SCHEME & SYLLABI

OF

M.TECH.
MANUFACTURING TECHNOLOGY & AUTOMATION

w.e.f. 2018 -2019
(as per AICTE model scheme)
(With New Codes w.e.f. 2024-25)

DEPARTMENT OF MECHANICAL ENGINEERING

J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD

J.C. Bose University of Science and Technology, YMCA, Faridabad

(A Haryana State Govt. University)

VISION

J.C. Bose University of Science and Technology, YMCA, Faridabad aspires to be a nationally and internationally acclaimed leader in technical and higher education in all spheres which transforms the life of students through integration of teaching, research and character building.

MISSION

- To contribute to the development of science and technology by synthesizing teaching, research and creative activities.
- To provide an enviable research environment and state-of-the-art technological exposure to its scholars.
- To develop human potential to its fullest extent and make them emerge as world class leaders in their professions and enthuse them towards their social responsibilities.

Department of Mechanical Engineering

VISION

To be a centre of excellence by producing high caliber, competent and self-reliant mechanical engineers, who possess scientific temperament and would engage in activities relevant to industries with ethical values and flair to research.

MISSION

- To provide efficient engineers for global requirements by imparting quality education.
- To explore, create and develop innovations in various aspects of engineering through industries and institutions.
- To emphasize on practical skills and socially relevant technology.

ABOUT THE DEPARTMENT

J.C. Bose University of Science and Technology, YMCA, Faridabad established in 2009, formerly known as YMCA Institute of Engineering, Faridabad, was established in year 1969 as a Joint Venture of Govt. of Haryana and National Council of YMCAs of India with active assistance from overseas agencies of West Germany to produce highly practical oriented personnel in specialized fields of engineering to meet specific technical manpower requirements of industries. Mechanical Engineering Department was started in 1969 and has been conducting 4 years B.Tech. Course in Mechanical Engineering since 1997 with an intake of '60' students and subsequently, it was increased to '75' in 1999, '90' in 2004 and '120' in 2007. Students are admitted through centralized counseling conducted by State Government. Presently, the total intake for the B.Tech. programme is 120 and 12 through LEET in second year along with B.Tech. Mechanical Engineering in Regional Language with an intake of 30. Besides B.Tech. in Mechanical Engineering, B.Tech. in Robotics and Artificial Intelligence has also been started with an intake of 30 since 2021. The department is also running M.Tech. in Manufacturing Technology and Automation, M.Tech. in Environment and Energy with an intake of 18 each and PhD programmes. All programmes are duly approved by AICTE/ UGC. All eligible programmes are NBA accredited. The department has started minor degree in 'Robotics' and 'Industry 4.0' from session 2023-24 and 2024-25 onwards respectively. The Mechanical Engineering Department has been well known for its track record of employment of the pass out students since its inception.

The Department has a separate building with ICT enabled class rooms, state of the art laboratories, research lab, workshops, seminar room, conference hall and departmental library. It has established Centre of Excellences with M/s Daikin (P) Ltd. in the field of 'Refrigeration and Air Conditioning'. It has well qualified and experienced faculty. The syllabi of UG/PG courses in Mechanical Engineering Department have been prepared with active participation from Industry. The Department is organizing number of expert lectures from industry experts for students in every semester. One semester Industrial training is mandatory for every B.Tech. student. Emphasis has been given on project work and workshop for skill enhancement of students. Choice based credit system (CBCS) allows students to study the subjects of their choice from a number of elective & audit courses.

PROGRAMME OUTCOMES (POs)

M.Tech. Engineering students will have following capabilities:

PO1 An ability to independently carry out research /investigation and development work to solve practical problems of Manufacturing Technology and Automation Engineering.

PO2 An ability to write and present a substantial technical report/document.

PO3 Students should be able to demonstrate a degree of mastery in the area of Manufacturing Technology and Automation Engineering. The mastery should be at a level higher than the requirements in the bachelor program of Mechanical Engineering.

PO4 An ability to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data for the solution of complex problems of manufacturing industries/institutions.

PO5 An ability to develop and apply computer-based software and hardware tools for the analysis of problems related to mechanical design, manufacturing and automation fields.

PO6 An ability to apply the acquired knowledge to assess societal, safety, ethical issues and subsequently design / develop mechanical equipments and systems.

J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD

M.TECH. (MANUFACTURING TECHNOLOGY & AUTOMATION)

Curriculum Structure – Semester-wise

First Semester:

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
MEP-207-V	Computer Integrated Manufacturing	3-0-0	3	25	75	Core-I
MEP-109-V	Welding & Allied Process ***(Common with M.Tech.-Mechanical Engineering, Manufacturing& Automation)***	3-0-0	3	25	75	Core-II
	Discipline specific Elective-I	3-0-0	3	25	75	Programme Elective-I
	Discipline specific Elective-II	3-0-0	3	25	75	Programme Elective-II
MAP-125-V	Manufacturing & Automation Lab-I	0-0-4	2	15	35	Core
MAP-127-V	Manufacturing & Automation Lab-II	0-0-4	2	15	35	Core
VAC-301-V	Research Methodology and IPR	2-0-0	2	25	75	Core
	Audit Course - 1	2-0-0	0	-	-	Audit
	Total	**16-0-8**	**18**	**155**	**445**	

Discipline specific Elective-I

MEP-113-V	Design, Planning & Control of Production Systems ***(Common with M.Tech.-Mechanical Engineering, Manufacturing & Automation)***
MEP-103-V	CAD/CAM ***(Common with M.Tech.-Mechanical Engineering, Manufacturing & Automation)***
MAP-111-V	Total Quality Management
MAP-113-V	Supply Chain Management

Discipline specific Elective-II

MAP-115-V	Foundry Technology
MAP-117-V	Robotics Engineering
MAP-119-V	Machine Tool Dynamics
MAP-121-V	Metal Forming Analysis ***(Common with M.Tech.-Mechanical Engineering Design, Machine Design, Manufacturing & Automation)***
MAP-123-V	Mechatronics Product Design

Audit course 1 & 2

AEC-301-V	English for Research Paper Writing
VAC-302-V	Disaster Management
AEC-302-V	Sanskrit for Technical Knowledge
VAC-303-V	Value Education
VAC-112-V	Constitution of India
VAC-304-V	Pedagogy Studies
AEC-317-V	Stress Management by Yoga
AEC-304-V	Personality Development through Life Enlightenment Skills

Second Semester:

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
MAP-102-V	Manufacturing Technology	3-0-0	3	25	75	Core-III
MAP-104-V	Automation in Manufacturing	3-0-0	3	25	75	Core-IV
	Discipline specific Elective-III	3-0-0	3	25	75	Programme Elective-III
	Discipline specific Elective-IV	3-0-0	3	25	75	Programme Elective-IV
MAP-118-V	Manufacturing & Automation Lab-III	0-0-4	2	15	35	Core
MAP-120-V	Manufacturing & Automation Lab-IV	0-0-4	2	15	35	Core
	Audit Course – 2	2-0-0	0	-	-	Audit
MAP-122-V	Mini-Project	0-0-4	2	25	75	Core
	Total	**14-0-12**	**18**	**155**	**445**	

Discipline specific Elective-III

MAP-106-V	Project Management
MAP-108-V	Mechanical Behavior of Materials
MAP-110-V	Principles of Management
MAP-112-V	Finite Element Methods

Discipline specific Elective-IV

MAP-114-V	Material Management ***(Common with M.Tech.-Manufacturing & Automation)***
MEP-124-V	Quality Control Techniques ***(Common with M.Tech.-Mechanical Engineering, Manufacturing & Automation)***
MAP-116-V	Artificial Intelligence
MEP-120-V	Industrial Inspection ***(Common with M.Tech.-Mechanical Engineering, Manufacturing & Automation)***

Third Semester:

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
	Discipline specific Elective-V	3-0-0	3	25	75	Programme Elective-V
	Open Elective	3-0-0	3	25	75	Open Elective
MAP-209-V	Dissertation (Phase - I)	0-0-20	10	50	150	Dissertation
	Total	**6-0-20**	**16**	**100**	**300**	

Discipline specific Elective-V

MAP-201-V	Advanced Theory of Vibrations
MAP-203-V	Value Engineering
MAP-205-V	Design & Metallurgy of welded joints ***(Common with M.Tech.- Manufacturing & Automation)***
MAP-207-V	Maintenance Engineering

Open Elective

OEP-101-V	Business Analytics
OEP-102-V	Industrial Safety
OEP-103-V	Operations Research
OEP-104-V	Cost Management of Engineering Projects
OEP-105-V	Composite Materials
OEP-106-V	Waste to Energy

Fourth Semester:

Subject Code	Subject Name	L-T-P	Credits	Marks Weightage		Course Type
				Internal	External	
MAP-202-V	Dissertation (Phase - II)	0-0-32	16	125	375	Dissertation
	Total	**0-0-32**	**16**	**125**	**375**	

Total Credits for the programme = 18 + 18 +16 +16 = **68**

Semester I

MEP-207-V Computer Integrated Manufacturing

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

1. Explain the basic concepts of computer integrated manufacturing.
2. Illustrate the numerical control and part programming.
3. Study the concept of computer aided quality control and material handling.

Course Outcomes:

At the end of the course the students should be able to:

1. Acquire knowledge about computer technology, FMS and CIM
2. Understand the basics of NC, CNC and DNC systems and to compare them
3. Develop the part programs for components to be machined on CNC machining and turning centres
4. Demonstrate the knowledge of AGVs and Robots as advanced material handling systems
5. Understand the basics of CMM and Machine vision system and to relate this knowledge in quality improvement of components

Syllabus Contents:

Unit 1:

Introduction: CAD/ CAM defined, computer technology: introduction, central processing unit, types of memory, input/ output, the binary number system, computer programming languages. Role of CAD/CAM in improving the product cycle. Introduction to CIM. Applications of computers in CIM.

Unit 2:

Conventional Numerical Control: basic components of NC system, NC motion control, system, applications of NC, advantages and disadvantages of NC, problems with conventional NC, NC controller technology, computer Numerical control, advantages of CNC, functions of CNC, Direct Numerical Control, components of a DNC system, functions of DNC, advantages of DNC.

Unit 3:

NC part programming: introduction, punched tapes in NC, tape coding and format, NC words, manual part programming, computer assisted part programming, The part programmer's job, the computer's job, NC part programming languages, APT language, geometry statements, motion statements, post processor statements, auxiliary statements.

Unit 4:

Robotics technology: joints and links, common robot configuration, work volume, drive systems, types of robot control, accuracy and repeatability, end effectors, sensors in robotics, applications of robots.

Unit 5:

Automated material Handling and FMS.: material handling function, types of material handling equipments, conveyor systems, types of conveyors, automated guided vehicle system, applications, FMS, components of a FMS, types of systems, where to apply FMS technology, FMS workstation, planning the FMS.

Unit 6:

Computer aided quality control: Introduction, the computer in QC, contact and non-contact Inspection methods- optical and non-optical, computer aided testing. Coordinate measuring machine (CMM) - its construction, drive systems, programming methods, software's used in CMM applications and benefits of CMM. Machine Vision System- its basic functions, Image

acquisition and digitization, Image processing and analysis, Interpretation, applications of machine vision system.

Unit 7:

Computer Integrated Manufacturing systems: Introduction, Technologies used in CIM, Difference between CIM and FMS, CIM hierarchy system, Implementation process of CIM, applications and benefits of CIM.

Reference Books:

1. CNC Technology and Programming—Tilak Raj

2. Automation, Production systems and Computer Integrated Manufacturing :- Groover M. P. (PHI)

3. CAD/CAM : - Zimmers and Groover (PHI)

4. Approach to computer integrated design and manufacturing :- Nanua Singh (John Wiley and sons)

MEP-109-V Welding & Allied Process

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study essential concepts for welding parameters and welding processes. To study various techniques for metal spraying and thermal cutting processes. To study the various techniques of welding automation.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand principles of various traditional and newer welding processes
2. Develop concept of welding specific materials such as plastics, stainless steel.
3. Develop concept and techniques of welding automation.
4. Analyze methods of advanced welding processes like underwater welding.
5. Analyze arc welding parameter section and types of metal transfer.
6. Understand concept of thermal spraying and thermal cutting of metals.

Syllabus Contents:

Unit 1:

Introduction: Review of welding processes like gas, arc and resistance welding. Weld bead geometry and shape factors, Weld dilution.

Unit 2:

Welding Power Sources: Types of power sources, External V-I characteristics for constant current and constant voltage power sources, Rectifiers, Solid-state Rectifiers, Inverter systems, Duty cycle.

Unit 3:

Arc Welding Consumables and Metal Transfer: Types of electrodes, AWS and Indian system of classification and coding of covered electrode for mild steel, Shielding gases and associated mixtures. Types of metal transfer, Short circuit/ dip transfer, Free flight, Globular type, Spray type, Forces affecting metal transfer.

Unit 4:

Arc welding processes: Electric arc welding principle, MIG: welding equipment and processes, shielding gas, types of metal transfer. Tungsten inert gas arc welding (GTAW): welding equipment, electrodes, inert gases and torches. Submerged arc welding (SAW): principle of processes, applications, fluxes and welding electrodes used. CO2 welding: Difference from MIG welding, Principle of operation, equipment, welding parameters and applications.

Unit 5:

Other advanced welding processes: Introduction, main features and applications of Ultrasonic welding, Friction welding, Explosive welding and Friction Stir welding, Introduction, methods and applications of Underwater Welding.

Unit 6:

Weldability of specific Materials: Welding of plastics: Difficulties in welding of Plastics, Processes for welding of Plastics. Welding of Stainless Steel, Aluminum and Cast Iron.

Unit 7:

Welding Allied Processes: Surfacing and metal spraying: Surfacing methods such as SMAW, MIG, TIG, SAW. Thermal spraying: Introduction, Procedures, Applications, Advantages and Disadvantages. Thermal cutting of metals: Introduction, types, principle and operation of flame and plasma cutting.

Unit 8:

Automation in Welding: Introduction, Semiautomatic welding, Automatic welding, Welding mechanization, Flexible Automated Welding, Robotic welding, Types of Welding Robots, Robot Selection Mechanics, Joint tracking system.

Reference Books:

1. Modern Welding Technology: by Howard B. Cary and Scott C. Helzer, (Pearson Education)
2. Welding and Welding Technology: by R. Little (TMH)
3. Welding Processes and Technology: by R. S. Parmar (Khanna Publishers)
4. AWS- Welding Handbook.

MEP-113-V Design, Planning & Control of Production Systems

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study life cycle approach both for production system and new product development & compare production system with service system. Clarify various MRP models in production planning & sequencing and scheduling of the job on the machines. Understand the utility of forecasting in planning of production system.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Develop life cycle approach to new product development and production system and understand their inherent characteristics.
2. Create logical approach to make or buy decisions, plant location, layout and line balancing.
3. Estimate demand of the product using forecasting techniques and analyse error.
4. Generate MRP-I, MRP-II and ERP models for a production system.
5. Develop competency in scheduling and sequencing of manufacturing operations.

Syllabus Contents:

Unit 1:

Introduction to production systems: Aim of production system, generalized model of Production systems, Types and characteristics of production and service systems, Life cycle approach to production management. Case studies of production and service systems.

Unit 2:

Product development and design: Product life cycle, New product development and process selection, stages in new product development, use of decision tree, Breakeven Analysis,

Make/buy decision, Problems for Break-even Analysis Non-linearity in B.E. Analysis, selection of location among alternatives –A case study, systematic layout planning, objectives, types, comparison and application of different types of layouts. Assembly line balancing concept and problems for maximum line efficiency.

Unit 3:

Planning and control for production system: Importance, objectives and types of forecasting methods, Analysis and comparison standard error of estimate, Material Requirement Planning (MRP) objective, dependent demand, inputs to MRP, MRP-II, MRP model, ERP. Element of monitoring and follow up.

Unit 4:

Sequencing and scheduling: Criteria for sequencing, priority sequencing and rules, n job 2 machine, n job 3 machine, n job m machine problems. Scheduling of flow shops and job shops. Gantt chart.

Reference Books:

1. Modern Production / operations management 8th ed. - Buffa, Elwood and Sarin, Rakesh (Wiley)
2. Elements of Production, planning and control - Eilon Samuel (Macmillan)
3. Production control: A quantitative approach - Biegel. J (Prentice Hall)
4. Industrial Engineering and production management – Martand Telsang (S. Chand)
5. Operations Management – Theory and Problems – Joseph Monks (Mcgraw Hill))
6. Production and Operations Management – Kanishka Bedi. (Oxford University Press)
7. Operations Management 2nd ed. – B. Mahadevan. (Pearson)

MEP-103-V CAD/CAM

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

Explain principles of various theories of computer aided designing involved along with their industrial applications. Study the design process of any product or operation and how CAD improvises it by increasing the efficiency and accuracy of the process. Study the manual & Computer aided part programming and the various methods for CAPP.

Course Outcomes:

At the end of the course, the student shall be able to:

1. Understand 2-D and 3-D transformations of different object based on coordinate system and design the 2D and 3D surfaces and solids.
2. Understand the various types of curves.
3. Develop a part program using CNC Part Programming.
4. Analyze a part program using APT language.
5. Understand the applications of various CAPP techniques /methods.

Syllabus Contents

Unit-1

Introduction of CAD/CAM, Co-ordinate system in CAD, 2D & 3D Transformation:-Scaling, Rotation, Shearing, Translations & Reflection, introduction of Part family and Group Technology.

Unit-2

Representation of parametric and non-parametric curves, Types of curves (analytic & synthetic curves), Geometric modeling, representation and types of surfaces.

Unit-3

Introduction to FEM and FEA, Basic Concepts of FEM, Meshing, Element Selection, Types of Analysis

Unit-4

Introduction of CAPP & its type (variant, generative and hybrid CAPP), NC part programming, APT programming, advances in CAD/CAM (Agile & Lean manufacturing, concurrent Engineering and reverse engineering)

Unit-5

Fundamentals of Rapid Prototyping, Benefits and Application, STL file Generation, Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling vs. RT, Need for RT. Rapid Prototyping Machines: Classification, Description of RP Machines: Stereo lithography, Selective Laser Sintering, Fused deposition modeling, laminated object manufacturing, Laser powder forming.

Reference Books:

1. CAD/CAM by Groover and Zimmer
2. CAD/CAM Theory and Practice, Ibrahim-Zeid, TATA McGraw Hill
3. CAD/CAM/CIM – P. Radhakrishnan, New age international.
4. Mathematical Elements of Computer graphics- Rogers and Adams
5. Computer Aided Design – Besant and Lui, PHI

MAP-111-V Total Quality Management

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To have an insight into the concepts and dimensions of quality and total quality management. Analyze the enablers for TQM Environment and their impact thereof. Understand the hard options and soft options TQM Develop Knowledge of tools & techniques, quality awards.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand the basic concepts of quality.
2. Analyse the TQM environment.
3. Analyze the role of soft options in TQM.
4. Evaluate the quality initiatives in organizations.
5. Analyze the impact of TQM.

Syllabus Contents

Unit 1: Introduction

Quality – Basic concepts, dimensions, economics of quality, quality Gurus.

TQM: Definition, evolution, journey from inspection to TQM, comparison at different stages, dimensions of TQM, TQM viewpoints, reasons for adopting TQM.

Unit 2: Introspection to TQM environment

Sphere of TQM, components of TQM, TQM – Managing Total Quality, Factors affecting TQM environment, Classification and interaction among factors, Researchers' viewpoint, TQM as a system, steps in TQM implementation, Roadblocks in TQM implementation, Reasons for TQM failure.

Unit 3: Role of soft options in TQM

Hard vs. Soft factors, Role and expectation of employer, employee, customer and supplier from organization and vice versa. Human factors in TQM, Role of top management commitment, work culture, motivation, coordination, attitude, innovation.

Unit 4: Quality initiatives in organizations

Role of tools and techniques in TQM, Classification of tools and techniques – Problem identification, Data analysis, Graphical, Creativity, Company wide.

Brief description of Quality awards – MBNQA, Deming award, European quality award, Australian quality award.

Unit 5: TQM Effectiveness

Impact of TQM, Need and difficulty in measuring TQM effect, Parameters governing effect of TQM and the attributes thereof.

Reference Books:

1. Total Quality Management- Oakland (Butterworth – Heinamann Ltd.)
2. Managing for total quality from Deming to Taguchi and SPC - Logothetis N. (PHI)
3. Total Quality Control - Feigenbaum A.V. (MGH)
4. Total Quality Management - Besterfield Dale H (Pearson Education)
5. A slice by slice guide to TQM - John Gilbert (Affiliated East West Press)
6. The TQM toolkit – a guide to practical techniques for TQM"by Waller Jenny, Allen Derek and Burna Andrew (Kogan Page)

MAP-113-V Supply Chain Management

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study the concept of supply chain management, supply chain dynamics, supply chain performance measurement, key issues in supply chain, application of internet in SCM and various quantitative tools in SCM.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand the process for implementation of SCM.
2. Analyse the effect of various parameters on the Supply chain dynamics.
3. Analyse various issues related to SC performance.
4. Understand application of internet in SCM.
5. Implementation of various Quantitative tools for SCM.

Syllabus Contents:

Unit 1:

Overview of supply chain management: Introduction, Definitions of SCM, types of SCM, process for implementation of SCM, Parties involve in SC, Flows in supply chain, Goals of SCM, Obstacles to process integration in SC, Key issues in SC.

Unit 2:

Supply chain dynamics: Introduction, Bullwhip effect, Impact of Lead time, offshoring and outsourcing on SC dynamic and cost.

Unit 3:

Performance measurement: Introduction, Purpose, Measuring the supply chain performance, Evolving SC matrices, Performance Monitoring, Key supply chain performance indicators, various issues related to SC performance, world class performance measurement system.

Unit 4:

Transportation, storage and warehousing: Introduction, Transportation mode choice, Transport operator decisions, Trucking sectors in India, Rail transport, Air Transport, Water transport, Transport network, Storage and warehousing, types of warehousing, risk pooling.

Unit 5:

IT Integration: Supply chain information system, Role of IT in SCM process, Business process Re-engineering, Internet and its applications in SCM.

Unit 6:

Quantitative tools for SCM: Introduction, Forecasting, Demand forecast, Forecasting strategy & technique, Management of Inventories in SC, Linear programming, Routing models, pricing decisions, Introduction to MCDM approach.

Reference Books:

1. Designing and Managing the Supply Chain concepts, Strategies and Case studies by D. Simchi-Levi, P. Kaminsky, E. Simchi-Levi, and Ravi Shankar, Tata McGraw Hill.
2. Supply Chain Management, Strategy planning and operation by Chopra and Mendel, Prentice Hall.

MAP-115-V Foundry Technology

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study the basic concepts regarding design and manufacture of a component by various casting methods. To provide knowledge to students on the principles that guides production of sound engineering castings.

Course Outcomes:

At the end of the course, the student shall be able to:

1. Understand the basic concepts of foundry technology and applications of different materials in casting process.
2. Design the pattern and gating system for preparing the mould.
3. Describe the basic concepts of core and mould.
4. Explain the different types of special casting methods.
5. Discuss the various processes for improving or controlling the quality of casted product and environment of foundry shop.

Syllabus Contents:

Unit 1: Introduction to Foundry Technology, Advantage, limitations and applications of foundry technology. Castability and factors affecting castability. Ferrous and Non-ferrous casting metals.

Unit 2: Pattern: Pattern material, Types of patterns, Pattern allowances, Colour coding system for patterns, Numerical on pattern allowances.

Unit 3: Moulding: Mould material, properties of moulding sand, Main constituents of moulding sand, Classification of moulding sand, Preparation of moulding sand, Testing of moulding sand,

Methods of moulding. Core: Introduction, Characteristics of core, Types of core, Core making, Core chaplets, Core print, Core boxes.

Unit 4: Gating system: Requirements of gating system, elements of gating system, Types of gates, Types of risers, Calculation of pouring time and solidification time, Casting design considerations, Chills.

Unit 5: Special casting methods: Gravity die casting, Cold chamber die casting, Hot chamber die casting, Investment casting, Centrifugal casting, Shell mould casting, Continuous casting.

Unit 6: Fettling of castings, Casting inspection, repair and salvage of castings, Heat treatment of castings, Quality control of castings, Pollution control in foundry, modernization of foundry.

Reference Books:

1. Principles of Metal Casting - Richard W. Heine , Carl R. Hoper, Philip C. Rosenthal, Tata McGraw Hill Education
2. Principles of Foundry Technology - P. L. Jain, Tata McGraw-Hill Education
3. Foundry practice - W.H. Salmon and E.N. Simons, Pitman
4. Principles of manufacturing materials and processes - J. S. Campbell, McGraw Hill
5. Materials and processes in manufacturing - E. Paul DeGarmo, J. T. Black, Ronald A. Kohser, John Wiley & Sons
6. A Textbook of Production Technology: Manufacturing Processes - P. C. Sharma, S. Chand publications

MAP-117-V Robotics Engineering

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study various techniques for robotic automation. To study kinematics of robot manipulation. To study vision and sensing characteristics of robot. Various robot teaching methods, task programming, robot level programming languages.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand the robotic automation strategies.
2. Analyze dynamics of robot manipulator.
3. Task programming of robots.
4. Understand vision and sensing characteristics of robots.
5. General design consideration on trajectories motion of robots.

Syllabus Contents

Unit 1:

Introduction: Automation and Robotics, Historical Development, Definitions, Basic Structure of Robots, Robot Anatomy, Complete Classification of Robots, Fundamentals about Robot Technology, Factors related to use Robot Performance, Basic Robot Configurations and their Relative Merits and Demerits, Types of Drive Systems and their Relative Merits, the Wrist & Gripper Subassemblies. Concepts and Model about Basic Control System, Transformation and Block Diagram of Spring Mass System, Control Loops of Robotic Systems, PTP and CP Trajectory Planning, Different Types of Controllers, Control Approaches of Robots.

Unit 2:

Kinematics of Robot Manipulator: Introduction, General Description of Robot Manipulator, Mathematical Preliminaries on Vectors & Matrices, Homogenous Representation of Objects, Robotic Manipulator Joint Co-Ordinate System, Euler Angle & Euler Transformations, Roll-Pitch-Yaw(RPY) Transformation, Relative Transformation, Direct & Inverse Kinematics' Solution, D H Representation & Displacement Matrices for Standard Configurations, Geometrical Approach to Inverse Kinematics. Homogeneous Robotic Differential Transformation: Introduction, Jacobian Transformation in Robotic Manipulation.

Unit 3:

Robotic Workspace & Motion Trajectory: Introduction, General Structures of Robotic Workspaces, Manipulations with n Revolute Joints, Robotic Workspace Performance Index, Extreme Reaches of Robotic Hands, Robotic Task Description.

Unit 4:

Robotic Motion Trajectory Design: Introduction, Trajectory Interpolators, Basic Structure of Trajectory Interpolators, Cubic Joint Trajectories. General Design Consideration on Trajectories:- 4-3-4 & 3-5-3 Trajectories, Admissible Motion Trajectories.

Unit 5:

Robot Teaching: Introduction, Various Teaching Methods, Task Programming, Survey of Robot Level Programming Languages, A Robot Program as a Path in Space, Motion Interpolation, WAIT, SIGNAL & DELAY Commands, Branching, Robot Language Structure, various Textual Robot Languages Such as VAL II, RAIL, AML and their Features, Typical Programming Examples such as Palletizing, Loading a Machine Etc,

Unit 6:

Robot Sensing & Vision: Various Sensors and their Classification, Use of Sensors and Sensor Based System in Robotics, Machine Vision System, Description, Sensing, Digitizing, Image Processing and Analysis and Application of Machine Vision System, Robotic Assembly Sensors and Intelligent Sensors.

Unit 7:

Industrial Applications: Objectives, Automation in Manufacturing, Robot Application in Industry, Task Programming, Goals of AI Research, AI Techniques, Robot Intelligence and Task Planning, Modern Robots, Future Application and Challenges and Case Studies.

Reference Books:

1. A Robot Engineering Textbook – Mohsen Shahinpoor – Harper & Row publishers, New York.
2. Robotics, control vision and intelligence, Fu, Lee and Gonzalez. McGraw Hill International.
3. Introduction to Robotics, John J. Craig, Addison Wesley Publishing.
4. Robotics for Engineers , Yoram Koren, McGraw Hill International.
5. Industrial Robotics, Groover, Weiss, Nagel, McGraw Hill International.
6. Robot Technology Fundaments, Keramas, Thomson Vikas Publication House.
7. Introduction to Robotics, Niku, Pearson Education, Asia.

MAP-119-V Machine Tool Dynamics

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study various theories of chatter in machine tools. To study damping character ship of machine tools, dynamic characteristic of the cutting process and dynamic acceptance tests. To study single and multidegree freedom system of machine tools.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand the theories of chatter in machine tools.
2. Analyze damping characteristics of machine tools.
3. Analyze static and dynamic analysis of machine tools.
4. Understand single and multi-degree freedom system of machine tools.
5. Understand chatter in grinders.

Syllabus Contents

Unit 1:

Chatter in machine Tools, sources of chatter, primary chatter, regenerative chatter, chatter frequency, forced vibration for machine tools, forced vibration due to perturbance of the cutting process, forced vibration due to perturbance of equivalent elastic system, theories of machine tool chatter: Tlusty's, Kudinovs, Toblas theories.

Unit 2:

Machine tool stability: dynamic characteristic of the cutting process, general procedure for assessing the dynamic characteristic of machine tool in single degree and many degree of freedom system, methods of reducing the instability in machine tool, dynamic acceptance tests

Unit 3:

Damping in machine tools: requirements of damping system,. Viscous dampers, active dampers,

Unit 4:

Static and dynamic analysis of machine tools: lumped parameter method, finite element method,

Unit 5: Chatter in grinding machine.

Reference Books:

1. Principles of machine Tools:- G.C.Sen and Amitabh Bhattacharya(New central book agency Calcutta)

2. Machine Tool Design: - S.K. Mehta (TMH)

MAP-121-V Metal Forming Analysis

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study effects of temperature and strain rate in metal working and application of finite element methods to metal forming processes. To study plastic deformation problems for metal forming analysis and analysis of important metal forming processes.

Course Outcomes:

At the end of the course students will be able to

1. Understand application of finite element methods to metal forming processes.
2. Understand the formulations of plastic deformation problems for metal forming analysis.
3. Understand technology and analysis of important metal forming processes- forging, rolling, extrusion, wire drawing, sheet metal forming processes.
4. Understand the thermos-mechanical problem formulation.
5. Analyse the effect of friction and lubrication in hot and cold working of materials.

Syllabus Contents

Unit 1:

Stress- Strain relations in Elastic and plastic Deformations, Yield Criteria for Ductile Metals, Work hardening and Anisotropy in Yielding, Flow Curves.

Unit 2:

Formulations of plastic deformation problems, application of theory of plasticity for solving metal forming problems using Slab method, Upper and lower Bound methods, Slip line field theory.

Unit 3:

Effects of temperature and strain rate in metal working, friction and lubrication in Hot and Cold working. Technology and analysis of important metal forming processes- Forging, Rolling, Extrusion. Wire drawing, Sheet Metal forming processes like Deep drawing, Stretch forming, Bending.

Unit 4:

Application of Finite Element Methods to Metal Forming Processes- special Discretization, Shape function, Stiffness matrices and their assembly, Implicit and explicit formulations, Elasto- plastic approximations, Lagrangian Vs Eularian schemes, Material integration schemes, auxiliary equations for contact, friction and incompressibility, Thermo-mechanical problem formulation, steady state solutions for Drawing, Forging, rolling and extrusion problems.

Unit 5:

Case Studies- analysis and validation of metal forming processes problems by standard softwares.

Unit 6:

Forming defects in products and their critical effects, remedies.

Unit 7:

An introduction to use of International standards in Metal Forming Problem solutions and system Design

Reference Books:

1. Metal Forming Analysis- R. H. Wagoner, Cambridge University Press.
2. Theory of Elasticity- Dally and Riley
3. Physical Metallurgy- Dieter, McGraw Hill Inc.
4. Metal Forming Handbook by H Frontzek, M Kasparbauer, Springer Verleg

SCHEME & SYLLABUS OF M.TECH - MANUFACTURING TECHNOLOGY & AUTOMATION

MAP-123-V : MECHATRONICS PRODUCT DESIGN

No. of Credits: 3 Sessional : 25 Marks

L T P Total Theory: 75 Marks

3 0 0 3 Total: 100 Marks

Duration of Exam: 3 Hours

Course Objectives:

To study application of latest mechatronics application in manufacturing system. To study interfacing of various hardware in mechatronics product design. To incorporate application of modern tools and CAD packages in mechanical engineering for enhancing product design values.

Syllabus:

UNIT 1.

System Transfer functions, first order system, second order system, systems in series, time constant, impulse input, step input and ramp input, Solution of numerical problems in time domain using Laplace transformation.

UNIT 2.

Design and selection of mechatronics components namely encoders and resolvers, stepper and servomotors, ball screws, solenoids, line actuators and controllers with application to CNC system. PLC and ladder programming.

UNIT 3.

Robots, components of a robot, robot languages and application of robots for automation. Consumer electronics products and design of a mechatronic products using software CAD packages like MATLAB and SIMULINK. Use of MATLAB for solution of mechanical engg. Problems.

UNIT 4.

Product design for automatic assembly, orientation devices- active and passive devices, mechatronics application in parts orientation and escapement devices.

UNIT 5.

Pneumatic and Hydraulic Components and Circuits, Boolean algebra, Pneumatic sensors and amplifiers, Jet destruction devices, Logic devices, Schimit triggering devices, Developing pneumatic circuits for automatic die casting machine.

UNIT 6.

Introduction, need and methods for system modeling, Linear and non-linear models, Modern tools- Artificial neural networks in manufacturing automation, AI in manufacturing, Machine learning , Comparison between AI in manufacturing and Machine learning , Fuzzy, fuzzy decision and control .

Course Outcomes (CO's): At the end of the course, the student shall be able to:

- Understand various types of part orientation devices and escapement devices.
- Develop pneumatic systems and simulation for manufacturing plant automation.
- Conceptual design for mechatronics products based on potential custom requirements.
- Work with modern manufacturing tools and CAD packages.

Reference books:

1. Mechatronics by W.Bolton, published by Pearson Education, 4th Ed.
2. Automation Production System and CIMS by Mikel P Groover, Prentice Hall of India New Delhi.

NPTEL Video Lecture , Web: http://nptel.ac.in, Mechatronics Engineering

Software available**: Control-X supplied by Cyber Tech.**

MAP-125-V Manufacturing & Automation Lab-I

No. of Credits: 2
L T P Total
0 0 4 4

Sessional: 15 Marks
Theory: 35 Marks
Total: 50 Marks

Course Objectives:

1. To impart knowledge about the computerized machining and inspection methods in advanced manufacturing systems
2. To develop domain knowledge in the field of Computer Integrated Manufacturing (CIM)

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand the basic features of CNC Machining Centres and CNC Turning Centres
2. Develop the part program for machining some components on CNC Machining Centres and CNC Turning Centres through live demonstrations of machining examples
3. Acquire the basic knowledge of Automatic Guided Vehicles (AGVs) and Robotics
4. Learn the basic features of Coordinate Measuring Machine (CMM) and Machine Vision System

Syllabus Contents:

1. To study general features different parts and specifications of a CNC Machining Centre.
2. To prepare part program and machine a steel/cast iron/aluminium component on CNC Machining Centre.
3. To study general features, different parts and specifications of a CNC Turning Centre.
4. To prepare part program and machine a steel/cast iron/aluminium component on CNC Turning Centre.
5. To study Robot anatomy and related attributes (i.e. different types of joints, links, configurations, drive and control systems, end effectors and sensors used in robots).
6. Demonstration of some small activity of an industrial robot.

7. To study some general features guidance technologies and traffic management system of Automated Guided Vehicles (AGVs).

8. To study different configurations, drive systems and software used in Coordinate Measuring Machine (CMM).

9. To study the basic concept of Machine Vision System

MAP-127-V Manufacturing & Automation Lab-II

No. of Credits: 2
L T P Total
0 0 4 4

Sessional: 15 Marks
Theory: 35 Marks
Total: 50 Marks

Course Objectives:

The objective of the course is to expose the students to the practice of welding using various manual, semiautomatic/automatic welding processes and to experimentally analyse the weld bead characteristics.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. To understand the principle of Welding processes and Welding power sources
2. To perform welding using different processes
3. To perform specific, allied and robotic welding processes
4. To analyse the Weld Bead Characteristics

Syllabus Contents:

1. To study the working principles of AC and DC Welding power sources
2. To make SMAW BUTT joint on Mild Steel base plates
3. To make SMAW T-Joint on Mild Steel base plates
4. To make SMAW Lap Joint on Mild Steel base plates
5. To study GMAW and make welded joint using the process
6. To study GTAW and make welded joint using the process
7. To study and practice cutting of mild steel plates using Oxy-fuel Gas Welding
8. To practice Under Water welding using SMAW process
9. To practice positional welding using robotic welding
10. To study the effect of welding parameters on Bead Characteristics using visual and metallurgical methods

VAC-301-V Research Methodology and IPR

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

The course has been developed with orientation towards research related activities and recognizing the ensuing knowledge as property. It will create consciousness for Intellectual Property Rights and its constituents. Learners will be able to perform documentation and administrative procedures relating to IPR in India as well as abroad.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understanding and formulation of research problem.
2. Analyze research related information, able to interpret and write research report.
3. Understand plagiarism and follow research ethics.
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Anticipate the importance of IPR in growth of individuals & nation and promote IPR related information among students in general & engineering in particular.
6. Understand current and emerging issues related to IP protection and its impact on research and development which ultimately leads to economic growth and social benefits.

Syllabus Contents:

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

Unit 2: Effective literature studies approaches, analysis Plagiarism, Research ethics.

Unit 3: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

Unit 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Reference Books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

Semester II

MAP-102-V Manufacturing Technology

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

1. To study essential concepts of metal cutting using single point and multipoint cutting tools.
2. To study concept and application of modern machining processes.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. To understand the chip formation process, tool wears and related facts.
2. To select cutting tool materials, tool geometry and to design turning tool and form tools
3. To demonstrate the knowledge of milling, broaching and gear manufacturing operations and to design broach, milling cutters and gear hobs.
4. To demonstrate the knowledge of hole making operations with proper application and design of drills, reamers and boring tools
5. To understand the concept of various grinding processes and non conventional machining operations and apply this knowledge for machining of different materials.

Syllabus Contents:

Unit 1:

Tool Geometry, Tool & work piece material: Common work and Tool materials, Tool inserts, Specifications of inserts and tool holders, Physical principle in metal cutting: Chip formation and types of chips, work done in cutting, BUE on metal cutting, curling & contraction of chip, Effect of cutting fluid on cutting process, Machining economics, cutting power, Tool wear, lubrication and surface finish, cutting fluids.

Unit 2:

Turning, Boring and threading tools: Operation, signature of single point tools, Design of single point turning tool, ISO tool shapes, design of flat and circular form tools, threading tools, chip breaking methods.

Unit 3:

Milling, Broaching, Gear cutting tools: Milling cutter design, design of broach, design of Gear hobs.

Unit 4:

Tools for holes: Hole Designs of Drill, Reamer and Boring tools.

Unit 5:

Grinding: Features of grinding process, characteristics, shapes, mounting, wear, turning, Dress of Abrasive tools, center type cylindrical grinding, centreless grinding, internal grinding, surface grinding, grinding fluid

Unit 6:

Modern machining Processes: USM, Abrasive Jet Machining, water jet machining, electrochemical machining, grinding, Honing, EDM, plasma arc machining, Laser Beam machining, Electron Beam machining Process detail, application.

Reference Books:

1. Metal Cutting theory and cutting tool design:-v Arshinov Mir Publishers, Moscow, Allekseev Mir Publishers, Moscow
2. Cutting tools: P.H. Joshi, Wheeler Publishing
3. Theory of Metal cutting: E.M. Trent
4. Tool design: Donaldson
5. Production Technology: HMT, Tata Mcgraw Hill, New Delhi
6. Modern Machining Processes: P.C. Pandey, H.S.Shah, Tata Mcgraw-Hill, New Delhi

MAP-104-V Automation in Manufacturing

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study various techniques of automatic material handling in a manufacturing organization. To understand the control strategies of automation. To study essential concepts of a system model in a mechanical system. To study interfacing of various hardware in mechatronics product design. To incorporate application of electronics and computer engineering in mechanical engineering for enhancing product design values.

Course Outcomes:

At the end of the course, the student shall be able to:

1. Understand the effect of manufacturing automation strategies.
2. Understand the basic principles of mechatronics and microprocessors.
3. Analyze appropriate sensors and transducers and devise an instrumentation system.
4. Develop system model for mechanical system.
5. Understand the working principles of various types of material handling systems.
6. Analyze the control Technologies of automation.

Syllabus Contents

Unit 1:

Introduction: Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations, Introduction to automation productivity.

Unit 2:

Mechatronics and Microprocessors: Introduction to Mechatronics systems and components, Principles of basic electronics – Digital logic, number system logic gates, Sequence logic flip flop system, JK flip flop, D-flip flop. Microcomputer computer structure/microcontrollers, Integrated circuits – signal conditioning processes. Various types of amplifiers. Low pass and high pass filters.

Unit 3:

Sensors: Introduction to sensors and transducers. Displacement, position proximity sensors, velocity, force sensors. Fluid presence Temperature, Liquid level and Light sensors. Selection of sensors, Actuators: Pneumatic and hydraulic systems, Mechanical actuation system, Electrical actuation system.

Unit 4:

Principles of Electronic system communication, Signal conditioning, Interfacing, A.D. and D.A. convertors, Basic system models, Mathematical models, Mechanical and other system building blocks. System models for Rotational-translation, Electro-mechanical and Hydraulic-mechanical system.

Unit 5:

Material Handling Systems: Overview of Material Handling Systems- rotary feeders, oscillating force feeder, vibratory feeder, elevator type and centrifugal type feeders, Principles and design consideration, Material transport systems, Storage systems.

Unit 6:

Control Technologies in Automation: Industrial Control Systems, Components, Process Industries Verses Discrete-Manufacturing Industries, Continuous Verses Discrete, Open and close loop control, PID Controller, Controller tuning: Process reaction method and ultimate cycle method.

Reference Books:

1. Handbook of Design, Manufacturing & Automation: R.C. Dorf, John Wiley and Sons.

2. Automation, Production Systems and Computer Integrated Manufacturing, M.P. Groover, PHI.

3. Industrial Automation, W.P. David, John Wiley and Sons.

4. Computer Based Industrial Control, Krishna Kant, PHI

5. Anatomy of Automation, Amber G.H & P. S. Amber, Prentice Hall.

6. Performance Modeling of Automated Manufacturing Systems, Viswanandham, PHI

7. Mechatronics - W.Bolton, Pearson Education, 4th Ed.

8. Automation Production System and CIMS - Mikel P Groover, Prentice Hall of India New Delhi.

MAP-106-V Project Management

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To develop project within time, resource & budget, types of projects, project life cycle and decisions.. To align project execution with strategies. To identify project issues clearly and come up with new solutions.

Course Outcomes:

At the end of the course the students should be able to:

1. Understand about the types of projects & project life cycle.
2. Complete understanding about development of project network.
3. Understand about the crashing of a project.
4. Understand Project evaluation & review technique (PERT) & Critical path method (CPM).
5. Understand how to control & monitor a project.

Syllabus Contents:

Unit 1:

Introduction & Overview: Definitions, Types of projects, Project life cycle (Project phases) and decisions.

Unit 2:

Go/ No go decisions based on: a) Project Identification and Screening, b) Project Appraisal: Market, Technical, social, Ecological & Financial, c) Project Selection: Pragmatic, pair wise, MADM approach.

Unit 3:

Development of Project Network: Project description, Work break down structure, Nomenclature, Rules for drawing and representation, consistency and Redundancy in Project Networks, Matrix representation.

Unit 4:

Basic Scheduling with Networks (Forward & Backward Pass)

Unit 5:

CPM & PERT: Activity times, Completion, Floats, Probability (ND usage), Examples, and Problems.

Unit 6:

Project Monitoring & Control: Project adjustments, Crashing: Direct & Indirect cost, Normal & Crash: duration & cost, Resource leveling: Types, usage, leveling, Problems, Managing Risk.

Unit 7:

Role of Human Factors: Dealing with people Team Building and Leadership in Projects, commitment, work culture, motivation, coordination, attitude, innovation.

Unit 8:

Project Completion, Review and Future Directions

Reference Books:

1. Project Management by Clifford Gray and Erik Larson. (Tata McGraw Hill Edition)
2. Management Guide to PERT/ CPM by Wiest, JD and Levy F.K. (PHI)
3. Industrial Engg. & Mgmt. by Dr Ravi Shankar. Galgotia Publications.

MAP-108-V Mechanical Behavior of Materials

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study plastics, composites, smart materials and non-material. To study improvement in design parameters using non-common metal and analysis of various properties for plastic components, manufacturing techniques of plastics materials.

Course Outcomes:

At the end of the course students will be able to

1. Understand the improvement in design parameters using plastics.
2. Understand the improvement in design parameters using composites.
3. Understand the improvement in design parameters using smart materials.
4. Understand the improvement in design parameters using nano-materials.
5. Understand the improvement in design parameters using composites in aircraft structure.

Syllabus Contents:

Unit 1:

Introduction: Modern materials in design- plastics, composites, smart materials and nanomaterials, Weight reduction using plastics and composites, Properties and uses of plastics, composites, smart materials and nanomaterials in the design of mechanical equipments. Estimation of factor of safety in design.

Unit 2:

Design of Plastic Components: Analysis of various properties for plastic components, manufacturing techniques of plastics, Various design considerations for plastic components, Applications of plastics in design of mechanical equipments, Mechanical properties of glass filled –polyphenylene, glass filled -polyethylene and glass filled-polyurethane.

Unit 3:

Design of Composite Structure: Structure and specific properties of composites, polymer-composite properties and application in aircraft industry, Prediction of service life, Main stages in composite structure design, Technological concept and production structure, Application of composites in passengers aircraft structures, Types of composite joints and their applications, Mechanical –joint design, Stress concentration and hole geometry.

Unit 4:

Characteristics of particulate composite materials, Metal-matrix composites, Fatigue failure in particulate composite material, Design and manufacturing of particulate composites, Shot peening for improving fatigue and mechanical properties of particulate composite materials, Mechanical properties of Aluminium-silicon carbide, Aluminium-alumina, Aluminium-boron fibre particulate composites.

Unit 5:

Smart Materials: Design and various characteristics of smart materials, Application of smart materials for design of intelligent structures, Smart paint, Modeling analysis and design of simple mechanical systems using smart materials.

Unit 6:

Nanomaterials: Nanotechnology, Nanoscale, Design applicaions, Nanotubes, Nano-sized particles in composites, Fabrication of nano-sized particles, nanodevices.

Reference Books:

1. Composite manufacturing technology by A.G. Bratukhin and V.S. Bogolyubov, Chapman & Hall publication.
2. Smart Materials and Structures, M.V. Gandhi and B.S. Thomson, Chapman &Hall.
3. Machine Design by R.L. Norton, Pearson Asia publication.
4. Introduction to Nanotechnology, Charles P Poole and Frank J.Owens, Wiley-Inderscience, 2003

MAP-110-V Principles of Management

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study about Management, management functions, management model and theories of management. To Study about organization system, managerial decision making, QFD and MIS.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand management functions.
2. Understanding about theories of management.
3. Understand about the organization as a system.
4. Understanding about the techniques of management, 5S, Kaizen, JIT, SCM, ERP, Six Sigma, TPM, TQM.
5. Understand usage of management techniques with applications.

Syllabus Contents

Unit 1:

Introduction: Definition, Management thoughts, Nature & purpose of management, Management- an art or science, Management vs. administration, Levels of management and skills required, Management functions, Branches of management, Management model.

Unit 2:

Theories of management: Traditional Management theory: Taylor's Theory, Scientific Management, Henry Fayol's management Theory, Behavioural Theory: comparison of traditional and behavioural theory, Maslow's need hierarchy theory, Herzberg's Two factor theory, Theory X and Theory Y, Contingency approach to management.

Unit 3:

Organisation as a system: Interaction with external environment. Managerial decision making and MIS. Planning approach to organizational analysis, design of organization structure: job design and enrichment; job evaluation and merit rating, Motivation and productivity. Leadership styles and managerial grid. Co-ordination, monitoring and control in organizations. Techniques of control.

Unit 4:

Management techniques: Conventional management tools, applications of cause & effect diagram, Pareto analysis, Force field analysis, QFD.

Unit 5:

Introduction to Japanese techniques- 5S, Kaizen, JIT, SCM, ERP, Six Sigma, TPM, TQM.

Unit 6:

Case studies.

Reference Books:

1. Management - James A.F. Stoner, R.Edward Freeman, Daniel R. Gilbert, Prentice-Hall of India.
2. Management for Business and Industry - Claude S. George., PHI Private Ltd.
3. Management Information Systems - W. S. Jawadekar, Tata McGraw-Hill Publishing Co.
4. Principles & Practice of Management - T.N. Chhabra, Dhanpat Rai & Co. (P) Ltd.
5. Motivation and Productivity - Saul W. Gellerman, D.B. Taraporevala sons & Co.

MAP-112-V Finite Element Methods

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study concepts of FEM, concepts of structural modeling, mathematical analysis of finite element method ,computer implementation of finite element method, linear analysis and various non-linearity analysis.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand the theories of linear system for finite element analysis.
2. Understand the theories of non-linear system for finite element analysis.
3. Develop the formulation of problem for analysis.
4. Analyse non-linear problem solution procedure.
5. Understand modeling of system with load, displacement and boundary conditions.

Syllabus Contents:

Unit 1:

Review of basic FEM concepts, FEM Discretization and the Direct Stiffness Method: Basic concepts of structural modeling, Review of the stiffness method of structural analysis, Modeling stiffness, loads and displacement boundary conditions.

Unit 2:

Formulation of Finite Elements: Mathematical interpretation of finite elements, variational formulation, Development of continuum elements, shape functions, consistent loads, Isoparametric elements for plane stress, Numerical integration, Convergence requirements.

Unit 3: Computer Implementation of the Finite Element Method: Pre processing: model definition, Element level calculations, Equation assembly, Equation solver, Post processing: strain and stress recovery.

Unit 4:

Advanced topics in linear problems: Static condensation and sub-structuring, Patch test and incompatible element, p-formulation, Advanced Beam, Plate and Shell elements: a) Timoshenko beam theory (shear locking) b) Plate and shell theory

i. Thin plate and Mindlin plate (shear and membrane locking)
ii. Mixed formulation for plate and shell
iii. Degenerated shell formulation

Dynamic analysis using FEM:

a. Consistent mass and lumped mass, mass lumping technique
b. Time integration methods: explicit, implicit, explicit-implicit methods.
c. Stability, convergence and consistency
d. Hyperbolic systems: structural dynamics and wave propagation
e. Parabolic system: transient heat transfer
f. Modal solution for natural frequencies and mode shapes
g. Modal Superposition method for structural dynamics

Nonlinear analysis:

a. Nonlinear solution procedures
b. Newton-Raphson, modified Newton-Raphson, and secant methods
c. Line search algorithm
d. Automatic time step control

Unit 5:

Material nonlinearity:

a. Rate independent elastoplasticity with return-mapping algorithm
b. Isotropic and kinematic hardening with Baushinger effect
c. Consistent tangent operator
d. Objective rate and finite rotation elastoplasticity

e. Multiplicative decomposition and finite deformation elastoplasticity

Geometric nonlinearity:

a. Generalized strain and stress
b. Total and Updated Lagrangian formulation
c. Kirchhoff stress and Cauchy stress

Boundary nonlinearity:

a. Frictionless contact problems
b. Penalty, Lagrange multiplier, augmented Lagrange multiplier, and perturbed Lagrange multiplier methods
c. Frictional contact problems including frictional return-mapping algorithm
d. Rigid-flexible contact and flexible-flexible contact
e. Multiplicative decomposition and finite deformation elastoplasticity

Geometric nonlinearity:

a. Generalized strain and stress
b. Total and Updated Lagrangian formulation
c. Kirchhoff stress and Cauchy stress

Boundary nonlinearity:

a. Frictionless contact problems
b. Penalty, Lagrange multiplier, augmented Lagrange multiplier, and perturbed Lagrange multiplier methods
c. Frictional contact problems including frictional return-mapping algorithm
d. Rigid-flexible contact and flexible-flexible contact

Assignments and Tutorials are essential part of this course. Various programming and formulation problems will be assigned through the course of study.

Reference Books:

1. Finite element analysis by P.Seshu, PHI, 2003.

MAP-114-V Material Management

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

Study the basic concepts of materials management like productivity, techniques of materials management, purchasing in production process and cost reduction techniques. Illustrate the material requirement planning process like JIT, production planning, economic analysis and break even analysis.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand materials management techniques for productivity improvement.
2. Analyse the concept of materials planning with the theoretical concepts like break even analysis, JIT etc.
3. Apply different concepts of Purchasing while purchasing a material for the company.
4. Understand mathematical model the cost reduction techniques for reducing the cost & enhancing the profits of an organization.
5. Analyse inventory management techniques like EOQ for the efficient Inventory management of production plant.

Syllabus Contents

Unit 1:

Introduction: introduction to material management and productivity, functions of material management, organization structures in material management, role of material management techniques in improved material productivity.

Unit 2:

Material planning: objectives, material requirement planning, manufacturing resource planning, JIT production planning, strategic material planning, material control: acceptance, sampling,

inspection, make or buy decision, simple cost analysis, economic analysis, break even analysis, break-even point theory, whether to add or drop a product line store management and warehousing, product explosion.

Unit 3:

Purchasing: importance of good purchasing system, organization of purchasing functions, purchase policy and procedures, responsibility and limitations, purchasing decisions, purchasing role in new product development, role of purchasing in cost reduction, negotiations and purchase, purchasing research: identification of right sources of supply, vendor rating, standardization, vendor certification plans, vendor and supply reliability, developing new source of supply.

Unit 4:

Cost reduction: cost control v/s cost reduction, price analysis, material cost reduction techniques, variety reduction, cost reduction and value improvement, techniques of cost control, standard costing, cost effectiveness, cost analysis for material management, material flow cost control.

Unit 5:

Inventory management: inventory v/s stores, types of inventory, inventory control, inventory build –up, EOQ, various inventory models, inventory models with quantity discount, exchange curve concept, coverage analysis, optimal stocking and issuing policies, inventory management of perishable commodities, ABC – VED analysis, design of inventory distribution systems, surplus management, information system for inventory management, case studies.

Reference Books:

1. Material management :- W. R. Stelzer Jr. (PHI)
2. Material management :- D. S. Ammer & Richard Erwin Inc.
3. Material management :- A. K. Dutta (PHI)
4. Material management- An integrated approach :- P. Gopal;akrishnan,& M. Sundersen (PHI)

MEP-124-V Quality control techniques

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study about statistical concepts in quality control, quality control techniques, various control charts. Study about variables inspection and attributes inspection, relative merits and demerits. To study about special control charts for variables, group control chart total quality control.

Course Outcomes:

At the end of this course, the students will be able to:

1. Appraise the effectiveness of SPC tools in improving quality.
2. Evaluate process capability of a manufacturing system.
3. Analyze the state of statistical quality control using control charts for variables and attributes.
4. Utilization of the probability theory, binomial and Poisson distribution in inspection and sampling process.
5. Understand chance and assignable causes of quality variation for product quality control.

Syllabus Contents

Unit 1:

Statistical concepts in Quality Control, Graphical Representation of Grouped Data, Continuous and Discrete Probability Distributions, control limit Theorem,

Unit 2:

Introduction to Quality Control, process Control and Product Control, Chance and Assignable causes of Quality variation, Advantages of shewhart control charts, Process Control charts for variables, X, R and σ charts, fixation of control limits, Type I and Type II Errors, Theory of runs, Interpretation of Out of Control points, Probability limits, Initiation of control charts, Trial control limits, Determination of aimed at value of Process Setting, Rational method of sub

grouping, control chart parameters, control limits and specification limits, Natural tolerance limits, Relationship of a process in Control to upper and lower specification limits, process capability studies.

Unit 3:

Special control charts for variables, group control chart, arithmetic moving X and R charts, Geometric moving chart, control chart with reject limits, steady trend in Process average with constant dispersion, trend chart with sloping limits, variable subgroup size.

Unit 4:

Variables inspection and Attributes inspection, Relative merits and demerits, Control charts for Attributes, p chart and np chart, varying control limits, high defectives and low defectives, special severe test limits, C chart, U chart, Dodge demerit chart, Quality rating, CUSUM or Cumulative sum control chart, Average run length (ARL) Relative efficiency or sensitivity of control chart.

Unit 5:

Probability theory, binomial and Poisson distribution, Acceptance Inspection, 100% Inspection, No Inspection and sampling Inspection, operating characteristic curve (O.C. curve). Effect of sample size and Acceptance number, type A and type B O.C. curves, Single, Double and Multiple sampling Plans, SS Plan. Acceptance/Rejection and Acceptance/Rectification Plans, Producers Risk and Consumer's Risk, Indifference Quality level, Average Outgoing quality (AOQ) curve, AOQL, quality protection offered by a sampling Plan, Average sample Number (ASN) curve, Average Total Inspection (ATI) curve.

Reference Books:

1. Statistical Quality control by E.L. Grant
2. Quality control and Industrial Statistics, by A.J. Duncan
3. Quality control by Dale H. Bestefield
4. Total Quality Control by A.Y. Feigenboum
5. Elementary S.O.L. by I.W.Burr, M. Dekkar.

MAP-116-V Artificial Intelligence

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

Study concept of artificial intelligence, overview of expert systems, the concepts AI in manufacturing problems. AI theory problems, problem spaces and search, Heuristic search technique and knowledge acquisition.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand knowledge acquisition and knowledge representation.
2. Apply artificial intelligence in manufacturing.
3. Understand expert system application.
4. Analyze state-of art expert system application.
5. Apply theoretical concepts to manufacturing problems.

Syllabus Contents

Unit 1:

Definition, basic concepts of artificial Intelligence, scope, role and potential of artificial intelligence in manufacturing, Expert systems, Popular AI application.

Unit 2:

Overview of Expert systems, architecture, comparison with procedural programming, developing Expert system for typical manufacturing domains, implementation and maintenance, state- of- art Expert system application, case study.

Unit 3:

AI theory problems, problem spaces and search, Heuristic search technique, Knowledge acquisition and knowledge representation, predicate logic, procedurals Declarative knowledge, forward V/s backward reasoning AI architecture, overview of advanced features, planning, learning, natural language processing, neural nets, fuzzy logic, object oriented programs.

Unit 4:

Case studies, examples of AI, theoretical concepts to manufacturing problems, CAD, CAPP, scheduling GT, CIM system. Domains welding, casting, forming, metal cutting, maintenance.

Reference Books:

1. Artificial Intelligence- Elaine Rich and Kevin Knight (2nd Edition) Tata Mcgraw-Hill
2. Artificial Intelligence: A Modern Approach, Stuart Russel, Peter Norvig, PHI
3. Introduction to Prolog Programming - Carl Townsend.
4. PROLOG Programming For Artificial Intelligence - Ivan Bratko(Addison-Wesley)
5. Programming with PROLOG- Klocksin and Mellish.

MEP-120-V Industrial Inspection

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study industrial process of inspection, design consideration for gauges and measuring instruments. To study Indian and international standards for limits, fits, tolerances. To identify geometrical and physical limitations in measuring devices. To study surface texture of components.

Course Outcomes:

At the end of the course, the student should be able to

1. Analyse and Design different gauges like Plug gauge, Snap gauge.
2. Illustrate the aspects of thread and gear inspection.
3. Understand various techniques of surface roughness measurement.
4. Describe Geometrical and positional tolerances.
5. Explain limitations in measuring devices.

Syllabus Contents:

Unit 1:

Design consideration for Gauges and measuring instruments: material selection for gauges, NAS per Indian and international standards, design of plug gauge, snap gauge, center distance gauge.

Unit 2:

Inspection of threads and gears: thread gauge design; thread size measurement by two wire and three wire methods, vernier gear tooth gauge design.

Unit 3:

Surface textures: components of machined surface texture, specification of surface texture, surface roughness measuring device and techniques, design of pneumatic gauges in process gauging methods.

Unit 4:

Geometrical and positional tolerances.

Unit 5:

Geometrical and physical limitations in measuring devices.

Reference Books:

1. Metrology:- I .C. Gupta (Dhanpat Rai Pub.)
2. Engg. Metrology :- R. K. Rajput (S. K. Kataria and sons)
3. Metrology :- R. K. Jain
4. PSG design data book for Gauge design

MAP-118-V Manufacturing & Automation Lab-III

No. of Credits: 2
L T P Total
0 0 4 4

Sessional: 15 Marks
Theory: 35 Marks
Total: 50 Marks

Course Objectives:

1. To impart knowledge about the cutting tools through live experiments
2. To develop domain knowledge in the field of metal cutting, conventional as well as non-conventional machining operations.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand various angles and parameters of single as well as multipoint tools.
2. Differentiate the kinds of chips produced in the machining of Aluminium and Mild Steel
3. Learn and perform the basic operations on EDM and Broaching machines through hole making operations
4. Manufacture the gears through Gear shaping machine
5. Demonstrate the knowledge to braze carbide tip on carbon steel shank and the effects of cutting fluid in machining operations

Syllabus Contents:

1. To identify various angles and parameters of various single point cutting tools
2. To identify various angles and parameters of various multipoint cutting tools
3. To grind various angles on a single point cutting tool.
4. To identify chips produced in turning of Aluminium, mild steel work piece at different speeds and feeds
5. To perform some hole making operations on Electro- Discharge Machine (EDM).
6. To study wear of cutting tool in turning.
7. To study surface finish by varying cutting parameters on surface grinding machine.
8. To cut a spur gear on gear shaping machine

9. To braze a carbide tip on a carbon steel tool shank.

10. To study effect of cutting fluid on machining.

11. To produce and inspect a splined/round hole on horizontal Broaching Machine.

MAP-120-V Manufacturing & Automation Lab-IV

No. of Credits: 2
L T P Total
0 0 4 4

Sessional: 15 Marks
Theory: 35 Marks
Total: 50 Marks

Course Objectives:

To develop domain knowledge in the field of automation of mechanical equipment's and select equipment's for automation. To design various types of feeders. Study a variety of software's for automation of mechanical equipment's.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand the various practical demonstrations of automation of mechanical equipment's.
2. To utilize the theories for designing feeder system.
3. Selection of equipment's and practical demonstration.
4. Operation of variety of software.
5. Computer programming on CNC machine.

Syllabus Contents:

1. To study the hardware of a retrofit and CNC machine tools.
2. Selection of various equipment's required with the specifications from Internet/Catalogue: To convert a manual machine tool/system into an automatic machine tool/system.
3. To write program with G code and M code for a component.
4. To simulate machining of component using machining software.
5. Study and applications of Hydraulic software.
6. Study and applications of Pneumatic software.
7. Study and applications of Robotic software.
8. Study and applications of PLC software.
9. To design an automated part feeder.
10. Developing pneumatic circuits for casting.
11. To simulate gear hobbing process and to calculate gear hobbing time.

MAP-122-V Mini-project

No. of Credits: 2
L T P Total
0 0 4 4

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks

Course Outcomes:

At the end of the course:

1. Students will get an opportunity to work in actual industrial environment if they opt for internship.
2. In case of mini project, they will solve a live problem using software/analytical/computational tools.
3. Students will learn to write technical reports.
4. Students will develop skills to present and defend their work in front of technically qualified audience.

Syllabus Contents:

Students can take up small problems in the field of design engineering as mini project. It can be related to solution to an engineering problem, verification and analysis of experimental data available, conducting experiments on various engineering subjects, material characterization, studying a software tool for the solution of an engineering problem etc.

Semester –III

MAP-201-V Advanced Theory of Vibrations

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study essential concepts for Mechanical Vibrations induced in various equipment. To study and analyze effects of vibrations in equipment. To study experimental methods in vibration analysis, vibration exciters, transducers and measurement devices.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Acquire knowledge of fundamentals of mechanical vibrations leading to analysis of single degree of freedom.
2. Understand the concept of two degree of vibration and vibration isolation and Transmissibility.
3. Analyse experimental methods for vibration analysis.
4. Understanding the influence and stiffness coefficients.
5. Analyse the concept of the non-linearity in vibrations.

Syllabus Contents

Unit 1:

Single degree of freedom systems, two degree of freedom systems: spring coupled, mass coupled, vibration absorbers, and vibration isolation.

Unit 2:

Multi degree of freedom systems: Lagrange's equation, close couples and far coupled systems, dunker ley's approximation method, rayleigh method, matrix method, matrix iteration,

orthogonality principle, orthogonality, expansion theorem and modal analysis, stodola method, holzer method, galerkin method, rayleigh- ritz method, myklested – prohl method for far coupled systems, transfer matrix method

Unit 3:

Experimental methods in vibration analysis: vibration instruments, vibration exciters, transducers and measurement devices, analyzers, vibration tests:- free and forced vibration tests.

Unit 4:

Vibration of continuous systems: Transverse, flexural, torsional vibration of beams, timoshenko beam, Hamilton principle, vibration of plates, collocation method, myklested – prohl method.

Unit 5:

Transient vibrations: duhamel's integral, method of step input, phase plane method, method of laplace transformation, drop test spectra by laplace transformations.

Unit 6:

Non-linear vibrations: nonlinear vibrations and superposition principle, examples of nonlinear vibrations, method of dealing with nonlinear vibrations, phase plane trajectories, method of direct integration, perturbation method, iteration method, Fourier series.

Reference Books:

1. Theory of vibration with applications:- W. T. Thomson (PHI)
2. Theory and practice of mechanical vibrations:- J. S. Rao & K. Gupta (Wiley eastern)
3. Mechanical vibration :- S. S. Rao (Addison Wesley)
4. Vibration and noise for Engineers :- Kewal Pujara (Dhanpat Rai and Co.)
5. Mechanical vibrations :- G. K. Grover and Nigam (Nem chand and sons)
6. An introduction to mechanical vibrations :- Steidel (John Wiley)
7. Elements of vibration analysis :- Meirovitch (TMH)

MAP-203-V Value Engineering

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To enhance value of a component either by reducing cost or by increasing its function. To study how to improve resource efficiency. To reduce operational, maintenance cost and help industries in competing more successfully in market.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Comprehend the life cycle approach of the product and its relationship with value engineering.
2. Describe the types and uses of value.
3. Understand and interpret different functions of product design & their relationship.
4. Implement the phases of value engineering in the job.
5. Analyse the cost reduction techniques in value engineering.

Syllabus Contents

Unit 1:

Introduction, Life cycle of a Product, Definition, objectives and methodology of value Engineering, Comparison with other cost reduction techniques, unnecessary cost.

Unit 2:

Quantitative definition of values, alternatives to increase value, Type of value, estimation of Product Quality/performance.

Unit 3:

Functions: definition, types and relationship between different functions in design of a Product, functional cost, functional worth, test for poor value, aim of value engineering. Systematic approach, Phases of value engineering Job plan: General phase, information phase, function phase creation/speculation phase, evaluation phase, investigation phase, recommendation and implementation phase.

Unit 4:

Decision /evaluation Matrix: Quantitative comparison of alternatives, estimation of weight factors and efficiency.

Unit 5:

FAST diagramming: Critical path of function, How, why and when logic, supporting and all time functions, Ground rule for FAST diagram.

Reference Books:

1. Value Engineering – A systematic Approach -A.E. Mudge
2. Techniques of value analysis and value engineering - L.D. Miles
3. Value engineering for cost reduction and product improvement -H S Mittal

MAP-205-V Design & Metallurgy of Welded Joints

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

To study welding defects, control and design of welded joints. Study metallurgy and cost estimation of welded joints. To study destructive and non-destructive testing of welds, residual stresses and control of residual stresses.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand to predict and control of distortion in welded joints.
2. Calculate cost estimation of welded joints.
3. Understand the effect of residual stress in welded joints.
4. Understand weld metallurgy: thermal effect of welding on parent metal
5. Develop the application of welding automation for enhancing productivity.

Course Contents

Unit 1:

Weld defects: common weld defects like weld cracks, LOP, LOF, porosity, blow holes etc., remedies and control, welding symbols.

Unit 2:

Cost analysis of welded joints: costing factors of welding jobs- fabrication cost, material cost, preparation cost, finishing cost, overhead cost etc., economy in preparation and welding a job, labour accomplishment factor, cost calculation of welded jobs.

Unit 3:

Prediction and control of distortion: calculation of longitudinal contraction, transverse contraction, angular contraction due to single weld pass, control of welded distortion, and calculation of shrinkage.

Unit 4:

Residual stresses: introduction, types, effect of thermal stresses, control of residual welding stresses. Destructive tests: equipment required and test piece geometry for tensile test, bend test, impact test, hardness test, brittle and fatigue failure tests, non-destructive tests for welds:-dye penetrate inspection, magnetic particle inspection etc.

Unit 5:

Weldability of metals: welding techniques, preparation of joints and electrode types for gray cast iron welding, aluminium welding, austenitic steels, titanium and its alloys. Weldability tests: definition and concept of weldability, purpose and types of weldability tests such as hot cracking test, root cracking tests, hydrogen induced cracking test, cruciform test.

Unit 6:

Welding metallurgy: thermal effect of welding on parent metal, structure of fusion welds, effect of cooling rate, weld metal solidification and heat affected zone. Automation in welding: introduction and concept, classification of welding automation, economics of welding automation.

Reference Books:

1. Modern welding technology:- carry H. B. (PH).
2. Welding technology: - A. C. Devis
3. Welding and welding Technology: - Little (TMH)
4. Welding technology: - R. S. Parmar
5. AWS- welding handbook (IV – VI) Edition
6. Elements of machine design: - Pandya and shah.

MAP-207-V: MAINTENANCE ENGINEERING

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand the importance of maintenance engineering.
2. Describe the types and uses of maintenance engineering.
3. Estimate systems reliability, availability and maintainability.
4. Gain the necessary knowledge about failure distributions and apply optimal maintenance policies.

Syllabus Contents

Unit 1: Principles and Practices of Maintenance Engineering

Introduction, Requirements of Maintenance Engineering Department, Basic Principles of maintenance Engineering — Importance and benefits of sound Maintenance systems – Maintenance organization – Definitions and terms used in Maintenance Engineering.

Unit 2: Types of Maintenance

Introduction, Planned Maintenance, Planned Maintenance Procedure, Basic Rules for Maintenance Schedule, Unplanned Maintenance, Preventive Maintenance-Basic Principle and objective, advantages, disadvantages, Corrective Maintenance- Basic Principle and objective, advantages, disadvantages, Basic requirements of Preventive maintenance, Condition Monitoring

Unit 3: Reliability, Availability & Maintainability (RAM)

Introduction, Definition of reliability, maintainability and availability; Failure data analysis, MTBF, MTBR, MTTR, Bath tub curve; Quantitative measures of maintainability and measures to assure maintainability; Fault tree analysis(FTA), Failure mode and effect analysis (FMEA),

Failure mode, effect and criticality analysis (FMECA). Markov analysis of availability. Industrial Case Studies.

Unit 4: Optimal Maintenance Policies

Introduction, Factors affecting the maintenance policies, Maintenance categories – Comparative merits of each category, Repair/Discard decisions-Factors affecting the R/D decisions, Cost comparison for R/D decisions, optimal module size, safety in Maintenance, Economics of maintenance.

Text Books

1. Industrial Maintenance – H.P.Garg

2. Ind. Maint. Management – S.K.Srivastava

3. Collacot R.A.- Mechanical fault diagnosis and condition monitoring

4. Hunt, T.M., (1993), Handbook of wear debris analysis and particle detection in liquids, Elsevier applied science, London and New York

5. Barlow, R.E. and Proschan, F. (1965). Mathematical Theory of Reliability. John Wiley, New York.

6. Dhillon, B.S. (2002). Engineering Maintenance: A Modern Approach. CRC Press, Boca Raton, Florida.

7. Jardine, A.K.S. and Tsang, A.H.C. (2006). Maintenance, Replacement, and Reliability: Theory and Applications. CRC Press, Taylor & Francis Group, ISBN 0-8493-3966-0.

8. Ross, S.M. (1970). Applied Probability Models with Optimization Applications. Holden Day, San Francisco.

9. Blischke, W.R. and Murthy, D.N.P. (2003). Case Studies in Reliability and Maintenance, John Wiley & Sons, USA.

10. E. Balagurusamy (2002),Reliability Engineering, Published by Tata McGraw-Hill Education Pvt. Ltd.,ISBN 10: 0070483396 / ISBN 13: 9780070483392

MAP-209-V Dissertation Phase-I

No. of Credits: 10
L T P Total
0 0 20 20

Sessional: 50 Marks
Theory: 150 Marks
Total: 200 Marks

Course Outcomes:

At the end of the course:

1. Students will learn to survey the relevant literature such as books, national/international refereed journals and contact resource persons for the selected topic of research.
2. Students will be able to use different experimental techniques.
3. Students will be able to use different software/ computational/analytical tools.
4. Students will be able to design and develop an experimental set up/ equipment/test rig.
5. Students will be able to conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them.
6. Students will be able to either work in a research environment or in an industrial environment.

Syllabus Contents:

The Project Work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Seminar should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for M. Tech. The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report. The work has to be presented in front of the examiners panel set by Head and PG coordinator. The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student.

Semester –IV

MAP-202-V Dissertation Phase- II

No. of Credits: 16	Sessional: 125 Marks
L T P Total	Theory: 375 Marks
0 0 32 32	Total: 500 Marks

Course Outcomes:

At the end of the course:

1. Students will develop attitude of lifelong learning and will develop interpersonal skills to deal with people working in diversified field will.
2. Students will learn to write technical reports and research papers to publish at national and international level.
3. Students will develop strong communication skills to defend their work in front of technically qualified audience.

Syllabus Contents:

It is a continuation of Project work started in semester III. He has to submit the report in prescribed format and also present a seminar. The dissertation should be presented in standard format as provided by the department. The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion. The report must bring out the conclusions of the work and future scope for the study. . The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner and a guide, co-guide etc. as decided by the Head and PG coordinator. The candidate has to be in regular contact with his guide.

OPEN ELECTIVES

OEP-101-V Business Analytics

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course objective

1. Understand the role of business analytics within an organization.
2. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
3. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
4. To become familiar with processes needed to develop, report, and analyze business data.
5. Use decision-making tools/Operations research techniques.
6. Mange business process using analytical and management tools.
7. Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Course outcomes

1. Students will demonstrate knowledge of data analytics.
2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
4. Students will demonstrate the ability to translate data into clear, actionable insights.

Contents:

Unit 1: Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

Unit 2: Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Unit 3: Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

Unit 4: Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Unit 5:

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Unit 6: Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Reference Books::

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.

2. Business Analytics by James Evans, persons Education.

OEP-102-V Industrial Safety

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Contents:

Unit-I: Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Unit-II: Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-III: Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-IV: Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-V: Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference Books::

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

OEP-103-V Operations Research

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Outcomes:

At the end of the course, the student should be able to

1. Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
2. Students should able to apply the concept of non-linear programming
3. Students should able to carry out sensitivity analysis
4. Student should able to model the real world problem and simulate it.

Syllabus Contents:

Unit 1: Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models.

Unit 2 Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming.

Unit 3: Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT.

Unit 4: Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit 5: Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Reference Books::

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008

2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.

3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008

4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009

5. Pannerselvam, Operations Research: Prentice Hall of India 2010

6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

OEP-104-V Cost Management of Engineering Projects

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course contents:

Unit 1: Introduction and Overview of the Strategic Cost Management Process, Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit 2: Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.

Unit 3: Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector.

Unit 4: Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit 5: Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Reference Books::

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

OEP-105-V Composite Materials

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Contents:

UNIT–I: Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II: Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III: Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV: Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method- Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V: Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

Text Books:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.

2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

Reference Books::

1. Hand Book of Composite Materials-ed-Lubin.

2. Composite Materials – K.K.Chawla.

3. Composite Materials Science and Applications – Deborah D.L. Chung.

4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

OEP-106-V Waste to Energy

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course outcomes:

Unit-I: Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors.

Unit-II: Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-III: Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-IV: Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-V: Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion
- Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass

- Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Reference Books::

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.

2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.

4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

Audit Courses

AEC-301-V English for Research Paper Writing

No. of Credits: 0
L T P Total
2 0 0 2

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course objectives:

Students will be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title

Note: Ensure the good quality of paper at very first-time submission

Course Contents:

Unit 1: Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

Unit 2: Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction.

Unit 3: Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit 4: Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Unit 5: Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

Unit 6: useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)

2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .

4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

VAC-302-V Disaster Management

No. of Credits: 0
L T P Total
2 0 0 2

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives: -Students will be able to:

1. learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Unit 1: Introduction: Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit 2: Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

Unit 3: Disaster Prone Areas in India: Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics.

Unit 4: Disaster Preparedness and Management: Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data From Meteorological and other Agencies, Media Reports: Governmental and Community Preparedness.

Unit 5: Risk Assessment: Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co- Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

Unit 6: Disaster Mitigation: Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Suggested Readings:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep &Deep Publication Pvt. Ltd., New Delhi.

AEC-302-V Sanskrit for Technical Knowledge

No. of Credits: 0
L T P Total
2 0 0 2

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world.
2. Learning of Sanskrit to improve brain functioning.
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
4. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

Course Contents:

Unit 1: Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Unit 2: Order, Introduction of roots, Technical information about Sanskrit Literature.

Unit 3: Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Suggested reading

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Output:

Students will be able to

1. Understanding basic Sanskrit language.
2. Ancient Sanskrit literature about science & technology can be understood.
3. Being a logical language will help to develop logic in students.

VAC-303-V Value Education

No. of Credits: 0
L T P Total
2 0 0 2

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives

Students will be able to

1. Understand value of education and self- development.
2. Imbibe good values in students.
3. Let the should know about the importance of character

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understand the importance of value in self-development.
2. Imbibe good values for personality development.
3. Apply positive thought process for betterment in life.
4. Understand the importance of character building in development of overall personality.

Course Contents:

Unit 1: Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

Unit 2: Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline.

Unit 3: Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs

suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

Unit 4: Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

Suggested reading

1 Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi.

Course outcomes

Students will be able to

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

VAC-112-V Constitution of India

No. of Credits: 0
L T P Total
2 0 0 2

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Unit 1: History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working).

Unit 2: Philosophy of the Indian Constitution: Preamble, Salient Features.

Unit 3: Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Unit 4: Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

Unit 5: Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit 6: Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Suggested reading

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

VAC-304-V Pedagogy Studies

No. of Credits: 0
L T P Total
2 0 0 2

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives:

Students will be able to:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

Course Contents:

Unit 1: Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.

Unit 2: Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

Unit 3: Evidence on the effectiveness of pedagogical practices. Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Unit 4: Professional development: alignment with classroom practices and follow-up support, Peer support. Support from the head teacher and the community. Curriculum and assessment. Barriers to learning: limited resources and large class sizes.

Unit 5: Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Suggested reading

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.

2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.

3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.

5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes:

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

AEC-317-V Stress Management by Yoga

No. of Credits: 0
L T P Total
2 0 0 2

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objectives

1. To achieve overall health of body and mind
2. To overcome stress

Course Contents:

Unit 1: Definitions of Eight parts of yog. (Ashtanga)

Unit 2 Yam and Niyam. Do`s and Don't's in life i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit 3: Asan and Pranayam i) Various yog poses and their benefits for mind & body ii) Regularization of breathing techniques and its effects- Types of pranayama.

Suggested reading

1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

Course Outcomes:

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also.
2. Improve efficiency

AEC-304-V Personality Development through Life Enlightenment Skills

No. of Credits: 0 Sessional: 25 Marks

L T P Total Theory: 75 Marks

2 0 0 2 Total: 100 Marks

Duration of Exam: 3 Hours

Course Objectives

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

Course contents

Unit 1: Neetisatakam-Holistic development of personality

Verses- 19,20,21,22 (wisdom)

Verses- 29,31,32 (pride & heroism)

Verses- 26,28,63,65 (virtue)

Verses- 52,53,59 (dont's)

Verses- 71,73,75,78 (do's)

Unit 2: Approach to day to day work and duties.

Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48,

Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17,23, 35,

Chapter 18-Verses 45, 46, 48.

Unit 3: Statements of basic knowledge.

Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68

Chapter 12 -Verses 13, 14, 15, 16,17, 18

Personality of Role model. Shrimad Bhagwad Geeta:

Chapter2-Verses 17, Chapter 3-Verses 36,37,42,

Chapter 4-Verses 18, 38,39

Chapter18 – Verses 37,38,63

Suggested reading

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes

Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life.
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students.