Programme: M.Tech

Production Engineering

Scheme and Syllabi

w.e.f. Academic Session 2020-21

BUEST

SCHOOL OF ENGINEERING & EMERGING TECHNOLOGIES

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Semester-I

Sr. No	Code	Course Title	L	T	P	Credit
1	PPE-101	Product Design and Development	4	0	0	4
2	PPE-102	Flexible Manufacturing system	4	0	0	4
3	PPE-103	Computer Control of Machine Tools	4	0	0	4
4	PPE-104	Production Management	4	0	0	4
5	PPE-105	Computer Control Machine Tools Lab	0	0	2	1
6	PPE-106	Project I	0	0	6	3
		Total	**16**	**0**	**8**	**20**

Total Contact hours: 24

Semester-II

Sr. No	Code	Course Title	L	T	P	Credit
1	PMA-151	Advanced Optimization Techniques	4	0	0	4
2	PMG-151	Research Methodology	4	0	0	4
3	PPE-151	Advanced Casting and Welding Technology	4	0	0	4
4	PPE-152	Quality & Reliability Engineering	4	0	0	4
5	PPE-153	Automation & Simulation Lab	0	0	2	1
6	PPE-154	Project II	0	0	6	3
		Total	**16**	**0**	**8**	**20**

Total Contact hours: 24

Semester-III

Sr. No	Code	Course Title	L	T	P	Credit
1	PPE-201	Machining & Forming	4	0	0	4
2	PPE-202	Industrial Automation and Robotics	4	0	0	4
3	PPE-203	Computer Integrated Manufacturing Systems	4	0	0	4
4	PPE-204	Ansys Lab	0	0	2	1
5	PPE-205	Pre-Dissertation	0	0	6	3
		Total	**12**	**0**	**8**	**16**

Total Contact hours: 20

Semester-IV

Sr. No	Code	Course Title	L	T	P	Credit
1	XXXXX	Elective-I	4	0	0	4
2	PPE-260	Dissertation	0	0	0	20
		Total	**4**	**0**	**0**	**24**

Total Contact hours: 4

List of Elective-I						
Sr. No	**Code**	**Course Title**	**L**	**T**	**P**	**Credit**
1	PPE-251	Composite Materials	4	0	0	4
2	PPE-252	Maintenance Engineering	4	0	0	4
3	PPE-253	Work System Design & Ergonomics	4	0	0	4
4	PPE-254	Rapid Prototyping & Reverse Engineering	4	0	0	4
5	PPE-255	Finite Element Methods	4	0	0	4

Semester-I

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Course Name:- PRODUCT DESION&DEVELOPMENT
Course Code:- PPE-101

Assessment and Evaluation Components	
Quizzes /Assignments/ Presentation/Class Test/ Open Book Test/ Case Study	25
Mid Term Tests (MTE)	20
Attendance Marks	05
End Term Examination	50
Total	**100**

L	T	P	Cr
4	0	0	4

Unit-1

Introduction: Design by Evolution and Innovation, Essential factors of product design, Production consumption cycle, Flow and value addition in Production consumption cycle, The Morphology of Design, Primary design phases and flowcharting, Role of Allowances, process capability and tolerances.

Product Design and Industry: The Designer, his role, myth and reality, the industrial design organization, basic design considerations, Role of Aesthetics in product design, Functional design practice.

Unit-2

Design for Production: Producibility Requirements in the design of machine components, Forging, Pressed component, Casting, Machining and powder metallurgical design considerations.

New Product Development: New product strategy, Product classification, development and management, new product development phases and Product life cycle, models in new product development and diffusion models.

Unit-3

Economic factors affecting Design: product value, Design for safety, Reliability and Environmental considerations, Economic analysis, profit and competitiveness, break-even analysis and economics.

Value Engineering and Product Design: Introduction, Historical perspective, Value, Nature and measurement of value, Maximum value, Normal degree of value, Importance of value, The value Analysis Job Plan, Creativity, Steps to problem solving and value analysis, Value Engg. Idea generation check list, Cost reduction, materials and process selection in value engineering.

Unit-4

Modern Approaches to product Design: Concurrent Design, Quality Function Deployment, reverse engineering.

Rapid Prototyping: Stereo lithography, Solid ground cutting, Selective laser sintering, Laminated object manufacturing, data transfer to RPT, Constraints on the Model, RPT in manufacturing, tooling, RPT in Industrial Design, Medical applications verses conventional technologies.

Text Books:

1. Product Design and Development by Kail T Ulrich and Steven D Eppinger
2. Product Design and Development by AK Chitale and Gupta
3. Design of Systems and Devices by Middendorf Marcel Dekker

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Course Name:- FLEXIBLE MANUFACTURING SYSTEMS
Course Code:- PPE-102

Assessment and Evaluation Components	
Quizzes /Assignments/ Presentation/Class Test/ Open Book Test/ Case Study	25
Mid Term Tests (MTE)	20
Attendance Marks	05
End Term Examination	50
Total	**100**

L	T	P	Cr
4	0	0	4

Unit 1

Introduction: Introduction to manufacturing system, different type of manufacturing system, volume variety relationship for understanding manufacturing system.

Flexible Manufacturing System: Components of an FMS, types of system, where to apply FMS technology, FMS work stations. Material handling and storage system: Functions of the handling system, FMS layout configuration, Material handling equipment.

Computer control system: Computer function, FMS data file, system reports planning the FMS, analysis method for FMS, application and benefits.

Unit 2

Distributed data processing in FMS: DBMS and their applications in CAD/CAM and FMS distributed systems in FMS –Integration of CAD and CAM - Part programming in FMS, tool data base - Clamping devices and fixtures data base.

Conveyors: AGVs – features of industrial robots - robot cell design and control- AS/RS.

Unit 3

Group Technology: Part families, part classification and coding. Types of classification and coding system, Machine cell design: The composite part concept, types of cell design. Determining the best machine arrangement, benefits of group technology.

Just In Time and Lean Production: Lean Production and Waste in Manufacturing, just in time production system, automation, work involvement.

Unit 4

Production Planning and control systems: Aggregate Production Planning and the master production schedule, Material Requirements and Planning, capacity planning, shop floor control, inventory control, extensions of MRP

CMM types: contact and non-contact inspection principles - programming and operation-in cycle gauging.

Text Books:

1. Paul Ranky., "The design and operation of FMS", IFS publication, 1983.
2. Mikell P Groover, "Automation Production systems, Computer Integrated Manufacturing", Prentice Hall, 1987.
3. David J. Parrish, "Flexible Manufacturing" Butterworth-Heinemann, 1990

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Course Name:- COMPUTER CONTROL OF MACHINE TOOLS
Course Code:- PPE-103

Assessment and Evaluation Components	
Quizzes /Assignments/ Presentation/Class Test/ Open Book Test/ Case Study	25
Mid Term Tests (MTE)	20
Attendance Marks	05
End Term Examination	50
Total	**100**

L	T	P	Cr
4	0	0	4

Unit-1
Introduction: Fundamental concepts in numerical control, Need of N.C. in machines tools, Its advantages, Structure of NC System
System Devices: Drives, Feedback Devices, Counting devices, DAC and ADCs

Unit-2
Part Programming: Fundamentals of part programming, numerical control procedure, Preparatory functions, Miscellaneous functions, Punched Tape formats, Block format and codes, Method of writing part program, Tool length and radius compensation, Part Programming for lathe and milling.
Advanced programming features: introduction, standardized fixed cycle/canned cycle, drill cycle, dwell cycle, peck drill cycle, bore cycle, tap cycle and their applications.

Unit-3
Automatically Programmed Tools (APT): Introduction, Programming Languages, APT language, part programming based on APT geometric definition and miscellaneous statements, Macro statement in APT.
N.C. Machine Tools: Types, Constructional details of N. C. m/c tools, MCU structure and functions, Methods of improving accuracy and productivity using NC, Problems with conventional NC.

Unit-4
Numerical Control of M/c Tools: NC, Functioning of NC, MCU Organization, CNC, DNC, Adaptive control types, Uses & benefits, Advantages of CNC, DNC their structure, Combined CNC/DNC system
Control Loops Of NC System: Control loop circuit elements in PTP system, Contouring system, Incremental and absolute systems.

Text Books:
1. Kundra, T. K., Rao, P. N. and Tewari, N. K., Numerical Control and Computer Aided Manufacture, McGraw Hill (2004).
2. Pabla, S. and Adithan, M., CNC Machines, New Age International (P) Ltd. (1994).
3. Koren, Y. and Benuri, J., Numerical Control of Machine Tools, Khanna Publishers (2005).
4. Groover, M. P. and Zimmers, E. W., CAD/CAM, Prentice Hall of India (1997).

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Course Name:- PRODUCTION MANAGMENT
Course Code:- PPE-104

Assessment and Evaluation Components	
Quizzes /Assignments/ Presentation/Class Test/ Open Book Test/ Case Study	25
Mid Term Tests (MTE)	20
Attendance Marks	05
End Term Examination	50
Total	**100**

L	T	P	Cr
4	0	0	4

Unit-1

Introduction: Production System, Objectives of Production Management, History and Development of Production Management, Function and scope, Production Management Frame Work, Types of Production, Classification of Production System, Organization Structure for production function.

New Product Design and Forecasting: Product Life Cycle, Product Policy, Product Design Process, Product Analysis; Need for demand Forecasting, Long term and short term forecasts, Classifications of forecasting methods, Costs and Accuracy of Forecasts.

Unit-2

Material Requirement Planning (MRP)& Capacity Planning: Introduction, Objectives, Functions, System, Lot sizing considerations, Manufacturing Resource Planning (MRP-II); Measurement of capacity, Capacity Planning, Estimating future capacity needs, Factors, Aggregate Planning, Master Production Schedule, Numericals.

Production Planning & Control (PPC): Introduction, Need for PPC, Objectives, Functions, Production Procedure, Organization, Problems.

Unit-3

Inventory Control& Batch Production: Introduction, types of inventory, Inventory Control, Cost relationships, Inventory Models, Safety Stock, Inventory Control System; characteristics of batch production, determination of batch sizes, minimum cost batch size, maximum profit batch size Numericals.

Maintenance Management& Make of Buy Decision: Introduction, Objectives, Costs, Types, Preventive Maintenance System, Basic Maintenance decisions, Maintenance Performance Measurement, Factors influencing make or buy decisions, functional aspects.Numericals.

Unit-4

Advanced topics in Production Management: Total Quality Management (TQM): TQM Approach, Stages, techniques; Business Process Engineering (BPR): Need, steps, process of BPR; Group Technology (GT): Group Layout, Stages, Benefits; Just in Time (JIT) Manufacturing: Basic Elements, Philosophy, Kanban System, Implementation; Materials Management: Objectives, Scope, Intergrated Materials Management, Supply chain management strategies, stages of development of buyers and suppliers relationship.

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Text Books:

1. Pr Alan Mulhlemann and others "Production and Operation Management" 6th Edition, ELBS Pitman Publishing (1994)
2. Montgomery D.C. and L.A. Johnson, Forecasting and time series analysis, McGraw Hill, New York.
3. Orlicky Joseph A. Material Requirements Planning, McGraw Hill, New York.
4. Starr and Miller, Inventory Control Theory and Practice, Prentice Hall of India, New Delhi
5. Martand Telsang, "Industrial Engineering and Production Management" S.Chand, New Delhi

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Course Name:- COMPUTER CONTROLOFMACHINE TOOLS LAB
Course Code:- PPE-105

Evaluation Components for Practical Courses **(Students are required to perform atleast 8 practicals mandatorily from the given list of practicals)**	
Lab Performance	10
Lab File Work	10
Viva-Voce	10
Total	**30**

L	**T**	**P**	**Cr**
0	**0**	**2**	**1**

EXPERIMENTS:

1. Study the structure and different parts of NC/CNC machine.
2. Study the different preparatory and miscellaneous functions used for part programming of NC/CNC machine.
3. Write a program for point to point machining using G-codes and M-codes.
4. Write a program for continuous machining using G-codes and M-codes.
5. Write a program for linear and circular interpolation using cutter radius compensation on lathe machine.
6. Write program on lathe machine for different operations like Facing, turning and Thread cutting.
7. Write a program for linear and circular interpolation using cutter radius compensation on milling machine.
8. Write a part program on lathe and milling machine using APT format.
9. Study about die designing in CAD software and generate machining codes using CAD-CAM integration.
10. Use simulation software for CNC and do simulations of part program on lathe and milling machine.

Text Books:

1. Kundra, T. K., Rao, P. N. andTewari, N. K., Numerical Control and Computer Aided Manufacture, McGraw Hill (2004).
2. Pabla, S. and Adithan, M., CNC Machines, NewAgeInternational (P)Ltd. (1994).
3. Koren, Y.and Benuri,J., Numerical Control of Machine Tools, Khanna Publishers (2005).
4. Groover, M. P. andZimmers, E.W., CAD/CAM, PrenticeHallofIndia(1997).

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

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Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Semester-II

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Course Name:- ADVANCED WELDING AND CASTING TECHNOLOGY
Course Code:- PPE-104

Assessment and Evaluation Components	
Quizzes /Assignments/ Presentation/Class Test/ Open Book Test/ Case Study	25
Mid Term Tests (MTE)	20
Attendance Marks	05
End Term Examination	50
Total	**100**

L	T	P	Cr
4	0	0	4

Unit-1

Investment Casting: Introduction, Pattern and Mould Materials used, Techniques and Production of Investment Moulds, Shaw Process, Full Mould Process, applications of Investment Casting Process.

Die Casting : Die Casting Machines- Gravity and Pressure Die Casting, Cold and Hot Chamber, Operation and Details, Die Materials, advantages of Die Casting.

Unit-2

Shell Moulding : Various Special Casting Techniques-Shell Moulding Machines, Pattern Equipment, Sands, Resins and other Materials used for Shell Moulding, application of Shell Moulding, advantages of Shell Moulding over other Methods of Moulding.

Centrifugal casting : Types of Centrifugal Casting Processes-calculation of Mould Rotary Speeds, Techniques, equipments and Production Processes, advantages and limitations of Centrifugal Casting Methods.

Unit-3

Special Welding Processes: Gas tungsten arc (TIG) welding, Gas metal arc (MIG)welding, submerged arc welding, electro slag welding processes, power sources and other characteristics for these individual processes, equipments and accessories, application and limitation of each process. Resistance welding processes-their principle-Types (spot, seam, projection, percussion, flash) - Equipments required for each application.

Unit-4

Modern Welding Processes: Electron beam welding, laser beam welding, Plasma arc welding, friction welding, explosive welding, ultrasonic welding, stud welding, under water welding, diffusion bonding, cold welding, welding of dissimilar metals – equipments and accessories, application and limitation of each process.

Text Books:

1. AWS Welding Handbooks, AWS, New York, 1995
2. Srinivasan.N.K., *Welding Technology*, Khanna Publications, Delhi, 1995.
3. Clegg. A J., *Precision Casting Processes*, Pergamon Press, London, U.K, 1991.
4. Heine, Loper And Rosenthal, *Principles of Metal Casting*, Tata McGraw-Hill Publishing's Co., Ltd, New Delhi, 1995.

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Course Name:- QUALITY & RELIABILITY ENGINEERING
Course Code:- PPE-152

Assessment and Evaluation Components	
Quizzes /Assignments/ Presentation/Class Test/ Open Book Test/ Case Study	25
Mid Term Tests (MTE)	20
Attendance Marks	05
End Term Examination	50
Total	**100**

L	T	P	Cr
4	0	0	4

Unit-1

Introduction: Quality- meaning and significance, Essential components of quality, Phases or elements for building quality, Evolution of the concepts of quality, Spiral of progress of quality, Changing scope of quality activities, Ishikawa's seven quality tools, Quality Circles, Quality system economics, Hidden quality costs, Economic models of quality costs.

Taguchi's Quality Loss Function; System approach for quality management, Juran's quality trilogy, Quality planning activities, Sporadic and chronic quality problems, Causes of variation, General quality control methodology.

Unit-2

Statistical quality control; Control charts for variables: X bar-R, X bar-S, median, X-MR charts, Control charts for attributes: p, np, c charts, Product reliability, and Process capability analysis.

Acceptance Sampling: Introduction, Advantages and Disadvantages, Operating Characteristics curve, Producer's and consumer's risk, Quality indices for acceptance sampling plans, Types of sampling Plans-single double sequential sampling plan, Sampling plan for variable, continues sampling plans, Skip lot sampling plans, Chain sampling plan.

Unit-3

Total Quality Management: Introduction, Concept of Total quality, Quality function Deployment tools for continuous quality improvement, The ISO 9000 family of standards, Six sigma and other extensions of TQM.

Unit-4

Reliability: Introduction, Factor effecting Reliability, Failure and its types, Failure curve, Majors of reliability, MTBF, MTTF, Relationship b/w reliability failure rate and MTBF and its characteristics.

Reliability Prediction and Analysis: Reliability prediction based on Exponential Distribution; System Reliability analysis, components in series and parallel, Block diagram method, fault tree and sconces tree methods, event tree method, failure mode, failure mechanisms.

Text Books:

1. Juran and Gryna, Quality Planning & Analysis, McGraw Hill (2001).
2. Grant, E. L., Statistical Quality Control, McGraw Hill (2008).
3. Feignbaum, Total Quality Control, McGraw Hill (1991).
4. Juran, Juran, Quality Control Handbook, McGraw Hill (1988).
5. Lt Gen H.Lol TOTAL QUALITY MANAGEMENT Wiley western ltd.1990

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Course Name:- AUTOMATION & SIMULATION LAB
Course Code:- PPE-153

Evaluation Components for Practical Courses **(Students are required to perform atleast 8 practicals mandatorily from the given list of practicals)**	
Lab Performance	10
Lab File Work	10
Viva-Voce	10
Total	**30**

L	**T**	**P**	**Cr**
0	**0**	**2**	**1**

EXPERIMENTS:

1. Study of different types of hydraulic/Pneumatic valves, actuators, sensor.
2. Design of hydraulic circuits for controlling single acting and double acting cylinder.
3. Design a Hydraulic Cylinder Sequencing circuit.
4. Simulation of Electro hydraulic/ Electro pneumatic circuits using suitable software.
5. Design of various pneumatic circuits, Electro pneumatic.
6. Exercise on flexible automation using PLC, different sensors and actuators
7. Exercise on control of electrical motors using microcontroller / microprocessor.
8. Simulation of Robotic system for automation using a suitable software
9. Study of different kind of conveyor and material handling systems.

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Semester-III

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Course Name:- MACHINING & FORMING
Course Code:- PPE-201

Assessment and Evaluation Components	
Quizzes /Assignments/ Presentation/Class Test/ Open Book Test/ Case Study	25
Mid Term Tests (MTE)	20
Attendance Marks	05
End Term Examination	50
Total	**100**

L	T	P	Cr
4	0	0	4

Unit-1

Metal cutting: Introduction, system of Tool nomenclature, Tool Geometry, Mechanism of Chip, formation and forces in orthogonal cutting, Merchant's force diagram.

Oblique Cutting: Normal chip reduction coefficient under oblique cutting, true shear angle, effective rake, influx region consideration for deformation, direction of maximum elongation, effect of cutting variables on chip reduction coefficient, forces system in oblique cutting, effect of wear land on force system, force system in milling, effect of helix angle.

Unit-2

Abrasive Machining: Mechanics of grinding, cutting action of grit, maximum grit chip thickness, energy and grit force temperature during grinding, wheel wear, grinding, process simulation, testing of grinding wheels, mechanics of lapping and honing, free body abrasion.

Unit-3

Plasticity – True stress and true strain, true stress-strain curves, selection of stress-strain curves for coldand hot working, yield of isotropic plastic material, yield criteria. Tresca maximum sheer-strainenergy criterion, plastic incompressibility, Poisson's ratio for plastic deformation flow rule, strain hardening function, heat generation and heat transfer in metal forming processes, temperatures in Quasi continuous forming operations.

Unit-4

Lubrication: Lubrication in metal forming processes, principles and mechanism of lubrications, hydrodynamic and their film lubrication, boundary and extreme pressure lubricants, solid lubricants, lubricants used for rolling and cold drawing, forging, extrusion and deep drawing processes; defects in various metal forming processes like rolling, forging, extrusion, wire drawing and deep drawing and their causes and remedial measures.

Theory and calculation of manufacturing processes: deep drawing of circular blanks, analysis of the process, prediction of radial stress and punch load, ironing, wrinkling, blank holding and various parameters/variables affecting the deep drawing process.

Text Books:

1. Benedict G.F, Marcel Dekker, Non Traditional Manufacturing Processes.
2. Kalpakjian, Manufacturing Processes for Engineering Materials, Addition Wesley. HMT, Production Technology, Tata Mc. Graw Hill, New Delhi.
3. P.C.Pandey, H.S.Shan, Modern Machining Processes, Tata McGraw Hil

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Course Name:- INDUSTRIAL AUTOMATION & ROBOTICS
Course Code:- PPE-202

Assessment and Evaluation Components	
Quizzes /Assignments/ Presentation/Class Test/ Open Book Test/ Case Study	25
Mid Term Tests (MTE)	20
Attendance Marks	05
End Term Examination	50
Total	**100**

L	T	P	Cr
4	0	0	4

Unit-1

Automated manufacturing systems: Fixed/Programmable/Flexible Automation, need; Basic elements of automated systems- program and control; advanced automation functions, Levels of automation, industrial control systems in process and discrete manufacturing industries, Continuous and discrete control; Low cost automation, Economic and social aspects of automation.

Transfer Lines: Fundamentals, Configurations, Transfer mechanisms, storage buffers, control, applications; Analysis of transfer lines without and with storage buffers.

Unit-2

Assembly Automation: Types and configurations, Parts delivery at workstations- Various vibratory and non-vibratory devices for feeding and orientation, Calculations of feeding rates, Cycle time for single station assembly machines and partially automated systems; Product design for automated assembly.

Unit-3

Fundamentals of Industrial Robots: Specifications and Characteristics, Basic components, configurations, Criteria for selection, various industrial applications. Robotic Control Systems: Drives, Robot Motions, Actuators, Power transmission systems; Robot controllers, Dynamic properties of robots- stability, control resolution, spatial resolution, accuracy, repeatability, compliance.

Unit-4

Robotic End Effectors and Sensors: Transducers and sensors- sensors in robotics and their classification, Touch (Tactile) sensors, proximity and range sensors, force and torque sensing, End Effectors- Types, grippers, Various process tools as end effectors; Robot-End effectors interface, Active and passive compliance, Gripper selection and design

Robot Programming: Lead through method, Robot program as a path in space, Methods of defining positions in space, Motion interpolation, branching; Textual robot programming languages.

Text Books:

1. Groover, M.P., (2004), "Automation, Production Systems & Computer Integrated Manufacturing" 2/e, (Pearson Edu.) ISBN: 81-7808-511-9
2. Niku, Saeed B. (2002), "Introduction to Robotics, Analysis, Systems & Applications" , (Prentice Hall of India).
3. Morris, S.Brian (1994), "Automated Manufacturing Systems", (McGraw Hill) ISBN: 0-07-13999-
4. Schilling, Robert J.(2004), "Fundamentals of Robotics, Analysis & Control", (Prentice Hall of India), ISBN: 81-203-1047-0

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Course Name:- COMPUTER INTEGRATED MANUFACTURING SYSTEMS
Course Code:- PPE-203

Assessment and Evaluation Components	
Quizzes /Assignments/ Presentation/Class Test/ Open Book Test/ Case Study	25
Mid Term Tests (MTE)	20
Attendance Marks	05
End Term Examination	50
Total	**100**

L	T	P	Cr
4	0	0	4

Unit-1

Introduction: Types of production systems and their automation. CAD/CAM integration. Concept of FMS and CIMS.

Elements of a General CIM System: Types of CIM systems. CAD-CAM link for CIMS. Benefits of CAM, FMS and CIMS. Automated material handling systems, equipment and their functions. Integration of Robots in CIMS, Automatic Storage and Retrieval Systems (AS/RS).

Unit-2

Rapid Prototyping, and Rapid Tooling: Introduction to Rapid Prototyping, and Rapid Tooling, Reverse Engineering. Concepts of concurrent engineering. Product life cycle management.

Group Technology: Concept and terminology, Part family formation, Classification and coding systems for components, Group Technology machine cells.

Unit-3

Computer Aided Process Planning: CAPP and route sheet development, CAPP system, Computer aided plant layout.

Computer Aided Production Planning and Control: Inventory control and MRP. Computer aided shop floor control, process monitoring. Computer aided Inspection & Quality Control. Shop floor data collection systems, Shop floor control, Sensors used, Tool management system, automatic identification systems, Barcode system.

Unit-4

Introduction to fundamentals of computer communications: Networking, Computer-machine-personnel communication links. Network architectures & techniques. Information flow in networks, Network standards.

CIM Database and Database Management Systems: Types, Management Information System, Manufacturing data preparation.

Text Books:

1. Groover, M. P. and Zimmers, E. W., CAD/ CAM, Pearson Education Asia (2008).
2. Groover, M. P., Automation, Production systems and Computer Integrated Manufacturing, Pearson Education Asia (2009).
3. Vajpayee, S. K., Principles of Computer Integrated Manufacturing, Prentice Hall (1999).
4. Rao, P. N., Tewari, N. K. and Kundra, T. K., Computer Integrated Manufacturing, McGraw Hill (1995).
5. Mitchell, H., CIM Systems -An Introduction to Computer Integrated Manufacturing, Prentice Hall (1991).
6. Rehg, J. A. and Kraebber, H. W., Computer Integrated Manufacturing, Pearson Education Asia (2002).

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Course Name:- ANSYS LAB
Course Code:- PPE-204

Evaluation Components for Practical Courses **(Students are required to perform atleast 8 practicals mandatorily from the given list of practicals)**	
Lab Performance	10
Lab File Work	10
Viva-Voce	10
Total	**30**

L	**T**	**P**	**Cr**
0	**0**	**2**	**1**

EXPERIMENTS:

1. Stress analysis of a plate with a circular hole.
2. Stress analysis of rectangular L bracket
3. Stress analysis of an axi-symmetric component
4. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
5. Mode frequency analysis of a 2 D component
6. Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
7. Harmonic analysis of a 2D component
8. Thermal stress analysis of a 2D component
9. Conductive heat transfer analysis of a 2D component.
10. Convective heat transfer analysis of a 2D component

Text Books:

1. Introduction to Ansys 10.0, by Dr. R.B. Choudhary, I.K.International Publishing house.
2. Finite Element Analysis: Theory and Applications with ANSYS, Moaveni,S., Prentice-Hall, 3rd edition.
3. Engineering analysis with ANSYS software, by TadeuszStolarski, Y. Nakasone, S.
4. Yoshimoto, Butterworth Heinemann publishers

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

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Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Semester-IV
(Elective-I)

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Course Name:- COMPOSITE MATERIALS
Course Code:- PPE-251

Assessment and Evaluation Components	
Quizzes /Assignments/ Presentation/Class Test/ Open Book Test/ Case Study	25
Mid Term Tests (MTE)	20
Attendance Marks	05
End Term Examination	50
Total	**100**

L	T	P	Cr
4	0	0	4

Unit-1

Introduction to Composites: History and categorization of composite into particle- and- fiber-reinforced systems, Fibers, Matrix, Reinforcement/matrix interface, polymer matrix composites, Metal Matrix Composites, Ceramic Matrix Composites, Carbon - Carbon Composites, Cement Matrix Composites, Applications of fiber reinforced structural composites. Aramid Aluminium Laminates.

Nature of fiber reinforcement: glass, carbon, Kevlar and whiskers, Fabrics, Fillers, Matrix materials (thermosets, thermoplastics and metal alloys) and Fiber/Matrix Adhesion.

Unit-2

Properties and processing: Comparison of mechanical properties with other engineering materials. Structures and processing for laminated structures, Press Moulding Processes, Filament Winding, the Pultrusion process for continuous Automated Manufacture of Engineered Composite Profiles and Processing thermoplastic matrix composites.

Environment and testing: Environmental Effects and Non Destructive Testing (NDT) of composites, High Strength, High temperature composite materials. Design Methodology and Practices in Composite Materials Design.

Unit-3

Strength of Composites: Micro mechanics of fiber and particle reinforced composites. Prediction of elastic components. Strength of Composites parallel and perpendicular to fibers, Krenchel Coefficients. Load transfer in composites, interfacial shear, critical fiber lengths, critical aspect ratio. Inter- laminar shear strength.

Unit-4

Laminates: Fracture and Damage Mechanics in Laminated Composites; Damage classification and failure mechanisms, Free edge delamination, stiffness loss in laminae due to damage.

Toughness of composites: Cook- Gordon effect, fracture energy of cross-laminated composites. Fatigue and creep of composites, S-N Curves, residual strength.

Prefered Readings

1. *Modern Composite Materials*, L.J. Broutman and R.M.Krock, Addison- Wesley.
2. *Composite Materials- Science & Engineering*, K. K. Chawla, Springer- Verlag, New York.
3. *Mechanisms and Mechanics of Composite Fracture*, R. B. Bhagat, S.G. Fishman,R.J. Arsenault, ASM Intrenationals,1993.
4. *Composite Materials- Science & Engineering*, K. K. Chawla, Springer- Verlag, New York.
5. *Mechanisms and Mechanics of Composite Fracture*, R. B. Bhagat, S.G. Fishman,R.J. Arsenault, ASM Intrenationals,1993.

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Course Name:- MAINTENANCE ENGINEERING
Course Code:- PPE-252

Assessment and Evaluation Components	
Quizzes /Assignments/ Presentation/Class Test/ Open Book Test/ Case Study	25
Mid Term Tests (MTE)	20
Attendance Marks	05
End Term Examination	50
Total	**100**

L	T	P	Cr
4	0	0	4

Unit-1

Introduction: Evolution of maintenance, objective of maintenance, maintenance policies and philosophies, maintenance concept, maintenance management &tero technology, relationship with other functional areas, importance of maintenance, elements of good maintenance, economics of maintenance, training and safety aspects in maintenance.

Classification: Classification of maintenance programs, corrective preventive and predictive maintenance, comparison of maintenance programs, preventive maintenance-concept, functions, benefits, limitations.

Unit-2

Condition Based Maintenance : Objectives, what to monitor, when to monitor, principles of CBM, condition based maintenance techniques, manual inspections, performance monitoring, vibration monitoring, current monitoring, coil debris/spectroscopy, thermography and corrosion monitoring, steps in implementation of CBM, benefits of CBM.

Reliability Centered maintenance: RCM logic, maintenance and RCM, benefits of RCM, total productive maintenance (TPM), introduction, key supporting elements of TPM, methodology, evaluation and benefits.

Unit-3

Purpose And Challenges: Techniques, visual aids-boroscopes, endoscopes, fiber optics scanners, magnetic particles inspection, liquid penetrants, eddy current, ultrasonic radiography, selection of NDT technique, metrits/demerits and applications of various techniques.

Planing and control: Basic ingredients, basic steps in maintenance management, maintenance planning and control system, documentation, maintenance-productivity areas for improvement

Unit-4

Maintenance techniques: Techniques for improvement of operational reliability, safety and availability of machines and production systems, maintainability criteria, checklist to assess the maintainability of a system, maintainability programs, objectives, key issues in availability improvements program, fault diagnosis, Pareto principle Ishikawa diagram.

Text Books:

1. Maintenance Planning and Control by Higgin L.R., McGiaw Hill Book Co1,1900
2. Maintenance Planning and Control by Kelly Anthony, East West Press Private Ltd, New Delhi, 1991.
3. Maintainability principle and practices by Blanchard B.S. and Lowey E.E.McGrawHill Book co.
4. Practical NOT by Raj B. Jaya Kumar T and Thavasimulyi K., Narora Publishing House, New Delhi, 1996.
5. Engineering Maintenance Management by Niebel Benjamin W. Marcel Dekhe Engineering Maintenance Management by Niebel Benjamin W. Marcel Dekhe

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Course Name:- WORK SYSTEM DESIGN AND ERGONOMICS
Course Code:- PPE-253

Assessment and Evaluation Components	
Quizzes /Assignments/ Presentation/Class Test/ Open Book Test/ Case Study	25
Mid Term Tests (MTE)	20
Attendance Marks	05
End Term Examination	50
Total	**100**

L	T	P	Cr
4	0	0	4

Unit-1

Work Study Fundamentals: Productivity and Work Study, Definitions, Scope, and History of Work Study, Analysis of Work Content, Introduction to Industrial Engineering and productivity, Measurement of productivity.

Method Study: Process Analysis, Process and Activity Charts, Operation Analysis, Basic procedure, Micro Motion Study, Principles of Motion Economy.

Unit-2

Work Measurement: Purposes and uses, Basic procedure, Techniques – Work Sampling, Stop-Watch Time Study, Rating and Allowances, Setting Standard Times for Jobs, Standard Data, predetermined motion system, Job evaluation of merit rating. Wage incentive plans, MTM.

Ergonomics: Fundamental Concepts, Issues in Work system Design, Measuring Work by Physiological means, Work Posture, Fatigue Measurement and Evaluation, Environmental Factors and Work Systems, Industrial Product Design, Development of ergonomics.

Unit-3

Design Approach: A new design, modification, of existing design, assessment of design. Limitation of man and machine with respect to each other, Posture-standing at work, Seated at work, Work station heights and seat geometry, Human anthropometry and its use in work place layout Analysis.

Work Load: Static and dynamic muscular work, Human motor activity, Metabolism, Physical work load, Measurement of physical work load, Mental work load, Measurement of mental work load, Repetitive and inspection work, Work duration and rest pauses, Principles of motion economy, Analysis.

Unit-4

Climates Heat Humidity: Body heat balance, Effective temperature scales, Zones of discomfort, Effect of heat on body and work performance. Vibration: Terminology, Response of body to low frequency (LF) vibration, Vibrations and discomfort, effect on health of worker, high frequency vibration, effect of H.F. vibrations, methods of reducing vibrations, analysis.

Noise: Terminology, Physiological effects of noise, Annoyance of noise, Speed interference, Hearing loss, Temporary and permanent thresh hold shift, Effect of noise on performance, Reduction of noise, Personal noise protection.

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Text Books:

1. Worstudy and Ergonomics-ILO
2. Introduction of Ergonomics – Bridger- Tata McGraw Hill-1995.
3. Sound, Noise and Vibration Control- Lyle, F.Yerges-Van Nostrand-1978.

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Course Name:- RAPID PROTOTYPING AND REVERSE ENGINEERING
Course Code:- PPE-254

Assessment and Evaluation Components	
Quizzes /Assignments/ Presentation/Class Test/ Open Book Test/ Case Study	25
Mid Term Tests (MTE)	20
Attendance Marks	05
End Term Examination	50
Total	**100**

L	T	P	Cr
4	0	0	4

Unit-1

Introduction: Classification of manufacturing processes, Different Manufacturing Systems, Introduction to Rapid Prototyping (RP), Need of RP in context of batch production, FMS and CIM and its application.

Unit-2

Rapid prototyping process: Basic Principles of Generative Manufacturing Processes. Steps in RP, Process chain in RP in integrated CAD-CAM environment, Advantages of RP; Need & Techniques, Data collection, Point-Cloud of data. Utility of Rapid Prototyping in Reverse Engineering.

Unit-3

Classifications Of Different RP Techniques: based on raw material, layering technique (2D or 3D) and energy sources; Process Technology and Comparative study of: - Stereo-lithography (SL) with photo-polymerization, SL with liquid thermal polymerization, Solid foil polymerization, Selective laser sintering, Selective powder binding, Ballastic particle manufacturing – both 2D and 3D, Fused Deposition Modelling, Shape Melting, Laminated Object Manufacturing, Solid Ground Curing, Repetitive Masking and deposition, Beam Inference Solidification, Holographic Interference Solidification.

Unit-4

Use of Computer for RP: Special Topic on RP using metallic alloys. Programming in RP, Modelling, Slicing, Internal Hatching, Surface Skin Fills, Support Structure

Text Books:

1. Rapid Prototyping And Tooling, KarunakaranK.P, Vijay P Bapat, Ravi B, Rapid Prototyping Cell,IIT-Mumbai
2. Rapid Prototyping: Theory And Practice by Ali K Kamrani Publisher: Springer

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.

Course Name:- FINITE ELEMENT METHODS
Course Code:- PPE-255

Assessment and Evaluation Components	
Quizzes /Assignments/ Presentation/Class Test/ Open Book Test/ Case Study	25
Mid Term Tests (MTE)	20
Attendance Marks	05
End Term Examination	50
Total	**100**

L	T	P	Cr
4	0	0	4

Unit-1

Introduction: Field Conditions, Boundary conditions, Approximate solutions

Basic Principles of structural Mechanics: Equilibrium conditions, Strain displacement relations, Linear constitutive relations, Principle of virtual work, Energy principles, Application to finite element method

Unit-2

Element Properties: displacement models, Relation between the nodal degrees of freedom and generalized coordinates, convergence requirements, Natural coordinate systems, Shape functions (interpolation functions), element strains and stresses, Element stiffness matrix, Static condensation

Unit-3

Isoparametric Elements: Two- dimensional Isoparametric elements, computation of stiffness matrix for isoperimetric elements, convergence criteria for isoparametric element.

Direct Stiffness Method of Analysis: Solution Technique, Assemblage of elements, direct stiffness method, Gauss elimination and matrix decomposition.

Unit-4

Analysis of Framed Structures- Two dimensional truss element, Three dimensional truss-element, Tree dimensional beam element.

Plane Stress and Plane Strain analysis: Triangular elements, Rectangular elements, Isoperimetric elements, Incompatible displacement models.

Text Books:

1. Finite Element Analysis- C S Krishnamoorthy
2. Material management- D. S. Ammer & Richard Erwin Inc
3. Concepts and Applications of Finite Element analysis- Cook
4. Basic Programs in Finite Element Method- David K Brown

Note for End Term Examination: Attempt five questions in all, selecting one question each from the sections A, B, C and D. Section E is compulsory.