B. Tech. Degree

IN

PRODUCTION ENGINEERING

SYLLABUS
FOR
CREDIT BASED CURRICULUM
(For students admitted in 2013-14)

DEPARTMENT OF PRODUCTION ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY
TIRUCHIRAPPALLI – 620 015
TAMIL NADU, INDIA
**B TECH PRODUCTION ENGINEERING CURRICULUM**

The total minimum credits required for completing the B.Tech. Programme in Production Engineering is First Year 45 and III to VIII Semester 140

**SEMESTER III**

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*STREAM SPECIFIC ELECTIVES ONLY*

*APPROVED GLOBAL ELECTIVES* should be from Production Engineering and allied Departments with the consent of respective course Faculty, Staff Advisor and HOD
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## Subjects offered to other Departments

### Mechanical Engineering

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MA 207 MATHEMATICS FOR PRODUCTION ENGINEERS

PREREQUISITE COURSE: Mathematics I and Mathematics II

COURSE OBJECTIVES:

- To apply various numerical computational techniques to solve various engineering problems
- To apply the basics of Fourier series and partial differential equations to solve thermal, fluid and general engineering problems.

Laplace Transforms of standard functions, derivatives and integrals – Inverse Laplace transform – Convolution theorem – Periodic functions – Application to ordinary differential equations and simultaneous equations with constant coefficients and integral equations.

Fourier Transforms, relationship between Fourier transform and Laplace transform, properties of Fourier transforms, Fourier Cosine and sine transforms - Inverse transforms - Convolution theorem and Parseval’s identity for Fourier transforms.

Newton's forward, backward and divided difference interpolation - Lagrange's interpolation - Numerical Differentiation and Integration - Trapezoidal rule – Simpson’s 1/3 and 3/8 rules - Curve fitting - Method of least squares – Newton-Raphson method for f(x,y)=0 and g(x,y)=0.


Numerical solution of Laplace equation and Poisson equation by Liebmann's method - solution of one dimensional heat flow equation - Bender - Schmidt recurrence relation - Crank - Nicolson method - Solution of one dimensional wave equation.

EVALUATION PATTERN:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

TEXT BOOKS:

REFERENCE BOOKS:
COURSE OUTCOMES:
- Understand the applications of Laplace method, Euler's method, Newton-Raphson method
- Solve linear and non-linear equations.
- Apply the studied techniques for optimization
- Solve problems using Fourier series, Laplace and Fourier transforms.
- Formulate and solve partial differential equation
- Apply acquired concepts in like heat conduction, and a prerequisite for post graduate and specialized studies and research

PR 201 CASTING TECHNOLOGY

PREREQUISITE COURSES: Branch specific course; Introduction to Production Engineering

COURSE OBJECTIVES:
- To perform casting design and able to perform foundry techniques.

Introduction to foundry, advantages and disadvantages. Pattern: Types, pattern making, allowances, materials and color codes. Core: types, core materials, core boxes, core

Sand Molding: Types of sands, sand properties, sand control tests, sand preparation, sand molding techniques, special molding processes.

Casting techniques: Permanent mold, pressure die casting, squeeze casting, centrifugal casting, continuous casting, electroslag casting, fettling, heat treatments for casting, defects and inspections

Casting Design: Gating system, risering system, casting design: Metallurgical consideration, design consideration, economical consideration. Modernization, mechanization of foundries.


EVALUATION PATTERN:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

TEXT BOOKS:
Department of Production Engineering


REFERENCES:

COURSE OUTCOMES:

- Fundamentals in patterns, cores, sand properties and molding, including special techniques and CAD/CAM applications.
- Understand various casting techniques, heat treatments, defects and inspections.
- Design a casting with metallurgical, design and economic consideration.

PR 203 MACHINING TECHNOLOGY

PREREQUISITE COURSE: Basic Engineering

COURSE OBJECTIVES:

- To perform different machining operations like turning, drilling, milling and finishing.
- To predict tool life and tool failure
- To select suitable cutting fluid for respective materials


**Department of Production Engineering**

**EVALUATION PATTERN:**
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

**TEXT BOOKS:**

**REFERENCES:**
3. ASM Handbook, *Machining*

**COURSE OUTCOMES:**
- Summarize the theory of metal cutting and compute cutting forces involved from Mohr’s circle.
- Recognize various parts of lathe, list the accessories and explain various operations performed.
- Explain the construction of drilling, boring, reaming and milling machines and explain operations performed

**PR 205 METALLURGY AND MATERIALS ENGINEERING**

**PREREQUISITE COURSES:** Chemistry I and Chemistry II

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**COURSE OBJECTIVES:**
- To test materials through various testing methods to evaluate their properties
- To conduct heat treatment processes for metals

Art and science of metallurgy-structure of metals and alloys-phase and structural constitutions-
Equilibrium diagrams
Ferrous metals and alloys-Fe-Fe₃C diagram-Effect of alloying elements in steel, Classification of ferrous alloys and their applications
Heat treatment of steel-CCT diagram-Surface hardening process-Non Ferrous Metals Alloys-composition-properties and applications of copper, nickel, lead, tin, zinc, aluminium, Mg and Ti alloys-Heat treatment of Non Ferrous alloy-Non Metallic Metals and alloys-ceramic material-polymer-composite material – Nano-structured materials

Testing of Materials-Non-Destructive Testing, Tensile testing, compression testing - Hardness Testing

Testing of Materials-Impact testing, Fatigue testing, Creep, other related testing methods characterization of TEM, XRD, SEM

**Practice:**


Demonstration on SEM/XRD

**EVALUATION PATTERN**

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

**TEXT BOOK:**


**REFERENCE BOOKS:**


**COURSE OUTCOMES:**

- Interpret microstructure of engineering materials and explain Equilibrium diagrams.
- Classify ferrous alloys and their applications with respect to foundry and welding processes.
- Understand heat treatment processes for alloys, non alloys & summarize testing methods like TEM, XRD, SEM
CE 282 FLUID MECHANICS AND MACHINERY

PREREQUISITE COURSES: Engineering mechanics

COURSE OBJECTIVES:
- To measure fluid flows and handle fluid machineries.

Introduction-Units and Dimensions - Fluid properties.Fluid statics : Pressure in a fluid - force on submerged planes - buoyancy - equilibrium of floating bodies

Types of Flow and Measurement-Types of flow - one dimensional continuity, momentum, and Energy equations-Flow measurement - Orificemeter - Venturimeter, Pitot tube, orifices, mouthpieces, notches and weirs

Boundary Layer Theory-Ideal and real fluid flow - boundary layer concepts- flow through pipes - friction factor - flow losses in pipeline

Pump-Centrifugal pump - types - specific speed - Equations for energy transfer - efficiencies. Reciprocating pump - gear pump – screw pump

Turbines - Hydraulic turbines - types - specific speed - pelton - Francis and Kaplan turbines - Calculation of power output efficiencies.

EVALUATION PATTERN:
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
- Understand properties of fluids.
- Determine flow through hydraulics machines and pipes
ME 325 THERMAL ENGINEERING

PREREQUISITE COURSES: Physics

COURSE OBJECTIVES:
- To design I.C. Engines, Compressors and Turbines effectively
- To perform flow analysis in nozzles used in different locations

Laws Of Thermodynamics-Basic concepts - first law of thermodynamics applied to closed and open systems - simple problems.

Second law of thermodynamics - concept of reversible process

Air standard cycles - otto, diesel and dual cycles - I.C. engines, S.I. engines and CI engines

Reciprocating compressor - effect of clearance volume, single and multistage compressor - Volumetric efficiency - calculation of power requirement - gas turbines - open and closed cycle - intercooling, reheating and regenerative cycles Wankel engine-Sonic velocity, mach no. Wave propagation - mach cone, static and stagnation property relations, isotropic flow, use of gas tables, normal shock, flow through converging and diverging nozzle


EVALUATION PATTERN:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation: 50 marks end semester exams

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES:
- Apply thermodynamic laws in engineering applications
- Calculation of power requirements of gas turbines and flow rates through nozzles
- Calculation of thermal efficiencies of steam turbines
PR 207 MECHANICS OF MATERIALS (Theory and Lab)

PREREQUISITE COURSES: Engineering mechanics

COURSE OBJECTIVES:
- To predict the behavior of structures on loading and implement the concepts in suitable applications.

Simple Stresses and Strains - Types of stresses - types of strain – Composite bar – Temperature stresses – Volumetric Strain.

Stress transformation equations. Principal stress and their planes. Plane of Maximum shear stress – Mohr’s Circle for stress

Shear force and bending moment Diagrams for different types of beams like cantilever, Simply Supported, overhanging subjected to concentrated load and Uniformly Distributed Load (UDL) – Bending stress, shear stress for different sections

Deflection equation elastic line of a beam – Different methods to find deflection and slope of beams like Macaulay’s method, Moment area method.


EVALUATION PATTERN:
Theory content is evaluated for 70 % and Practical input is evaluated for 30 %

THEORY:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.
External Evaluation: 50 marks end semester exams and End semester Practical examination

PRACTICE:
Internal Evaluation: Continuous internal evaluation during performing exercises.
External Evaluation: End semester Practical examination

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES:
- Able to perform simple stress and strain calculations.
Department of Production Engineering

- Able to calculate the bending stresses of beams.
- Able to design different types of shafts and springs

PR 211 MANUFACTURING PROCESSES LAB – I

PREREQUISITE COURSES: Branch specific course and Workshop practice

COURSE OBJECTIVES:
- To perform all lathe operations to produce a component of their need.

EXERCISE-1: Step turning
EXERCISE-2: Taper turning and parting off
EXERCISE-3: Knurling
EXERCISE-4: Thread cutting
EXERCISE-5: Boring
EXERCISE-6: Eccentric turning
EXERCISE-7: Copy turning

EVALUATION PATTERN:
Internal Evaluation: Continuous internal evaluation during performing exercises.
External Evaluation: End semester Practical examination

COURSE OUTCOMES:
- Summarize the machine tool construction.
- Create work pieces by turning, boring using lathe and drilling machine.
- Utilize different machine tool attachments
ME 331FLUID MACHINERY AND THERMAL ENGINEERING LAB

COURSE OBJECTIVES:

- To perform various tests on different hydraulic turbines and pumps.

EXERCISE-1: Francis turbine
EXERCISE-2: Pelton turbine
EXERCISE-3: Submersible pump
EXERCISE-4: Reciprocating pump
EXERCISE-5: 'V' Notch
EXERCISE-6: Centrifugal pump
EXERCISE-7: Venturimeter

EVALUATION PATTERN:

Internal Evaluation: Continuous internal evaluation during performing exercises.
External Evaluation: End semester Practical examination

COURSE OUTCOMES:

- Study the functional aspects of different pneumatic components and its usage in circuits.
- Study the functional aspects of different hydraulic components and its usage in circuits.
- Design different pneumatic and hydraulic circuits for different applications

THERMAL ENGINEERING LABORATORY

COURSE OBJECTIVES:

- To perform tests on different fuels to determine their properties.
- To perform performance tests on gas turbines to collect data for their design and inspection.
- To evaluate IC engines through various tests.
1. Determinations of flash and fire point-lubricating oil.
2. Valve timing and port timing diagram
3. Performance test for constant speed engine
4. Heat balance test using exhaust gas calorimeter
5. Morse test on multi-cylinder petrol engine
6. Performance curve for air compressors.
7. Determination of COP using Refrigeration Test Rig.

EVALUATION PATTERN:
Internal Evaluation: Continuous internal evaluation during performing exercises.
External Evaluation: End semester Practical examination

COURSE OUTCOMES:
- Conduct of experiments on various thermal systems.
- Support in development of energy field.

MA 208 PROBABILITY AND STATISTICS

PREREQUISITE COURSE: Mathematics-I, Mathematics-II

COURSE OBJECTIVES:
- To apply probability and statistics tools for quality assurance procedure for their products.

Random variable - Two dimensional random variables – standard probability distributions – Binomial Poisson and normal distributions - moment generating function

Sampling distributions – testing of hypotheses – Large sample tests for mean and proportion – t-test, F-test and Chi-square test – Independence of attributes-Analysis of Variance

Point estimation-Interval estimation – Measures of quality of estimators-Confidence intervals for means and variance -Correlation -rank correlation – multiple and partial correlation – Regression Analysis


Department of Production Engineering

EVALUATION PATTERN:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

TEXT BOOK:

REFERENCES:

COURSE OUTCOMES:
- Understand the fundamentals and application of statistics to engineering problem
- Use statistical concepts in their research work.
- To form hypothesis and able to test their hypothesis with various statistical tests. Identify the significant factors using ANOVA

PR 204 KINEMATICS AND DYNAMICS OF MACHINES

PREREQUISITE COURSES: Engineering Mechanics

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COURSE OBJECTIVES:
- To design various machines and to perform kinematic and dynamic analysis.

Kinematic pairs, diagram and inversion - Displacement, velocity and acceleration analysis of planar linkages - static and dynamic analysis of simple mechanisms

Cam profile synthesis - Gears dynamic force analysis

Flywheel – fluctuation of energy and speed, Governors

Inertia forces and their balancing for rotating and reciprocating machines. Hydrodynamic and boundary lubrication in journal and thrust bearings.

Longitudinal – Transverse – Torsional vibration – Two degrees of freedom and multi-degree of freedom systems.

EVALUATION PATTERN:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams
TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES:
- Understand the basic concepts of machines and machinery
- Understand law of gearing
- Understand the laws of dry friction
- Understand all mechanisms of machines.
- Design various mechanisms of machines
- Evaluate various mechanisms of machines

PR206 WELDING TECHNOLOGY

PREREQUISITE COURSES: Metallurgy and Materials Engineering

COURSE OBJECTIVES:
- To apply the basics of metal joining processes to join different metals.
- To select appropriate technique for joining suitable materials

Classification of welding processes: Arc welding power sources, power source characteristic curves, flux covering, different types of electrodes and their applications, gas welding and cutting, flame characteristics

Gas tungsten arc welding process, electrode polarity, shielding gas, use of pulsed arc welding process; gas metal arc welding, mode of metal transfers, pulsed MIG welding process. Submerged arc welding, advantages and limitations.

Orbital welding of tubes / pipes; Plasma-arc welding process, transferred and non-transferred arc welding and their applications, plasma cutting, surfacing and applications


Radiant energy welding processes - equipment -electron beam welding (EBW) - laser beam welding (LBW) - applications of EBW and LBW- Friction Steel Welding-Defects in welding.
EVALUATION PATTERN:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

TEXT BOOKS:

REFERENCES:
2. ASMHandbook”Welding”

COURSE OUTCOMES:
- Understand the different types of welding
- Analyze the parameters that influences welding
- Understand the application of various welding processes

PR 208 FORMING TECHNOLOGY

PREREQUISITE COURSES: Chemistry I, Chemistry II and Metallurgy and Materials Engineering

COURSE OBJECTIVES:
- To apply basic of metal forming processes to shape products to their desired forms without any defects.

Yield criteria for ductile metals - Flow theories – strain hardening - recrystallization
Fundamentals of metal forming- Effect of temperatures, speed and metallurgical microstructure on forming processes - Mechanics of Metal Forming
Forging Processes Forging Equipment, Forging defects - Types of Rolling mill - process variables – defects
Types of extrusion - Process variables - Wire drawing - Drawing and Deep drawing – Sheet metal working
High energy rate forming processes.
EVALUATION PATTERN:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES:
- Understand the properties of ductile metals
- Understand the effects of temperature, speed on metal forming process
- Understand the principle, procedure and applications of Bulk Metal Forming and Sheet Metal Forming

PR 210 METROLOGY (Theory & Lab)

PREREQUISITE COURSE: Physics-I

COURSE OBJECTIVES:
- To apply various measurement techniques to inspect and test products
- To apply statistical tools for quality assurance purpose
- To test and evaluate various components using various measuring instruments

LAB EXERCISES
Study and use of Electronic comparator - Profile projector - sine bar - precision measuring instruments - coordinate measuring machine Measurement of Gear tooth thickness - Adjacent base pitch error - surface roughness

EVALUATION PATTERN:
Theory content is evaluated for 70 % and Practical input is evaluated for 30 %
Theory
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.
External Evaluation: 50 marks end semester exams and End semester Practical examination
Practice
Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination

TEXTBOOK:

REFERENCES:

COURSE OUTCOMES:
- Describe the fundamental concepts in measurement methods, techniques.
- Apply various instruments for measurements
- Apply quality control tools to achieve defects free quality products
- Take precise measurements using various instruments.
- Develop data for engineering analysis.

EE 244 ELECTRICAL AND CONTROL SYSTEMS (Theory and Lab)

PREREQUISITE COURSES: Physics

COURSE OBJECTIVES:
- To apply concepts of electrical drives and control systems to various industrial applications.
- To test various electrical and electronic devices like generators, motors, semiconductor diodes, rectifiers and logic gates.
DC machines - Characteristics - Starting and speed control of DC motors. Transformers: (Single phase only)- equivalent circuit and regulation - losses and efficiency - auto transformer.
Alternators - EMF equation - regulation by synchronous impedance method - Synchronous motors - starting and applications.
Three - phase induction motor - Cage and slip ring motors -torque slip characteristics –starting and speed control of induction motors - single phase induction motors and universal motors.
Electric drive for general factory, textile mill - pump, blowers, hoists, traction etc. - group and individual drives - Construction and working of dynamometer type watt meters and induction type energy meters.
Control System – open loop and closed loop systems- transfer function - time response of second order system - frequency response method - polar plot. Concept of stability - application of routh criterion for simple systems.

**LAB**

EXERCISE-1: No - load speed characteristics of D.C. shunt motor
EXERCISE-2: Load test on D.C.Shunt generator
EXERCISE-3: Equivalent circuit of single - phase transformer
EXERCISE-4: Swinburne's test
EXERCISE-5: Starting of 3-phase induction motors
EXERCISE-6: Semiconductor junction diode V-I characteristics
EXERCISE-7: Semiconductor zener diode V-I characteristics
EXERCISE-8: Inverting and Non-inverting Operational Amplifiers
EXERCISE-9: Uni Junction Transistor ( UJT) and Silicon Controlled Rectifier( SCR) characteristics
EXERCISE-10: Logic gates

**EVALUATION PATTERN:**
Theory content is evaluated for 70 % and Practical input is evaluated for 30 %

**THEORY:**
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.
External Evaluation: 50 marks end semester exams and End semester Practical examination

**PRACTICE:**
Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination
TEXT BOOK:

REFERENCES:

COURSE OUTCOMES:
- Understand the concepts of transformer and DC machines
- Understand open and closed system
- Understand the mechanics of fluids, transportation of mass, momentum and energy
- Conduct exercises to learn DC motor
- Conduct experiments for understanding VI characteristics of diodes
- Conduct experiments to learn about Logic Gates

PR 212 MANUFACTURING PROCESSES LAB – II

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PREREQUISITE COURSES: Workshop practice I and Metallurgy and Materials Engineering

COURSE OBJECTIVES:
To perform various operations on special machines like milling machine, drilling machine, grinding machine and slotting machine.

EXERCISE-1: Shaping rectangular block or cube

EXERCISE-2: Slot cutting / Step-cutting / V-block

EXERCISE-3: Milling rectangular block or cube

EXERCISE-4: T - Slot milling

EXERCISE-5: Spur gear cutting

EXERCISE-6: Surface grinding

EXERCISE-7: Single point tool grinding

EXERCISE-8: Spur and Helical gear generation on hobbling machine
EXERCISE-9: Complex shaped component production using EDM.

EXERCISE-10: Drilling

**EVALUATION PATTERN:**
Internal Evaluation: Continuous internal evaluation during performing exercises.
External Evaluation: End semester Practical examination

**COURSE OUTCOMES:**
- Hands on Experience on lathe machine, Milling machine, drilling machine
- Hands on experience on casting methods.
- Hands on experience on welding

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**PR 214 WELDABILITY AND FORMABILITY TESTING LAB**

**PREREQUISITE COURSES:** Metallurgy and Materials Engineering

**COURSE OBJECTIVES:**
To weld materials effectively and evaluate weldment properties

1. Arc butt welding of mild steel
2. Arc lap welding of mild steel
3. Macrostructure and microstructure evaluation of nugget zone
4. Bending testing on welded plates.
5. Hardness test on weldments

**EVALUATION PATTERN:**
Internal Evaluation: Continuous internal evaluation during performing exercises.
External Evaluation: End semester Practical examination

**COURSE OUTCOMES:**
- Application of welding knowledge to fabricate sound parts
- Application of testing knowledge to evaluate the quality of weldments.
FORMABILITY TESTING LAB

PREREQUISITE COURSES: Metallurgy and Materials Engineering

COURSE OBJECTIVES:

To test the formability of sheet metals

LAB EXERCISES

1. Tensile testing
2. Three point bend test
3. Deep drawing test

EVALUATION PATTERN:

Internal Evaluation: Continuous internal evaluation during performing exercises.
External Evaluation: End semester Practical examination

COURSE OUTCOME:

- Able to test sheet metals and evaluate their properties

PR 301 DESIGN OF MACHINE ELEMENTS

PREREQUISITES: Engineering Mechanics, Strength of materials

COURSE OBJECTIVES:

- To understand material properties, design process and various theories of failures
- To design various basic machine components
- To design new components based on design principles

Introduction to the design process, factor influencing machine design, mechanical properties of materials, direct stress, bending stress, torsional stress and variable stress in machine parts, theories of failure, stress concentration factor, factor of safety.

Design of shafts based on bending moment, twisting moment, combined of bending and twisting moments, axial loads in addition to combined torsional and bending loads, rigidity and stiffness. Design of spring.
Belt and chain drives: selection of flat belt, V belt and chain drives. Design of couplings, keys and bearings.

Welded joints: types of joints, welding symbol and weld symbol and their representation, strength of welded joints subjected to various types of load. Riveted joints: types of joints, design of riveted joints for structure.

Design of spur and helical gears. Design of gear box: layout diagram, speed diagram, fixing number of teeth and module of gears.

**EVALUATION PATTERN:**
Internal Evaluation: Cycle test 1-20 marks; Cycle test 2-20 marks; Assignment 10 marks
External Evaluation: 50 marks end semester exams

**TEXT BOOKS:**

**REFERENCES:**

**COURSE OUTCOMES:**
- Understand the various theories of failures
- Design various machine components
- Design new components based on the design principles

**PR 305 TOOLING FOR MANUFACTURING**

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**PREREQUISITES:** Design of Machine Elements, Strength of materials, Engineering Mechanics

**COURSE OBJECTIVES:** To study the various design considerations for tooling.

Design of cutting tools: Tool materials, design of single point cutting tool, form tool, drill, reamer, broach & plain milling cutter.

Theory of metal cutting – design of tool holders for single point tools – Boring bars – selection of tools for machining applications – economics of machining

Design of fixtures: standard work holding devices – principles of location and clamping – clamping methods and elements – quick-acting clamps – design & sketching of milling fixtures
for simple components – Turning, Grinding, Welding fixtures. inspection fixtures and design of gauges

Design of Drill jigs: Drill bushings – types of jigs: Plate, Leaf, Turn over & Box Jigs – design & sketching of drill jigs for machining simple components


EVALUATION PATTERN:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

TEXT BOOKS:
1. A Bhattacharyya, Metal Cutting Theory and Practice, Central Book Agency Kolkata.

REFERENCES:

COURSE OUTCOMES
- Design single point cutting tool, form tool, drill etc
- Understand how to conduct machining economically
- Design jigs, fixtures and press tools

PR 307 QUALITY, RELIABILITY AND SAFETY ENGINEERING

PREREQUISITES: Basic Engineering

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COURSE OBJECTIVES
- To identify and analyze failures of components and subcomponents of mechanical and electronic items.
- To distinguish different concepts in maintenance and explore in order to increase service life of the products/machines.
- To list various safety measures concerned with environment described for a safety engineer.

Introduction to quality assurance and quality control – Statistical concepts in quality – Central limit theorem – Quality control tools

Control charts for variables and attributes– process capability studies – Sampling inspection – Quality System standard
Failure Rate, Mean Time Between Failures (MTBF)-Mean Time To Failure (MTTF), Bathtub distribution, Down time, Repair time, Availability, Series-Parallel Structures, Redundancy, Reliability Allocation, Mechanical Reliability, Failure Mode Analysis.


**EVALUATION PATTERN:**

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams.

**TEXT BOOKS:**

1. David J Smith, Butterworth-Heinemann, Reliability Maintainability and Risk; Practical methods for engineers, New Delhi, 2001
2. B.S. Dhillon, Maintainability, Maintenance and Reliability for Engineers, CRC Press, 2006

**REFERENCES:**

2. B.S. Dhillon, Engineering maintenance; a modern approach, CRC Press, 2002

**COURSE OUTCOMES:**

- Identify and analyze the failures of the components and subcomponents of mechanical and electronic items.
- Distinguish different concepts in maintenance and explore in order to increase the service life of the products/machines
- List various safety measures concerning with environments described for a safety engineer
PR 309 UNCONVENTIONAL MACHINING PROCESSES

PREREQUISITES: Machining Technology

COURSE OBJECTIVES:
- To understand several non-traditional machining process in micro and precision manufacturing field
- To select suitable machining process for materials considering their merits and demerits

Introduction - Classification - process economy - Mechanical machining - Types - Ultrasonic machining (USM) - Abrasive Jet Machining (AJM) - Abrasive Flow Machining (AFM) - Water Jet Machining (WJM) - Operating principle - Process parameters - Applications - Limitations.

Electro chemical machining - Chemical material removal - Types - Electro chemical machining (ECM) - Electro chemical drilling (ECD) - Electro chemical grinding (ECG) - Electro chemical honing (ECH) - Shaped tube electrolytic machining - Operating principle - Process parameters - Applications - Limitations.

Thermo electrical machining - Types – Electrical discharge machining (EDM) - Electrical discharge wire cutting (EDWC) - Electron beam machining (EBM) - Ion Beam Machining (IBM) - Plasma Arc Machining (PAM) - Operating principle - Process parameters - Applications - Limitations.


Special processing technologies - Rapid Prototyping - Methods - Fused Deposition Modeling (FDM) - Laminated Object Manufacturing (LOM) - Selective laser sintering (SLA) - Solid Ground curing (SGC) - 3D printing (3DP) - Processing of integrated circuits - Micro and nano fabrication technologies.

EVALUATION PATTERN:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES:
- Understand the contribution of non-traditional machining process in micro and precision manufacturing field.
- Select suitable machining process for suitable materials
- Summarizes the merits and demerits of the non-traditional manufacturing process
PR 311 PROFESSIONAL ETHICS AND PSYCHOLOGY

PREREQUISITE COURSES: Basic Engineering

COURSE OBJECTIVES:
To create awareness on Engineering Ethics and Human Values and Morals


Introduction to Industrial Psychology – Definitions & Scope. Major influences on industrial Psychology- Scientific management and human relations schools Hawthorne Experiments Individual in Workplace


Boredom, accidents and safety Job Analysis, Recruitment and Selection – Reliability & Validity of recruitment tests. Performance Management : Training & Development.

EVALUATION PATTERN:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

TEXTBOOK:

REFERENCES:

COURSE OUTCOMES:
- Recognize human values, Engineer’s responsibility, Employee rights.
- Instill Moral and Social Values and Loyalty.
- Appreciate the rights of others.
COURSE OBJECTIVES:

- To gain knowledge in Engineering product specification and CAD/CAM integration.
- To impart knowledge in CAD software package for modeling, assembly, FEA of mechanical components and CNC programming for Milling/Turning.

CIM - evaluation, hardware and software of CIM - concurrent engineering – advance modeling techniques.


Cellular manufacturing - Group Technology – Flexible Manufacturing Systems- Configurations- Workstations - Control systems - Applications and benefits

Materials handling and Storage Systems - types of material handling systems – storage systems – Automated storage and retrieval systems – Robotics technology - control systems - Programming - Applications – Automated inspection and testing – Coordinate measuring machines.

LAB EXERCISES

1. Plain turning and facing operations on EMCO turning machine.
2. Step turning operation on LEADWELL machine.
3. External threading operation on LEADWELL and STC 15 machines.
4. Profile milling operation on VMC machine.
5. Rectangular pocketing and drilling operations on EMCO milling machine.
6. Mirroring operation on MTAB milling machine.
7. Inspection on CMM

EVALUATION PATTERN:

Theory content is evaluated for 70 % and Practical input is evaluated for 30 %

Theory
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.
External Evaluation: 50 marks end semester exams and End semester Practical examination
Practice
Internal Evaluation: Continuous internal evaluation during performing exercises.
External Evaluation: End semester Practical examination

TEXT BOOK:

REFERENCES:

COURSE OUTCOMES:
- Assembly of mechanical components using CAD software Solid Works/CATIA/Pro-E.
- Finite Element Analysis (FEA) using Pre-processing (solid modeling, meshing, analysis setup)
- and post processing (graphical display and report) with software PATRAN/ NASTRAN/ MARC/
- ABAQUS/ LS-DYNA/ ANSYS/PAM-CRASH (Exercises include Simple Beam, Plane Stress, Strain, axi-symmetric, 3D Solids).
- CNC code generation for CNC Milling.
- CNC code generation for CNC Turning.
- Demonstration of CNC Router Machine/ CNC Lathe/ CNC Milling (Students have to submit detailed reports on each demonstrations).

PR315 MACHINE DRAWING PRACTICE

PREREQUISITES: Engineering Graphics

COURSE OBJECTIVES
- To prepare the precise machine drawings for manufacture of components.
- To facilitate better product design.
- To interpret and generate suggestions about drawings.

Conventions, Abbreviations and symbols: Conventional representations of interrupted views, symmetrical objects, intersection curves, square ends and openings, adjacent parts, common machine elements, springs, gear drives – Abbreviations, designation and composition of ferrous materials, nonferrous materials and engineering drawing.
Limits, Fits and Tolerances, tolerance grades, fundamental deviation, indication of tolerances - classification, system, selection and indication of fits, geometrical tolerances, surface texture.

Screw threads and threaded fasteners, types of bolts and nuts, locking pins, screws. Rivet joints, Keys and welded joints.

Assembly Drawing: Cotter and pin joints, couplings, clutches, pulleys and pipe joints.

Assembly Drawing: Bearings, heat engine parts, valves, pumps and machine parts.

EVALUATION PATTERN:
Internal Evaluation: Continuous internal evaluation during performing exercises.
External Evaluation: End semester Practical examination

TEXTBOOK:

REFERENCES:

COURSE OUTCOMES:
- Prepare the precise machine drawings for manufacturing of components.
- Facilitate better product design.
- Interpret and give suggestion about the drawings.

PR 302 OPERATIONS RESEARCH
PREREQUISITES: Applied statistics

COURSE OBJECTIVES:
- To understand Linear programming, assignment and queuing problems
- To make decisions under uncertainty
- To prepare project network and perform project scheduling

Concept of linear programming model - Development of LP models - Graphical method. Simplex method - Big M method - Two-phase method - Special cases in Linear Programming. Introduction to duality theory.


Decision under uncertainty- Laplace criterion, Maximin criterion, Minimax criterion, Savage minimaxregret criterion, Hurwicz criterion. Decision making under risk-expected value criterion-decision tree, Investment decisions—present worth method, annual equivalent method, rate of return method, Replacement Analysis-types of replacement problem. Replacement of item that fail with respect to time. Replacement of item that fail suddenly-individual replacement and group replacement.

Project network construction – Critical Path Method (CPM) - determination of critical path - Project Evaluation and Review Technique (PERT)-probability of completing a project in a scheduled date - Crashing of project network-cost considerations in project scheduling , Production scheduling- single machine scheduling, flow shop scheduling, Johnson’s algorithm

**EVALUATION PATTERN:**

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation: 50 marks end semester exams

**TEXTBOOK:**


**REFERENCES:**


**COURSE OUTCOMES:**

- Summarize different techniques for production planning like queuing uncertainty and mathematical modeling are involved
- Apply optimization in utilization of resources
- Apply resource management techniques to industrial operations
PR 304 WORK DESIGN AND FACILITIES PLANNING

PREREQUISITE: Reliability, maintenance and safety Engineering

COURSE OBJECTIVE:
To understand method study and work management techniques

Methods study - motion and time study, and productivity - micromotion and macromotion study - Ergonomics.

Work measurement - techniques of work measurement - time study - production study.
Facility layout - steps in facility location study - layout types and analysis.

Layout design process - systematic layout planning - analysis - designing the layout - Assignment model

Computerized layout planning - CRAFT, ALDEP and CORELAP

EVALUATION PATTERN:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

TEXTBOOKS:

REFERENCE:

COURSE OUTCOMES:

- Perform ergonomic analysis
- Perform computerized layout planning
- Perform work measurements
PR 306 PRECISION ENGINEERING (Theory&Lab)

PREREQUISITES: Machining technology

COURSE OBJECTIVES:
To provide and enhance technical knowledge in precision engineering, its components and applications.

Precision machining – Concepts and significance – Classification - Top down – Bottom up approaches – Precision and micromachining - Machining of micro-sized components - Ultra precision machining grinding


Nano surface generation-Concepts and applications-Types- Ductile mode of machining- Diamond turning of parts to nanometer accuracy – ELID grinding – Chemo Mechanical Polishing-Magnetorhelogical finishing.

Precision metrology –In-process measurement of position of processing point - Post process and online measurement of dimensional features -Mechanical measuring systems - Optical measuring systems - Electron beam measuring systems – Scanning Tunneling – Atomic Force Microscope.

Precision Lab exercises
2. Exercise on Micro-milling operation on DT-110 Multi-process micro-machining center.

EVALUATION PATTERN:
Theory content is evaluated for 70 % and Practical input is evaluated for 30 %

Theory
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.
External Evaluation: 50 marks end semester exams and End semester Practical examination

Practice
Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination

TEXT BOOKS:
REFERENCES:

COURSE OUTCOMES:
Understand the concept of precision engineering, its principles and importance as applicable to instruments and machines.

PR 308 COMPUTER AIDED DESIGN AND ENGINEERING (Theory & Lab)

PREREQUISITES: Physics, Applied Electronics

COURSE OBJECTIVES
- To understand various hardware and software that serve as components of CAD system
- To understand plotting, transformations techniques, geometric modeling
- To understand graphic standards, finite element modeling and DBMS

Geometric modeling: Wireframe modeling, Surface modeling : Representation of curves and surfaces, design of curves : cubic splines, bezier curves and B-spline, design of surfaces.
Solid modeling: Constructive solid geometry (C-rep) and Boundary representation (B-rep).
Graphics standards: GKS, DXF and IGES standards - Parametric design programmes.
Finite element modeling and analysis: types of analysis, degrees of freedom, element and structure-stiffness equation, assembly procedure. Database concepts and data base management systems - SQL.

LAB EXERCISES
- Part modelling using CAD
- Assembly using CAD
- Manufacturing analysis using CAM
- Engineering analysis using CAE

EVALUATION PATTERN
Theory content is evaluated for 70 % and Practical input is evaluated for 30 %

Theory
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.
External Evaluation: 50 marks end semester exams and End semester Practical examination

Practice
Internal Evaluation: Continuous internal evaluation during performing exercises.
External Evaluation: End semester Practical examination

**TEXT BOOKS:**

**REFERENCES:**

**COURSE OUTCOMES**
- Summarize the concepts and applications of CAD.
- Elaborate fundamental of computers, networks, transformations techniques, geometric modeling solid modeling and finite element modeling
- Distinguish various concepts and techniques used for Product design and to develop product design skills.

**PR 310 MECHATRONICS AND INDUSTRIAL AUTOMATION (Theory&Lab)**

**PREREQUISITE:** Fluid mechanics and Machinery, Engineering mechanics

**COURSE OBJECTIVE:**
To study hydraulic and pneumatic systems, sensors and their applications

Introduction - overviews, principles and application of hydraulic, pneumatic, electric controls system.


Pneumatic system, pneumatic components - pressure-flow-direction controls valves - pneumatic components symbols- Design and application of pneumatic circuits of machine tool.

Semi automats-automats-transfer lines - automatic assembly - transfer devices and feeders-classifications and applications-job orienting and picking devices- setting of automats and transfer lines.

Introduction to mechatronics, mechatronics system, Microprocessors and their applications, Sensors and Principles, PLC system, examples of mechatronics systems.

**LAB EXERCISES**
1. Design, simulate and testing of Pneumatic and Electro Pneumatic circuits for engineering applications using actuators and control valves (pressure, flow and direction).
2. Design, simulate and testing of Hydraulic and Electro Hydraulic circuits for engineering applications using actuators and control valves (pressure, flow and direction).
3. Design, simulate and testing of PLC circuits for engineering applications using sensors.
4. Using MAT Lab/SCI lab - Study on Robot programming and operation with vision systems.

EVALUATION PATTERN:
Theory content is evaluated for 70% and Practical input is evaluated for 30%

Theory
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.
External Evaluation: 50 marks end semester exams and End semester Practical examination.

Practice
Internal Evaluation: Continuous internal evaluation during performing exercises.
External Evaluation: End semester Practical examination.

TEXTBOOKS:

REFERENCES:

COURSE OUTCOMES:
- Understand hydraulic devices and their applications.
- Analyze the integrated product design.
- Generate electro-hydraulic, electro-pneumatic solutions.
PR 312 PRODUCTION DRAWING AND COST ESTIMATION

PREREQUISITES: Machine Drawing, Design of machine elements

COURSE OBJECTIVES
- To understand the fundamentals of manufacturing drawings
- To develop process sheets and production drawing for various assemblies
- To perform cost and time estimation

Review of Current International standards (ISO) and Indian Standards (IS) - Geometric Dimensioning and Tolerancing - Centrality Analysis - Compound Assembly.

Process Sheet - Fundamentals - Contents - Preparation of process sheet for various components.

Manufacturing Drawings: Surface texture indication on drawing - welds symbolic representation of drawings. Given a sub-assembly/assembly to prepare manufacturing drawings of components, Sample exercises on CAD - preparation of manufacturing Drawings.

Re-dimensioning and Tolerance Charting: Introduction to re-dimensioning to suit manufacturing requirements-manufacturing datum-functional datum. Introduction to tolerance charting


EVALUATION PATTERN:
Internal Evaluation: Continuous internal evaluation during performing exercises.
External Evaluation: End semester Practical examination

TEXTBOOK:
1. IS:10714, 10715, 10716, 10717, 11669, 10719, 813, 919, 2709, 8000 pt 1 to 10721, 11158 and AWS/ISO

REFERENCES:

COURSE OUTCOMES:
- Interpretation of contents of production drawing
- Development of process sheet and manufacturing drawings
- Systematic estimation of cost and time
PR 401 SUPPLY CHAIN MANAGEMENT

PREREQUISITES: Operations Research, Quality, Reliability & Safety Engineering

COURSE OBJECTIVES
To provide an insight on the fundamentals of supply chain strategy, logistics, sourcing and outsourcing supply chain networks, tools and techniques.


Supply chain configuration design - factors involved - sourcing, models for strategic alliances – supplier selection, outsourcing and procurement process – facility location and capacity allocation - modeling approaches LP, MILP - network design in uncertain environment – evaluation using simulation models.

Demand forecasting-collaborative forecasting models-bullwhip effect-information sharing - aggregate planning in supply chain- strategies-multi echelon inventory planning-models-discounting- risk pooling- centralized versus decentralized systems.

Roles of transportation-tradeoffs in transportation design-modes of transportation and their design - vehicle routing and scheduling - models - packaging-pricing and revenue management.


EVALUATION PATTERN:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

TEXTBOOKS:

REFERENCES:
COURSE OUTCOMES:
- Define structure of supply chain
- Design supply chain configuration
- Analyze the role of Transportation in SCM

PR 403 ANALYSIS OF PRODUCTION SYSTEMS AND IELAB

PREREQUISITES: Operations research

COURSE OBJECTIVES:
To understand production function, Design of Product, Planning functions,
Material Planning and Layout and Scheduling

Engineering Economy and Costing: Elementary cost accounting and methods of depreciation;
break-even analysis, techniques for evaluation of capital investments.

Production Planning: Forecasting techniques – causal and time series models, moving average,
exponential smoothing, trend and seasonality

Capacity and aggregate production planning; master production scheduling; MRP and MRP-II

Scheduling and priority dispatching

Inventory – functions, costs, classifications, deterministic and probabilistic inventory models,
quantity discount; perpetual and periodic inventory control systems.

IE LAB EXERCISES
The objective of this lab is to have practical exposure on operations management and also to study
on the ergonomic aspects of human evaluation.

Part-A Operations Management
1. Forecasting Models
2. Inventory Models
3. Scheduling Case studies
4. Material Requirements Planning
5. Project management

Part-B Ergonomics Study
1. Performance rating using stop watch
2. Peg board experiment
3. Time study trainer
4. Fitness study using treadmill
5. Fitness study using ergo cycle

**EVALUATION PATTERN:**

Theory content is evaluated for 70% and Practical input is evaluated for 30%

**Theory**

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.

External Evaluation: 50 marks end semester exams and End semester Practical examination

**Practice**

Internal Evaluation: Continuous internal evaluation during performing exercises.

External Evaluation: End semester Practical examination

**TEXT BOOKS:**


**REFERENCES:**


**COURSE OUTCOMES:**

- Effective Forecasting of Production functions
- Enhanced Planning of Product Design and Service Operations
- Facility Planning and Project Management
PR 405 MANUFACTURING SYSTEM SIMULATION (Theory & Lab)

PREREQUISITES: Applied statistics, Resource Management Techniques

COURSE OBJECTIVES:
- To study various simulation software
- To simulate various production system model

Introduction to Simulation - Components of a system, Types of models, Monte Carlo Simulation, Steps in simulation, applications -Discrete Event Simulation – components of DES -Time advance mechanism.

Introduction – probability mass function, probability density function, Statistical models – Discrete distributions – Bernoulli, Binomial, Poisson, Geometric- Continuous distributions – Normal, Uniform, Exponential Gamma, Triangular Empirical Distributions

Properties of random numbers- Random number generation techniques – midsquare, mid product Constant multiplier, linear, additive congruential. Test for random numbers- uniformity, independence- Kolmogorov simronov test, chi square Runs test, Gap test, poker test, autocorrelation test Random variate generation-Inverse transform Acceptance rejection, convolution method

Input Analysis Methods-Examples-Verification of simulation models- Validation of simulation models-Measure of performance and their estimation- Output Analysis Methods-Transient and steady state behavior – Evaluation of alternate system design – Simulation Based Optimization (SBO).

Simulation packages spreadsheet, witness, Arena etc., Simulation of queuing models, inventory models, Material handling, assembly systems, logistics and supply chains – Tutorial.

LAB EXERCISES

ARENA
Exercise 1: Simulation of Single Server Queuing System.
Exercise 2: Simulation of manufacturing shop

SIMQUICK
Exercise 3: Simulation of supply chain Inventory System
Exercise 4: Simulation of Multiple Servers Queuing System
Exercise 5: Simulation of batch shop manufacturing process
WITNESS
Exercise 6: Simulation of multi machine assignment system
Exercise 7: Simulation of Manufacturing and material handling systems
Exercise 8: Simulation of supply chain inventory system

GPSS
Exercise 9: Simulation of Job shop System
Exercise 10: Simulation of queuing System

Demo on
QUEST, UGRIP, Systat, GAMS

EVALUATION PATTERN
Theory content is evaluated for 70% and Practical input is evaluated for 30%

Theory
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.
External Evaluation: 50 marks end semester exams and End semester Practical examination

Practice
Internal Evaluation: Continuous internal evaluation during performing exercises.
External Evaluation: End semester Practical examination

TEXTBOOK:

REFERENCES:

COURSE OUTCOMES:
- Understand the basics of Discrete event system simulation
- Apply several tests
- Acquire knowledge about the design/evaluation of different manufacturing systems using simulation modeling.
- Model and simulate using ARENA, SIMQUICK, WITNESS, Flexsim
- Familiarize QUEST, UGRIP, Systat
- Simulate job shop system and queuing system
PR 407 SUSTAINABLE MANUFACTURING (Theory & Lab)

PREREQUISITES: Fundamentals of Manufacturing

COURSE OBJECTIVES

- To understand the importance of sustainable manufacturing
- To study various tools/techniques of sustainable manufacturing
- To perform Life Cycle Assessment and assess environmental impacts of manufacturing processes
- To develop eco friendly products/processes

Sustainable Manufacturing - Concept of Triple bottom line, Environmental, Economic and Social Dimensions of Sustainability, Relation between lean and sustainable manufacturing.


Sustainability Assessment – Concept Models and Various Approaches, Product Sustainability and Risk/Benefit assessment – Corporate Social Responsibility.


Laboratory Exercises:
Sustainability Analysis, Life Cycle Assessment, Design for Environment, Sustainable product design

Software packages used: Sustainability Xpress, GaBi, Simpro.

EVALUATION PATTERN:

Theory content is evaluated for 70 % and Practical input is evaluated for 30 %

Theory
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.
External Evaluation: 50 marks end semester exams and End semester Practical examination

Practice
Internal Evaluation: Continuous internal evaluation during performing exercises.
External Evaluation: End semester Practical examination
**Department of Production Engineering**

**TEXTBOOKS:**

**REFERENCES:**
1. P. Lawn, Sustainable Development Indicators in Ecological Economics, Edward Elgar Publishing Limited.

**COURSE OUTCOMES:**
- Recognize the need for sustainable manufacturing
- State-of-art tools and techniques of sustainable manufacturing
- Design Eco friendly processes/products

**PR 411 COLLOQUIUM**

**PREREQUISITE:** All subjects from manufacturing and industrial streams.

**COURSE OBJECTIVES:**
To gain knowledge from academic institution by doing mini project, attending inplant training, Internship.

Preparing and making presentations – preparing slides, time management and communication aspects.

Making presentation on experience gathered during 50 working day practical training in the area of Manufacturing Engineering /Industrial Engineering.

Preparation of report, making a presentation with audience response sheet and a critique on writing style, completeness and editorial get-up.

**EVALUATION PATTERN:**
Presentation by students on gained knowledge
COURSE OUTCOMES:

- Develop presentation & reporting skills.
- Improve the soft skills like time management, communication
- Understand contemporary industrial practices

PR447 COMPREHENSIVE TRAINING

COURSE OBJECTIVES:

To review the engineering concepts and advancements in manufacturing and industrial engineering

GATE (Production & Industrial Engineering) syllabus

EVALUATION PATTERN:

Internal Evaluation: Cycle test-1-25 marks; Cycle test-2-25 marks

External Evaluation: Final Exam: 25 Marks and Viva Voce - 25 marks

COURSE OUTCOMES:

Comprehensive understanding of manufacturing and industrial engineering

PR402 ENTREPRENEURSHIP DEVELOPMENT

PREREQUISITES: Professional ethics and psychology

COURSE OBJECTIVES:

To introduce the basic concepts, project identification, marketing, and accounting

Concept Of Entrepreneurship-Definition and concept of enterprising - profile of an entrepreneur - need scope and characteristics of entrepreneurs

Project Identification-Methodology of project identification - short listing and zeroing on product/service - problems in project evaluation
Marketing-Market share - distribution - sale strategies - certification agencies - term finance - source and management working capital

Assistance To Entrepreneur-Small industries development in India and its concept - ancillary industries - starting a small scale industry


**EVALUATION PATTERN:**
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

**TEXTBOOK:**

**REFERENCES:**
1. EDI-1 Faculty and Experts, A Handbook for new entrepreneur, Entrepreneurship Development Institute of India, 1986.

**COURSE OUTCOMES:**
- Point out the scope of an entrepreneur
- Identify Project & market scenario
- Identify key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc

**MANUFACTURING ENGINEERING STREAM**

**PR 001 MATERIAL HANDLING & STORAGE**

**COURSE OBJECTIVES**
- To understand about material handling systems
- To understand material storage methods
- To understand automation in material transfer

Introduction to material handling- Principle of material handling equipment-layout and aerial handling systems- Types of material handling systems.

Fixed Path Equipment- flexible-path equipment - Conveyors-automated guided vehicles (AGV) - Applications of AGVS
Production line equipments - pick and place robots-transfer devices-feeder lines, robotic devices

Conveyors-storage equipments-Automated ware houses- types of storage systems- small containers - unit load containers - rack and shelving

Automated storage and retrieval systems-methods of protecting materials for packages - auxiliary equipments - automated identifications systems

**EVALUATION PATTERN:**

Internal Evaluation: Cycle test 1-20 marks; Cycle test 2-20 marks; Assignment 10 marks

External Evaluation: 50 marks end semester exams

**TEXTBOOKS:**


**REFERENCE BOOKS:**


**COURSE OUTCOMES**

- Classify various material handling and and storage systems
- Identify various fixed path equipment
- Summarize various packaging techniques

**PR 002 MANUFACTURING OF COMPOSITE MATERIALS**

**COURSE OBJECTIVES:**

- To understand the properties of composite materials
- To classify the composites based on properties
- To design metal matrix composite

FRP composites – Fiber types, fiber forms and properties, matrices type and properties, lamina, laminate, orthotrophy, anisotrophy, composites
Macro and micro-mechanical analysis and properties, Failure theories – Tsai – Hill, Tsai-Wu

Primary and secondary manufacturing of composites – Lay-up, Autoclave Molding filament winding, Pultrusion, Compression Molding, RTM, RIM, SRIM, machining, drilling and routing

Metal matrix composites – Manufacturing route Design, Structural and testing, application
Ceramic matrix composites – Manufacturing routes and application

**EVALUATION PATTERN:**
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

**TEXTBOOKS:**

**REFERENCE BOOKS:**

**COURSE OUTCOMES**

- Define fundamentals of composite material strength and its mechanical behavior
- Classification of composites – matrix composites, metal matrix composites, Ceramic matrix composites reinforcement – particle reinforced composites, fiber reinforced composites
- Analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.

**PR 003 MACHINE TOOL TECHNOLOGY**

**COURSE OBJECTIVES:**

- To understand different types of machine tools
- To analyse the source of vibration in machine structure
- To apply automation in machine control

Classification of machine tools - features construction and operation of basic machine tools - different types and mechanics of transmission of machine tool motion - kinematic structure of machine tools

Mechanical drives for rotational movement - stepped and step less O/P -mechanical drives for reciprocation

Strength and rigidity of machine tool structures - design of lathe beds - design of drill columns - analysis of spindle bearings hydrodynamic bearings - stack slip motion - hydrostatic bearings-
Department of Production Engineering

Vibration of machine - sources of vibration

Semi automation - automatic machines with mechanic controls.

**EVALUATION PATTERN:**
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

**TEXTBOOKS:**

**REFERENCE BOOKS:**

**COURSE OUTCOMES:**
- Classify different types of machine tools
- Analyse vibration of machine structures
- Design lathe beds, drill columns

**PR 004 INDUSTRIAL ROBOTICS**

**COURSE OBJECTIVES**

- To understand the components of robot
- To understand the drives and programs used to actuate the robot
- To utilize robot technology in various applications

Fundamentals of Robotics: Definition - robot classification - robot arm geometry - power sources, application areas - control techniques - path control - robot controller operation - open loop and closed loop systems.

End of arm tooling and sensors: characteristics - classification - special purpose tools - Typical designs, compliance in Wrists. End Effectors: types, mechanical and other types of griper - types of sensors and applications.

Robot Programming And Languages: Language classification - program commands, arm motion, task point diagram - on line/off line programming, sample programs, program analysis - AI and experts systems.

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Recent developments: Recent developments in advanced Robotics – Modular concept - Special applications of robotics - micro robotics, Bio robotics - technologies and applications.

EVALUATION PATTERN:

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

TEXTBOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES

• Explain the basic concepts, parts of robots and types of robots
• Identify the various drive systems for robot, sensors and their applications in robots, programming of robots
• Discuss about the various applications of robots, justification, implementation and safety of robot

PR 005 PLANT ENGINEERING

COURSE OBJECTIVES

• To exemplify different types of plants and its functions
• To analyse the principles used in plants maintenance
• To understand the safety methods in plants

Organization of the plant engineering function-Classification of maintenance work- Electric power supply system’s-Electric generators and turbines-compressors, ventilation and air-conditioning
Producer Gas Plants-operation and safety aspects in P.G. Compressor and Oxygen plants
Material handling system-AS and RS (Automatic Storage and Retrieval System)-AGV and robotics- piping system design and components-Pollution control and plant safety

Noise and vibration control - safety in plant operations, fire and electrical protection and prevention security equipment

Lubrication and corrosion- Synthetic and solid lubricants -lubrication systems - causes and control deterioration - paints and protective coatings.
EVALUATION PATTERN
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

TEXTBOOKS:

REFERENCE BOOK:

COURSE OUTCOMES
- Understand the different type of plant and material handling system AS and RS (Automatic Storage and Retrieval System)- AGV and robotics
- Define the principles, functions and practices adapted in industry for the successful management of maintenance activities.
- Know about safety in plant operation, fire and electrical protection and prevention security equipment

PR 006 NON-DESTRUCTIVE TESTING

L  T  P  C
3  0  0  3

COURSE OBJECTIVES:
To study and understand various Non Destructive Evaluation and Testing methods, theory and their industrial applications.

OVERVIEW OF NDT: NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT., Visual inspection – Unaided and aided.


THERMOGRAPHY AND EDDY CURRENT TESTING: Thermography- Principles, Contact and non contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation - infrared radiation and infrared detectors, Instrumentations and methods,


**RADIOGRAPHY:** Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films—graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed Tomography

**EVALUATION PATTERN**

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation: 50 marks end semester exams

**TEXT BOOKS:**

**REFERENCES:**

**COURSE OUTCOMES:**
- Upon completion of this course, the students can able to use the various Non Destructive Testing and Testing methods understand for defects and characterization of industrial components
PR 007 MICRO FABRICATION PROCESSES

COURSE OBJECTIVE:

To perform various micro fabrication processes to achieve very concise tolerances in micron level materials removal applications.

References:


COURSE OUTCOMES:

- Students can perform various micro fabrication techniques to achieve micron level materials removal
COURSE OBJECTIVE:
To apply various surface protection techniques to protect metallic materials from degradation and wear.

Introduction - Significance of surface engineering - Solid surface - Surface energy - Superficial layer - Physico-chemical parameters - Properties of the superficial layer - Surface coating - Classification.

Physical vapor deposition (PVD): Ion plating - Sputter deposition - Reactive deposition - Magnetron sputtering - Chemical vapor deposition (CVD) - Ion implantation - Electron beam technology - Applications.

Thermal Spraying Techniques - Flame Spraying, Atmospheric Plasma Spraying (APS), Vacuum Plasma Spraying (VPS), Detonation-Gun Spraying (D-GUN), High-Velocity Oxy-Fuel (HVOF) Spraying - Applications.


REFERENCES:

COURSE OUTCOMES:
- Perform different surface protection techniques like PVD, thermal spray techniques and laser surface modification techniques for the protection of metallic surfaces.
COURSE OBJECTIVE:
To enable students to understand the methods of preparation, properties and applications of thermoplastic materials covering commodity, engineering and high performance plastics.

Methods of manufacturing - Properties and applications of poly(vinyl chloride) - Poly (vinylidene chloride) - Poly(vinyl alcohol) - Poly(vinyl acetate) - Chlorinated poly(vinyl chloride) - Plastisols, Poly vinylpyrrolidiene, Polystyrene, HIPS, EPS, SAN, EVA, EPDM, ABS.

Methods of manufacturing - properties and applications of Acrylates - Poly (methyl methacrylate) - Polycrylonitrile. Aliphatic polyamides - Aromatic polyamides - Polyethylene terephthalate - Polybutylene terephthalate - Polyacetals and copolymers - Polycarbonates - Thermoplastic polyurethane (TPU)

Methods of manufacturing - Properties and applications of Fluoro polymers - Polytetrafluoroethylene, Polychlorofluoroethylene, Thermoplastic polyurethanes, Biodegradable polymers - poly ε-caprolactone and copolymers - polylactic acid - Bacterial polyhydroxy alkonates.

Preparation, properties and applications of High performance Thermoplastic materials PPS, PO, Polysulphone, Polyether Sulphone, PEEK, Polyimide. Biopolymer-cotton wool, collagen, hyaluroran.

EVALUATION PATTERN
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

TEXT BOOKS:
REFERENCES:

COURSE OUTCOMES:
- Familiarize in manufacturing process of plastic
- Acquire skills in selecting polymeric materials for specific applications
- Demonstrate basic knowledge of degradable plastics

DESIGN STREAM

PR 021 RAPID PROTOTYPING, TOOLING AND MANUFACTURE

COURSE OBJECTIVES

- To understand need of rapid prototyping process
- To understand about different Rapid prototyping process
- To understand tools used in Rapid prototyping techniques

Introduction- Need for the compression in product development, History of RP systems, Survey of applications, Growth of RP industry, Classification of RP systems.


Rapid Tooling: Indirect rapid tooling - silicone rubber tooling, aluminum filled epoxy tooling, spray metal tooling, Direct rapid tooling - direct AIM, copper polyamide, sand casting tooling, laminate tooling, soft tooling Vs hard tooling.


Allied Processes: Vacuum casting, surface digitizing, surface generation from point cloud, surface modification, data transfer to solid models.

EVALUATION PATTERN

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

TEXTBOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES
- Understand the principle, parameters and applications of RP processes
- Recognize various types of rapid tooling
- Identify different allied processes

PR 022 FINITE ELEMENT METHODS

COURSE OBJECTIVES
- To apply partial differential equations in element analysis
- To evaluate the element shape using FEM
- To apply numerical methods in element analysis

Introduction - Different approaches in Finite Element Method - Steps involved in FEM - Types Of Elements Used

Interpolation Polynomials - Linear elements Shape function - Finite Element Formulation Of Field Problems

Classification of partial differential equations - Finite Element Formulation Of Solid Mechanics Problems

Axial force member - element matrices for axial force members - Truss element analysis of pinned truss - Two dimensional elasticity problems - Numerical Methods In FEM

Evaluation of shape functions - Solution of finite element equations - Cholesky decomposition, Skyline storage - Computer implementation.

EVALUATION PATTERN
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams
TEXTBOOK:

REFERENCE BOOKS:

COURSE OUTCOMES

- Obtain expertise in formulating finite element models for structurals thermal and vibrational problems.
- Obtain ability to solve FE models using numerical solutions.

PR 023 PRODUCT DEVELOPMENT STRATEGIES

COURSE OBJECTIVES:

- To understand the complexities in product development
- To gain knowledge on tools/techniques of product development
- To recognize the need for design to suit environment

Product development versus design, types of design and redesign, modern product development process, reverse engineering and redesigning product development process, examples of product development process, scoping product development – S-curve, new product development.

Gathering customer needs, organizing and prioritizing customer needs, establishing product function, FAST method, establishing system functionality.

Tear Down and Experimentation- Tear down method, post teardown report, benchmarking and establishing engineering specifications, product portfolios.

Generating Concepts- Information gathering, brain ball, C-sketch/6-3-5 method, morphological analysis, concept selection, technical feasibility, ranking, measurement theory, DFMA, design for robustness

Design for the Environment: DFE methods, life cycle assessment, weighted sum assessment method, techniques to reduce environmental impact – disassembly, recyclability, remanufacturing regulations and standards, analytical and numerical model solutions.

EVALUATION PATTERN

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
Department of Production Engineering

External Evaluation: 50 marks end semester exams

**TEXTBOOKS:**


**COURSE OUTCOMES**

- Explain modern product development process
- Design for the Environment through DFE method life cycle assessment
- Gather customer needs

**PR 024 DESIGN FOR MANUFACTURE AND ASSEMBLY**

**COURSE OBJECTIVES**

- To identify opportunities for design.
- To address technical considerations of design and manufacturing.
- To utilize DFM and Concurrent Engineering Principles on a "real life" project.


Process capability analysis – Cumulative effect of tolerances – Centrality analysis – Compound assembly – Selective and Interchangeable assembly – Grouped Datum systems


**EVALUATION PATTERN**

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation: 50 marks end semester exams

**TEXTBOOKS**

REFERENCES
3. Boothroyd, DFMA.

COURSE OUTCOMES
- Identify opportunities for design.
- Address technical considerations of design and manufacturing.
- Utilize DFM and Concurrent Engineering Principles on a "real life" project.

PR 025 VIBRATION AND NOISE ENGINEERING

COURSE OBJECTIVES:
To understand the sources of vibration and noise in automobiles and make design modifications to reduce the vibration and noise and improve the life of the components.

BASICS OF VIBRATION: Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies.

BASICS OF NOISE: Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.


CONTROL TECHNIQUES: Vibration isolation, tuned absorbers, un-tuned viscous dampers, damping treatments, application of dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

SOURCE OF NOISE AND CONTROL: Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers.
EVALUATION PATTERN

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES:
- Understanding causes, source and types of vibrations in machineries
- Gaining knowledge in sources and measurement standard of noise
- Ability to design and develop vibrations and noise control systems.

PR 026 CONCEPTS OF ENGINEERING DESIGN

COURSE OBJECTIVES:
- To study about fundamental design standards and needs
- To learn about human and product factors involved in design concepts and rapid prototyping methods


DESIGN METHODS: Creativity and Problem Solving –Creativity methods-Theory of Inventive Problem Solving(TRIZ)– Conceptual decomposition-Generating design concepts-Axiomatic Design – Evaluation methods-Embodiment Design-Product Architecture Configuration Design-


**EVALUATION PATTERN**

Internal Evaluation: Cycle test-1 20 marks; Cycle test-2 20 marks; Assignment 10 marks

External Evaluation: 50 marks end semester exams

**TEXT BOOK:**


**REFERENCES:**


Karl T. Ulrich and Steven D. Eppinger “Product Design and Development”


**COURSE OUTCOMES:**

- Demonstration of fundamental design standards and customer needs
- Understand human and product factors involved in design concepts
- Application of engineering design concepts

**PR 027 ENGINEERING OPTIMIZATION**

**COURSE OBJECTIVE:**

To perform different optimization techniques to solve various engineering problems

**Introduction:** Introduction to engineering optimization - General principles – Classification – Problem formulation & their classifications – Classical optimization techniques – Single variable and multivariable optimization - Single and Multi objectives - Pareto Optimal solutions.

Constrained Optimization Techniques: Optimization with equality and inequality constraints - Direct methods – Indirect methods using penalty functions.


Applications: Structural applications – Design of simple truss members - Design applications – production planning, controlling and scheduling – Facility layout applications, etc.

EVALUATION PATTERN

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

TEXT BOOKS:


REFERENCES:


COURSE OUTCOMES:

- Able to perform classical optimization techniques
- Able to perform constrained and unconstrained optimization techniques
- Able to perform optimization techniques for design of simple truss members, production planning and scheduling
PR 028 COMPUTATIONAL FLUID DYNAMICS

COURSE OBJECTIVES:
- To introduce governing equations of viscous fluid flows
- To introduce numerical modeling and its role in the field of fluid flow and heat transfer
- To enable students to understand the various discretization methods, solution procedures and turbulence modeling.
- To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers.


FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION:

FINITE VOLUME METHOD FOR CONVECTION DIFFUSION: Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Transportiveness, Hybrid, Power-law, QUICK Schemes.


EVALUATION PATTERN
- Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
- External Evaluation: 50 marks end semester exams
TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES:
- Perform numerical modeling and its role in the field of fluid flow and heat transfer
- Use various discretization methods, solution procedures and turbulence modeling to solve flow and heat transfer problems.

PR 029 EXPERIMENTAL STRESS ANALYSIS

PREREQUISITES
- Strength of Materials.

COURSE OBJECTIVES:
To understand the basic aspects of experimental stress analysis that includes exhaustive treatment of the most versatile techniques like photo elasticity and strain gauges and also a brief introduction to the emerging techniques like digital image correlation.

Overview of Experimental Stress Analysis- Optical Methods Work as Optical Computers-Stress, Strain and Displacement Fields- Physical Principle of Strain Gauges, Photo elasticity and Moiré- Introduction to Moiré, Brittle Coatings and Holography- Hologram Interferometry, Speckle Methods- Introduction to Shearography, TSA, DIC and Caustics- Fringe Patterns – Richness of Qualitative Information

Multi-Scale Analysis in Experimental Mechanics- Selection of an Experimental Technique- Introduction to Transmission Photo elasticity- Ordinary and Extraordinary Rays- Light Ellipse, Passage of Light Through a Crystal Plate- Retardation Plates, Stress-optic Law- Plane Polariscope- Jones Calculus
Circular Polariscope-Determination of Photoelastic Parameters at an Arbitrary Point-
Tardy’s Method of Compensation-Calibration of Photo elastic Materials-Fringe Thinning Methodologies
Photoelasticity Ordering Fringe in Miscellaneous-Topics in Transmission Photoelasticity -Three
Dimensional Photoelasticity


Strain Gauge Alloys, Carriers and Adhesives-Performance of Strain Gauge System-Strain Gauge Selection-Bonding of a Strain Gauge-Soldering, Accounting for Transverse Sensitivity Effects-Correction Factors for Special Applications-Special Gauges

EVALUATION PATTERN:
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

REFERENCE BOOKS:


COURSE OUTCOMES:
- Understand stress strain analysis with its relation
- Recognise materials structure and testing methods
PR 030 DESIGN OF AUTOMATED MANUFACTURING SYSTEM

CORSE OBJECTIVES:
To understand pneumatic, electric, hydraulic and electronic systems in automation of mechanical operations.

FUNDAMENTAL CONCEPTS OF INDUSTRIAL AUTOMATION: Fundamental concepts in manufacturing and automation, definition of automation, reasons for automating. Types of production and types of automation, automation strategies, levels of automation.


PNEUMATIC CONTROL: Components, constructional details, filter, lubricator, regulator, constructional features, types of cylinders, control valves for direction, pressure and flow, air motors, air hydraulic equipments. PNEUMATIC CONTROL SYSTEM DESIGN: General approach to control system design, symbols and drawings, schematic layout, travel step diagram, circuit, control modes, program control, sequence control, cascade method, Karnaugh–Veitch mapping.


EVALUATION PATTERN
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES:
• Knowledge of industrial automation by transfer lines and automated assembly lines.
• Understanding of automated controls using pneumatic and hydraulic systems
• Ability to understand electronic control systems in metal machining and other manufacturing processes.

INDUSTRIAL ENGINEERING STREAM
PR 041 DESIGN AND ANALYSIS OF EXPERIMENTS

COURSE OBJECTIVES:
• To provide an introduction to fundamental concepts of statistical Process control
• To enhance student understanding of the complexities of Statistical Analysis and control chart interpretation

Factorial Experiments-Main and interaction effects –Two and three Factor full factorial Designs, $2^k$ designs with Two and Three factors-Unreplicated design- Yate’s Algorithm
Special Experimental Designs: Blocking in factorial design, Confounding of $2^k$ design, nested design-Response Surface Methods.
Taguchi Techniques- Fundamentals of Taguchi methods, Quality Loss function, orthogonal designs, application to Process and Parameter design.

**EVALUATION PATTERN:**
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

**TEXT BOOKS:**

**REFERENCE BOOKS:**

**COURSE OUTCOMES:**
- Create steps, need and terminology for experiments
- Know about factorial experiments and special experimental techniques
- Apply Taguchi techniques for various design problems

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**PR 042 AGILE MANUFACTURING**

**COURSE OBJECTIVES:**

To enable manufacturing enterprises to be competitive by dynamically reconfiguring software, equipment and organization structures.


Implementing technology to enhance agility- Implementing new technology – reasons – guidelines preparation for technology implementation - A checklist, technology applications that enhance agility - agile technology make-or-buy decisions.

Creating the learning factory: Imperative for success, factory becoming a learning factory, building a road map for becoming a learning factory - core capabilities, guiding vision, leadership that fits, ownership and commitment, pushing the envelope, prototypes, integration, learning challenges for learning manufacturing business.

**EVALUATION PATTERN**

| Internal Evaluation: | Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks |
| External Evaluation: | 50 marks end semester exams |

**TEXTBOOKS:**


**REFERENCE BOOKS:**


**COURSE OUTCOMES**

- Understanding recent trends in manufacturing
- Customization of product for manufacturing
- Implementation of new technology

**PR 043 INTEGRATED MATERIALS MANAGEMENT**

**COURSE OBJECTIVES:**

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To study the fundamentals of Integrated Materials Management, Inventory Management, Material Handling and to ensure that continuity of supply of materials to the users is maintained by avoiding out of stock situation.


Material Handling: layout, selection of equipment, principles of materials handling – Packaging, types of material handling equipment

Introduction to Supply Chain Management – Understanding the supply chain – Supply chain performance – Supply chain Drivers and Obstacles – Supplier selection and Supplier evaluation

EVALUATION PATTERN:
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:

- Understand various concepts and functions of material management
- Classification of inventory management
- Summarize Material handling and Logistic

PR 044 LEAN MANUFACTURING

COURSE OBJECTIVES:
To introduce the fundamentals of Lean Manufacturing and Components for Lean including: Waste identification and elimination (value stream analysis), 5S, JIT, Kaizen and Poke Yoke.


Standard work -communication of standard work to employees -standard work and flexibility - visual controls-quality at the source- 5S principles -preventative maintenance-total quality management-total productive maintenance -changeover/setup time -batch size reduction - production leveling.
Value Stream Mapping-The as-is diagram-the future state map-application to the factory simulation scenario-line balancing -Poke Yoke – overall equipment effectiveness. One Piece Flow-Process razing techniques – cells for assembly line – case studies

Introduction - elements of JIT - uniform production rate - pull versus push method- Kanban system - small lot size - quick, inexpensive set-up - continuous improvement. Optimised production technology.


EVALUATION PATTERN:
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

TEXTBOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:

- Indentify the waste and how to eliminate those waste
- know the recent trends of manufacturing like just in time (JIT) and Pull Push system
- Implementation of some modern tool like 5S, Poke-Yoke and Kaizen in an organization
PR 045 TOTAL QUALITY MANAGEMENT

COURSE OBJECTIVES:

To facilitate understanding of Quality Management principles and tools.

Understanding quality, quality, competitiveness and customers, building quality chains, managing quality, quality in all functions, models and frame works for total quality management, Early TQM frameworks – quality award models – the four Ps and three Cs of TQM - a new model for TQM.

The TQM approach – commitment and policy – creating or changing the culture – effective leadership – excellence in leadership.

Design, innovation and improvement – the design process – quality function deployment (QFD) – the house of quality – specifications and standards - design in the service sectors – failure mode effect and criticality analysis (FMECA) – The links between good design and managing the business.


EVALUATION PATTERN:

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation: 50 marks end semester exams

REFERENCE BOOKS:

COURSE OUTCOMES:

- Apply TQM principle for continuous process improvement
- Lead teams for quality production
- Utilization of modern tool like QFD, FMECA to design and manage the business.
PR 046 ENGINEERING OPTIMIZATION

COURSE OBJECTIVE: To perform different optimization techniques to solve various engineering problems need optimum values for effective usage.

Introduction: Introduction to engineering optimization - General principles –Classification - Problem formulation & their classifications – Classical optimization techniques – Single variable and multivariable optimization-Single and Multi objectives-Pareto Optimal solutions.


Constrained Optimization Techniques: Optimization with equality and inequality constraints - Direct methods – Indirect methods using penalty functions.


Applications: Structural applications – Design of simple truss members - Design applications – production planning, controlling and scheduling – Facility layout applications, etc.

EVALUATION PATTERN:
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES:
- Perform classical optimization techniques.
- Perform constrained and unconstrained optimization techniques.
- Perform optimization techniques for design of simple truss members, production planning and scheduling.
GLOBAL ELECTIVES

PR 081 OPERATIONS MANAGEMENT

COURSE OBJECTIVES:

To understand various components and functions of operation management such as Aggregate Planning, process planning, production scheduling, Assembly Line Balancing.


Measures of capacity, Factors affecting capacity, Capacity planning, Systematic approach to capacity planning, Long-term and short-term capacity decisions, Tools for capacity planning, Capacity Requirement planning- Business process outsourcing

Aggregate Planning strategies and methods-Pure and mixed strategies-Transportation method-LPP method
Master Production Schedule, MRP-Lot sizing methods - Wagner and whitens algorithm, MRP II, CRP
Assembly Line Balancing – algorithms, Group technology – Production Flow analysis – Rank order clustering, Business Process Reengineering-JIT

EVALUATION PATTERN:

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation: 50 marks end semester exams

TEXTBOOKS:


REFERENCE BOOKS:

COURSE OUTCOMES
- Perform production management tasks.
- Describe the various components and functions of production planning and control such as capacity planning, aggregate planning, process planning, productionscheduling, line balancing.
- Know the recent trends like manufacturing requirement Planning (MRP II) and Master production schedule (MPS)

PR 082 PROJECT MANAGEMENT

COURSE OBJECTIVES:

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To understand the concepts of project definition, life cycle, Market and demand analysis, Financial analysis and systems approach and to handle the complex tasks of time estimation and project scheduling, including PERT and CPM


Financial analysis – cash flows for project appraisal- Investment evaluation using capital budgeting techniques - net present value, profitability index internal rate of return, pay back period, accounting rate of return

Mathematical Techniques for project evaluation – Linear programming, goal programming, Network technique for Project Management – CPM, PERT, Multiple projects and constraints, scheduling.

Organization systems for project implementation- Work Breakdown-coordination and control-Project Management Soft wares

EVALUATION PATTERN:

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation: 50 marks end semester exams

TEXTBOOKS:
REFERENCE BOOKS:


COURSE OUTCOMES:

- Understand the Method for Project Identification & appraisial
- Develop & Analyze quantitative models for Project selection & Scheduling.

**PR 083 VALUE ENGINEERING**

COURSE OBJECTIVES:

To give a brief account of value analysis and engineering tool for productivity improvement and removing unnecessary cost through case studies

An Overview Of Value Engineering - Concepts and approaches of value analysis and engineering - importance of value, Function - identity, clarify – analysis

Evaluation of VE - Evaluation of function, Problem setting system, problem solving system, setting and solving management - decision - type and services problem, evaluation of value

Results accelerators, Basic steps in using the systems

Understanding the decision environment, Effect of value analysis on other work in the business-Life Cycle Cost (LCC), Case studies

VE Level Of Effort - VE Team, coordinator, designer, different services, definitions, construction management contracts, value engineering case studies, Effective organization for value work, function analysis system techniques- FAST diagram, Case studies.

EVALUATION PATTERN:

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
TEXTBOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:

- Understand the concept and approaches of value analysis and engineering
- Justify the value of money and value of product
- Implementation of Value Engineering in any type of organization

PR 084 ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS

COURSE OBJECTIVES:  

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- To study the concepts of Artificial Intelligence
- To understand the methods of solving problems using Artificial Intelligence
- To learn about the components of decision support system and expert systems.

Aspects of intelligence and AI - heuristic search - logic programming and reasoning - automatic programming-scope of AI-in manufacturing - components of intelligent manufacturing-

Requirements of AI languages - Languages Lisp and Prolog - simple programs

Knowledge engineering- protocol analysis - fuzzy logic - Semantic networks, Learning systems - inference engine

Vision programmes - factory vision systems - machine learning

Features of Experts systems - applications in manufacturing planning and control.

EVALUATION PATTERN:
- Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
- External Evaluation:50 marks end semester exams
TEXTBOOKS:


REFERENCE BOOKS:

2. Ernest R Tello, "Mastering AI tools and techniques"

COURSE OUTCOMES:

- Describe the basic concepts, Operations and Principles of Artificial Intelligence
- Recognize the basic concepts, Operations and Principles of Fuzzy Logic
- Employ the concept of AI & fuzzy logic in Manufacturing Environments

ME 080 AUTOMOBILE ENGINEERING

COURSE OBJECTIVES:

To study about various components of vehicles and its functions for different types of vehicles and maintenance

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Engine And Fuel System-Introduction: General classification of vehicles- major parts-Petrol and Diesel Engines - their working- Cooling, lubrication and electrical system-Types of cooling - Transmission Systems
Need for clutch - Type of clutches - Mechanical details
Brakes, Wheels And Suspension System-Principle of braking, Mechanical brake system, Hydraulic and pneumatic brakes - drum and disc brakes - power assisted brakes. Wheels - tyres wheel alignment, tyre specification - tyre wear and maintenance
Suspension system: Purpose and characteristics- rigid axle suspension system, and torsion bar – Steering-Principle of Steering, Ackerman principle of correct steering, center point steering, steering geometry
Maintenance, Servicing and tuning up on engine, Faultfinding and remedy.

EVALUATION PATTERN:

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

TEXTBOOKS:


REFERENCE BOOKS:

COURSE OUTCOMES

- Classification of vehicles- petrol and diesel engines and their working principle
- Describe various component of automobile like clutch, brakes wheels and suspension system
- Recognize the basic concepts of mechanisms and machinery

HM080 CORPORATECOMMUNICATION

COURSE OBJECTIVES:

To learn about culture, communication, speech mechanics, listening, reading, writing and marketing of corporate with its barriers and strategies

Corporate culture and communication - Process of communication – Networks and channels of communication – Barriers to communication – Strategies to overcome them - Use of technology in successful communication – Role of psychology in communication- Internal and External Communication.


Importance of listening in the corporate world -Listening for information and content – Kinds of listening – Factors affecting this – Methods to overcome them – Retention of facts, data and figures- Role of Speaker in listening.


EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams
TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
• Appropriate decision for business improvement through group discussion
• Improve business electively by having good communication with internal and external customers

MB 080 FINANCIAL MANAGEMENT

COURSE OBJECTIVES

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• To understand the types of investment in finance
• To evaluate the asset of a management
• To understand about the management and investments

Financial management – Nature, Scope, Objectives, Decisions
Management of current asset
Short and intermediate financing
Capital investment and evaluation
Long term financing

EVALUATION PATTERN

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

TEXTBOOKS:
REFERENCE BOOKS:

COURSE OUTCOMES

- Start and manage new business
- Evaluate and monitor short term and long term investments
- Evaluate and monitor current asset

HONORS ELECTIVES

PR 091 TOLERANCE TECHNOLOGY
(Use of approved design data book is permitted in the examination)

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PREREQUISITE COURSE: Machine Drawing practice

COURSE OBJECTIVE:

- To recognize the importance of tolerances
- To perform tolerance analysis

Introduction to Geometric Dimensioning and Tolerancing, Scope, Definitions, and General Dimensioning, General Tolerancing and Related Principles, Symbology, Datum Referencing, Tolerances of Location, Tolerances of Form, Profile, Orientation, and Runout
Properties of the surface, Principles for tolerancing, Principles for geometrical tolerancing, Profile tolerancing, Tolerancing of cones, Positional tolerancing, Projected tolerance zone, Substitute elements, Maximum material requirement, Envelope requirement, Least material requirement
Tolerancing of flexible parts, Tolerance chains (accumulation of tolerances), Statistical tolerancing.
General geometrical tolerances, Tolerancing principles, Tolerancing of edges, ISO Geometrical Product Specifications (GPS).

EVALUATION PATTERN:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

REFERENCES:
COURSE OUTCOMES:
- Interpretation of tolerances
- Perform tolerance analysis

PR 092 ROBOTICS

PREREQUISITE COURSE: Computer Integrated Manufacturing

COURSE OBJECTIVE:
- To understand the fundamentals of robotics
- To perform robot programming

Robot and its peripherals - sensors, machine vision - image processing & analysis - application of artificial intelligence, voice communication - robot control units - motion controls.


Robot Programming - different languages - expert systems.


EVALUATION PATTERN:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

REFERENCES:
COURSE OUTCOMES:
- Demonstration of knowledge in robotic engineering
- Develop programming for robot applications

PR 093 INTELLIGENT MANUFACTURING SYSTEMS

PREREQUISITE COURSE: Mechatronics and Industrial automation

3 0 0 3

COURSE OBJECTIVE:
- To understand the basic concepts of intelligent manufacturing
- To develop knowledge based systems for various applications

Basic concepts of Artificial intelligence and expert systems - System Components - System architecture and Data flow – System Operations

Knowledge based systems - knowledge representation – knowledge acquisition and optimization
- Knowledge based approaches to design mechanical parts and mechanisms and design for automated assembly

Knowledge based system for material selection – Intelligent process planning system.

Intelligent system for equipment selection - Intelligent system for project management & factory monitoring. Scheduling in manufacturing – scheduling the shop floor – Diagnosis & trouble shooting

The role of Artificial Intelligence in the factory of the future – Intelligent systems.

EVALUATION PATTERN:
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

REFERENCES:
Department of Production Engineering

COURSE OUTCOMES:
- Development of knowledge based systems
- Application of Artificial Intelligence for future automated factories

PR094TOTAL QUALITY ENGINEERING

PREREQUISITE COURSE: Quality, Reliability and Safety Engineering

COURSE OBJECTIVES:
- To study the quality control tools and ISO Standards
- To understand TQM applications in service sector


EVALUATION PATTERN:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

REFERENCES:

COURSE OUTCOMES:
- Apply TQM principle for continuous process improvement
- Lead teams for quality production
- Utilization of modern tool like QFD, FMECA to design and manage the business
PR 095 PRODUCT ANALYSIS AND COST OPTIMIZATION

PREREQUISITE COURSE: Production drawing and cost estimation

COURSE OBJECTIVES:
- To perform value engineering projects
- To perform cost accounting


Job plan information phase - speculation phase - analysis phase - development phase - presentation phase - implementation phase - follow up phase - fast diagramming - cost models - life cycle costs.

Cost accounting - cost estimation

Cost calculations for machined components, welding, casting and forging components - calculation of selling price - activity based cost analysis.

EVALUATION PATTERN:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

REFERENCES:

COURSE OUTCOMES:
- Execute value engineering projects
- Cost computation for various fabricated products
PR096 DECISION SUPPORT SYSTEMS

**PREREQUISITE COURSE:** Work Design and Facilities planning

**COURSE OBJECTIVE:**
- To introduce decision support systems and show their relationship to other computer-based information systems,
- To demonstrate DSS development approaches, and to utilize DSS capacities to support different types of decisions

DSS components - Data warehousing, access, analysis, mining and visualization-modeling and analysis-DSS development -Group support systems-enterprise DSS-supply chain and DSS-knowledge management methods, technologies and tools-Artificial intelligence and expert systems-Representation in logic and schemas, semantic networks, production rules and frames, inference techniques – DSS applications.

**EVALUATION PATTERN:**

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

**REFERENCES:**

**COURSE OUTCOMES:**
- Recognize the importance of decisions in the work and and use DSS Software Tools.
- Evaluation of the Success/Failure of Decision Support Systems
- Discuss the advantages/disadvantages of different Types of decision support systems and analyze practical cases from the life for different problems (technical, management)
PR097 KNOWLEDGE MANAGEMENT

PREREQUISITE COURSE: Work Design and Facilities planning

COURSE OBJECTIVE:

To understand the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management.


EVALUATION PATTERN

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation: 50 marks end semester exams

REFERENCES:

COURSE OUTCOMES:

- Appreciate the role and use of knowledge in organizations and institutions, and the typical obstacles that Knowledge Management aims to overcome.
- Understand the core concepts, methods, techniques, and tools for computer support of knowledge management.
- Understand how to apply and integrate appropriate components and functions of various knowledge management systems.
COURSE OBJECTIVE:
• To understand product life cycle management strategies
• To recognize PLM integration with other functions


EVALUATION PATTERN:
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

REFERENCES:

COURSE OUTCOMES:
• Understand PLM applications
• Develop product data management tools

COURSE OBJECTIVE:
• To understand technology development process
• To recognize technology management issues in the context of advanced manufacturing systems

PREREQUISITE COURSE: Operations Research

Definition-scope-components -Issues in managing new technology, Life cycle approach to technology management-Approaches to forecasting, Technology performance parameters. Use of Experts in technology forecasting, planning technological process, Morphological analysis of a

EVALUATION PATTERN:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

REFERENCES:

COURSE OUTCOMES:
- Develop an awareness of the range, scope, and complexity of technological innovation, and the issues related to managing technological change.
- Understand different approaches to manage innovation, with multi-criteria decision making techniques
- Clearly identify drivers and barriers to technological innovation within an organization.

PR100MULTI-CRITERIA DECISION MAKING TECHNIQUES

PREREQUISITE COURSE: Operations Research

COURSE OBJECTIVE:
- To recognize the need for Multi-criteria decision making
- To understand various MCDM methods

EVALUATION PATTERN:
Internal Evaluation: Cycle test-1 20 marks; Cycle test-2 20 marks; Assignment-10 marks
External Evaluation: 50 marks end semester exams

REFERENCES

COURSE OUTCOMES:
- Understanding of various MCDM methods
- Apply MCDM methods for real time applications

SUBJECTS OFFERED TO OTHER DEPARTMENTS

PR511 PRODUCTION TECHNOLOGY I

COURSE OBJECTIVE:
To learn about different types manufacturing and joining methods


**EVALUATION PATTERN:**
- Internal Evaluation: Cycle test 1-20 marks; Cycle test 2-20 marks; Assignment - 10 marks
- External Evaluation: 50 marks end semester exams

**REFERENCES:**

**COURSE OUTCOMES:**
- Understand different types of casting processes, moulding machines and foundry components
- Ability to learn different welding methods and their defects

**PR 512 PRODUCTION TECHNOLOGY – II**

**COURSE OBJECTIVES**
- To learn about different types of machines, working principles and mechanism
- To study about NC and CNC machines and its programs


NC & CNC machine tools and manual part programming. Machining centre. Turning centre. NC part programming.

Computer aided part programming. APP: Post processors, APT programming. Additional APT statements.

**EVALUATION PATTERN:**
- Internal Evaluation: Cycle test 1-20 marks; Cycle test 2-20 marks; Assignment - 10 marks
- External Evaluation: 50 marks end semester exams
REFERENCE BOOKS:
4. HMT, "Production Technology", Tata McGraw Hill,

COURSE OUTCOMES
- Understand different type of machine like Lathes, Drilling machine, Boring machine, shaper, planner and slotter machine and their work holding and tool holding device
- Fundamentals and application of CNC machine, constructional features, working and programming CNC machines with programming methods with or without the multiple tools for straight line machining and complex machining.
- Understand Computer aided part programming

PR 513 PRODUCTION PROCESSES LABORATORY

COURSE OBJECTIVES
- To measure various forces during machining, hands-on operation with welding; bead profile measurement and testing of sand for casting are involved
- To measure cutting forces in turning, drilling and milling using strain gauge are involved
- To measure temperature distribution in the rake surface of the single point cutting tool using thermocouple is studied

EXERCISE.1 Measurement of cutting forces in turning using strain gauge
EXERCISE.2 Measurement of cutting forces in drilling using strain gauge
EXERCISE.3 Measurement of cutting forces in milling using strain gauge
EXERCISE.4 Measurement of temperature distribution in the rake surface of the single point cutting tool using thermocouple
EXERCISE.5 Measurement of specific cutting energy in orthogonal cutting operation
EXERCISE.6 TIG welding of butt joints
EXERCISE.7 Bead profile measurement in TIG welding
EXERCISE.8 Sand testing – Permeability, Moisture content, Shear strength

Internal Evaluation: Continuous internal evaluation during performing exercises.
External Evaluation: End semester Practical examination

COURSE OUTCOMES

- Measurement of various forces during machining, hands-on operation with welding; bead profile measurement and testing of sand for casting are involved
- Measurement of cutting forces in turning, drilling and milling using strain gauge are involved
- Measurement of temperature distribution in the rake surface of the single point cutting tool using thermocouple is studied

PR 514 RESOURCE MANAGEMENT TECHNIQUES

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COURSE OBJECTIVES

To study about different types of production techniques and optimization process in industrial operations

Linear programming, graphical method - simplex method - big M method - Two-phase method - introduction to duality theory


Queuing theory & sequencing - applications of queuing model - single and multi server model.

Decision theory and replacement analysis.

Project scheduling - project network - determination of critical path, project duration and slack time calculation - Cost considerations in project scheduling.

EVALUATION PATTERN

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation: 50 marks end semester exams

REFERENCE BOOKS:


COURSE OUTCOMES

- Summarize different techniques for production planning like queuing uncertainty and mathematical modeling are involved
- Apply optimization in utilization of resources.
- Apply resource management techniques to industrial operations.