuttle valve & twin pressure valve, Binary Arithmetic, logic & Boolean Algebra, use of kannoughveitch map for pneumatic circuit design. 10 Hrs

MODULE 5

Electrical Control in Fluid Power: Contactors, & Switches, Relays, Limit switch, Electro hydraulic & Electro Pneumatic Circuits, Simple Cylinder reciprocation, interlocking using relays, Proximity switches, application of proximity switches, Time dependent will dependent and travel dependent circuits. 10 Hrs

TEXT BOOKS:

1. **Fluid Power with Application** - Anthony Esposito - Peason Education - 5th edition.
2. **Oil hydraulics -Principles & maintenance** - S.R. Majumdar - Tata M C Graw Hill

REFERENCE BOOKS:

1. **Components & Application** - Bosch Rexroth didactic - Hydraulics Trainer - vol 1. Publication
2. **Pneumatic System, Principles and Maintenance** - S.R. Majumdar - Tata M C Graw HillPublication.
3. **Pneumatics: Theory and Applications** - Bosch Rexroth didactic - Publication
4. **Electro Pneumatics** - Bosch Rexroth didactic -Vol. 2, Publication.

Professional Elective 4

PROJECT MANAGEMENT

Sub Code	: 18 MPT 331	CIE Marks	: 40
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	SEE Marks	: 60

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

TEXT BOOKS:

1. **Projects: appraisal, preparation, budgeting & implementation** – Prasannachandra - TMH
2. **Handbook of Project Management** - Dennis lock.

REFERENCE BOOKS:

1. **Project Management** - Dennis lock - GowerPublishing Ltd - 8th Revised edition.

COMPOSITE MATERIALS

Sub Code	: 18 MPT 332	CIE Marks	: 40
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	SEE Marks	: 60

MODULE 1

Introduction to composite materials: Definition, Classification, Types of matrices & reinforcements, characteristics & selection, Fiber composites, laminated composites, particulate composites, prepegs, sandwich construction 10 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. 10Hrs

MODULE 3

Manufacturing: Lay up and curing – open and closed mould processing – Hand layup 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. 10 Hrs

MODULE 4

Fabrication of Composites: Cutting, machining, drilling, mechanical fasteners & adhesive 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. 10 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 metallurgy technique, liquid metallurgy technique 10 Hrs

TEXT BOOKS:

1. **Composite Materials Handbook** - Mein Schwartz - McGraw Hill Book Company - 1984.
2. **Mechanics of Composite Materials** - AutarK.Kaw - CRC Press New York - 1stedi, 1997.

REFERENCE BOOKS:

1. **Composite Materials hand book** - Meing Schwaitz - McGraw Hill Book Company
2. **Forming Metal hand book**, ASM handbook, V15, 1988, P327-338.
3. **Composite Science and Engineering** - K.K.Chawla - Springer

ADVANCED MATERIALS & PROCESSING

Sub Code	: 18MPT 333	CIE Marks	: 40
No. of Lecture Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 50	SEE Marks	: 60

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. 10Hrs

MODULE 2

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

Non Ferrous Alloys: Alloys of copper, Aluminum, nickel, magnesium, titanium, lead, tin, Zinc - composition, heat treatment, structure, properties and application. 10Hrs

MODULE 3

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. 10Hrs

MODULE 4

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. 10Hrs

MODULE 5

Processing of Polymers: composites, ceramics - thermal spraying - Ion beam machining diamond coating techniques-tribological Applications. 10Hrs

TEXT BOOKS:

1. **Engineering Metallurgy** - Raymond and Higgens - ELBS/EA
2. **Introduction to Material Science and Engineering** - James.F.Shackelford - McMillan, NY

REFERENCE BOOKS:

1. **Powder Metallurgy-Metals Hand Book** -ASM, USA - Vol.7, 1974.
2. **Composite Materials - Science and Engineering** - Chawla K.K. ,Springer - Verlag, NY
3. **Elements of Material science and Engineering** - Van Vlack L.H. - Addison Wesley, NY