RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Industrial Production Engineering, VI-Semester

IP601- Tool Engg. & Design of Machine Tools

COURSECONTENT:

UNIT 1. Tooling classification, material, properties and application, General design considerations. Design of single point cutting tool for strength & rigidity, Design for optimum geometry, Design strategies for H.S.S. Carbide and Ceramic, Chip Breakers, Design of form tool. Design of drill, and milling cutters

UNIT 2. Design of Metal Working Tools: Design of elements of press working tool dies and dieset, concept of center of pressure, compound dies, progressive dies, Combination dies, bending, forming dies, press tonnage and its calculations.

UNIT 3. Tooling for forging and rolling –Design principles for forging dies, drop forging, upset forging, Design principles and practice for rolling, roll pass design.

UNIT 4. Design of Jig and Fixtures: Economics of jigs and fixture, principle of location and clamping, Drilling Bushes, Design of various jigs and fixtures, such as Drilling jig, milling fixture, Assembly fixture, Welding fixtures.

UNIT 5. Diesand Mould Design for Plastics and rubber Parts: Compression moulding, transfer moulding, blow moulding.

PRACTICALS:LIST OF EXPERIMENTS:
1. Study of various locating devices
2. Study of various clamping devices
3. Study of tool guiding elements
4. Study of Drill jigs
5. Study of Milling fixture
6. To design a single point cutting tool for the turning of given bar
7. To design a drill jig for the given component
8. To design a form tool.

TEXT BOOKS RECOMMENDED:

1   Machine Tools Handbook: Design and Operation, Prakash Hiralal Joshi, DME, AMIE (India)
2   Fundamentals of Tool Design, David Spitler, Jeff Lantrip, John Nee, David A Smith, Society of Manufacturing Engineers; 5th Edition

REFERENCE BOOKS RECOMMENDED:

1   Eeryand Johnson, Process Engineering, PrenticeHall, NJ, USA

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Industrial Production Engineering, VI-Semester

IP602- CAD CAM

1. Geometric Modeling in CAD: Wire-frame models, parametric representation of Analytical and Synthetic Curves. Surface Models: Parametric Representation of Analytical and Synthetic Surfaces. Solid Modeling : Boundary Representation, Constructive Solid Geometry, Parametric and Variational modeling, Feature Based Modeling**.**

2. Volumetric modeling, Representative techniques: Exhaustive enumeration, Octree. Voxellization of geometric models and rendering of volume data: volume rendering and surface rendering. Applications of volumetric modeling. CAD/CAM data exchange standard: DXF, IGES, STEP. Surface representation standards STL, Virtual Reality Markup Language. Analysis problems in engineering, Continuous and discrete systems, Solution by differential formulation, Variational formulation, Approximate solution method (Rayleigh-Ritz method), Discretization and piecewise approximation.

3. Concepts of: Shape functions, Element matrices, Global matrix, Assembly, Boundary conditions. Solution of FE equations, Post processing, Convergence requirements, Treatment of distributed loads. Application to structural mechanics problems Longitudinal/Axial bar problem, Beam problem, Plane stress/strain problem, Iso-parametric formulation, Axis symmetric problem, Bending of plates. Weighted residual approach.

4. Numerical Control: Concepts and Types, Position and motion control, Constructional features of NC machines. DNC and Machine Center, Adaptive Control.Programming of CNC Machines. Computer assisted Part Programming: APT, Automated Part Program generation, Surface machining.

5. Group Technology: Concept, Part family formation, Part Classification and Coding Systems types, OPITZ system, Production Flow Analysis, Composite Part Manufacturing and Machine Cell formation. Process planning, Computer Aided Process Planning and its Types. Flexible Manufacturing Systems : Concept, Components and Types. Automated Storage and Retrieval Systems, AGVs and their types, Adoption Strategies of FMS, Flexibility Analysis. FMS Scheduling.

Books & References Recommended:
1. Groover & Zimmers, CAD/CAM, P.H.I.
2. Besant & Lui, CAD/CAM, E.W.P.
3. Groover, Production System & CIM, P.H.I.
4. Ramamurthy, Computer Graphics & CAD, T.M.H.
5. Surendra Kumar, Industrial Robotics & CIM, I.B.H.

6.   Zeid, CAD/CAM Theory & Practice, McGraw-Hill
7.   Finite element method: Chandrupatla&Belegundu
8.   Volume graphics, Chen M and A E Kaufmann, Yagel R, Springler-Verlag
9.   Voulme visualization, A E Kaufmann, IEEE press
10.   Computer graphics: Principles and practice, Foley, Van Dam, Feiner and Huges, Pearson
11.   Numerical Control Programming in APT Irvin H Kral Prentice Hall

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Industrial Production Engineering, VI-Semester

Departmental Elective IP- 603 (A) Statistical Quality Control

1   Basic Concept of Quality Control & Product quality. Inspection & Quality Control. Quality System, Quality cost concept, function of Quality control Deptt. Evolution of Total Quality Management, Historical perspective. People involvement, Teamwork, Discipline, Supplier involvement, Defining the immediate customer, Quality at source.

2.   Statistical Quality Control : Statistical concept, Frequency distribution, Process capability, variables and attributes, Theory of control charts, Control charts for variables - X bar and R charts, Applications of control charts for variables.

Control Charts for Attributes :   p, np, C and demerit control charts and their applications.

3.   Acceptance Sampling : Fundamental concepts, OC Curve - construction of OC curve, Evaluation of Parameters affecting OC curve, Sampling plans - Single, Double, Multiple & sequential sampling plans, Dodge Roming, MIL-STD-105D, Indian standard sampling tables, selection of sampling plan.

4.   Quality Measurement : Quality assurance, Quality Circle, Zero defect concept, Quality audit, Introduction to ISO 9000, Six Sigma Quality System.

5.   Reliability :Definition, Failure pattern of complex product, measurement of reliability, Mean Time between failure and mean repair time, Failure mode and effect analysis, Hazard analysis, system reliability- components in series, parallel & mixed system.

Books & References Recommended :

1.   Grant E. L. & Leave Worth, Statistical Q. C., T.M.H.
2.   Juran and Grayan, Quality Planning Analysis, T.M.H.
3.   Balagurusamy, ReliabilityEngg., T.M.H.
4.   Mahajan , Statistical Q.C.

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New Scheme Based On AICTE Flexible Curricula

Industrial Production Engineering, VI-Semester

Departmental Elective IP- 603 (B) Hydraulic and Pneumatics Engineering

1. **Introduction to Hydraulic Power:**Introduction to Hydraulic Power and hydraulic system, advantages, limitations, applications, Pascal's law, structure of hydraulic control system, problems on Pascal's law. The source of Hydraulic Power: Pumps, Classification of pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps, fixed and variable displacement pumps, Pump performance characteristics, Selection factors, problems.Hydraulic Actuators and Motors**:**Classification of cylinder and hydraulic motors, Linear Hydraulic Actuators [cylinders], single and double acting cylinder, Mechanics of Hydraulic Cylinder Loading, mounting arrangements, cushioning, special types of cylinders, problems, construction and working of rotary actuators such as gear, vane, piston motors, Hydraulic Motor Torque, Power and Flow Rate, Performance, problems, symbolic representation of hydraulic actuators (cylinders and motors).

2. **Control Components in Hydraulic Systems :**Classification of control valves, Directional Control Valves, constructional features of poppet, sliding spool, rotary type valves solenoid and pilot operated DCV, shuttle valve, check valves, Pressure control valves - types, direct and pilot operated types. Flow Control Valves -compensated and non-compensated FCV, needle valve, temperature compensated, pressure compensated, pressure and temperature compensated FCV, symbolic representation.

3. **Hydraulic Circuit Design And Analysis :**Control of Single and Double -Acting Hydraulic Cylinder, Regenerative circuit, Pump Unloading Circuit, Double Pump Hydraulic System, Counter balance Valve Application, Hydraulic Cylinder Sequencing Circuits, Automatic cylinder reciprocating system, Locked Cylinder using Pilot check Valve, Cylinder synchronizing circuit using different methods, factors affecting synchronization, Hydraulic circuit for force multiplication, Speed Control of Hydraulic Cylinderand Motors, Safety circuit, Accumulators, types, construction and applications with circuits.

4. **Introduction to Pneumatic Control andActuators:**Introduction to Pneumatic Control and system, advantages, limitations, applications, Choice of working medium. Characteristic of compressed air. Structure of Pneumatic control System, fluid conditioners and FRL unit. Pneumatic Actuators: Linear cylinder - Types, Conventional type of cylinder- working, End position cushioning, seals, mounting arrangements- Applications. Rod - Less cylinders types, working, advantages, Rotary cylinders- types construction and application, symbols.

5. **Pneumatic Control Valves Signal Processing Elements :**Pneumatic Control Valves: DCV such as poppet, spool, suspended seat type slide valve, pressure control valves, flow control valves, types and construction, use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, twin pressure valve. Simple Pneumatic Control:Direct and indirect actuation pneumatic cylinders, speed control of cylinders - supply and Exhaust air throttling. Signal Processing Elements: Use of Logic gates - OR and AND gates in pneumatic applications. Practical Examples involving the use of logic gates, Pressure dependent controls- types - construction - applications, Time dependent controls principle, Construction, practical applications.Multi- Cylinder Application,Electro- Pneumatic Control of Compressed Air.

Books & References Recommended:

1. Industrial Hydraulics by John Pippenger and Tyler Hicks, McGraw Hill.
2. Fluid Power with Applications by Anthony Esposito, Pearson.
3. Fluid Power: Generation, Transmission and Control, Jagadeesha T., Thammaiah Gowda, Wiley.
4. The Analysis & Design of Pneumatic Systems by B. W. Anderson, John Wiley.
5. Control of Fluid Power Analysis and Design by Mc Clay Donaldson, Ellis Horwood Ltd.
6. Hydraulic and Pneumatic Controls: Understanding made Easy, K.ShanmugaSundaram, S.Chand&
   Co Book publishers, New Delhi, 2006 (Reprint 2009)
7. Basic Pneumatic Systems, Principle and Maintenance by S R Majumdar**,** McGraw-Hill.
8. Basic fluid power Dudley, A. Pease and John J. Pippenger, , Prentice Hall, 1987

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Industrial Production Engineering, VI-Semester

Departmental Elective IP- 603 (C) Finite Element method

1. **Introduction**
   Structural analysis, objectives, static, Dynamic and kinematics analyses, Skeletal and continuum structures, Modeling of infinite d.o.f. system into finite d.o.f. system, Basic steps in finite element problem formulation, General applicability of the method.

2. **Element Types and Characteristics**
   Discretization of the domain, Basic element shapes, Aspect ratio, Shape functions, Generalized co-ordinates and nodal shape functions. ID spar and beam elements, 2D rectangular and triangular elements, Axisymmetirc elements.

3. **Assembly of Elements and Matrices**
   Concept of element assembly, Global and local co-ordinate systems, Band width and itseffects, Banded and skyline assembly, Boundary conditions, Solution of simultaneousequations, Gaussian elimination and Choleksy decomposition methods, Numericalintegration, One and 2D applications.

4. **Higher Order and Isoparametric Elements**
   One dimensional quadratic and cubic elements, Use of natural co-ordinate system, Areaco-ordinate system continuity and convergence requirements, 2D rectangular andtriangular requirement.

5. **Static & Dynamic Analysis**
   Analysis of trusses and frames, Analysis of machine subassemblies, Use commercial software packages, Advantages and limitationsHamilton's principle, Derivation of equilibrium, Consistent and lumped mass matrices,Derivation of mass matrices for ID elements, Determination of natural frequencies andmode shapes, Use of commercial software packages.

Books & References Recommended:
1. Rao, S.S., The Finite Element Method in Engineering, 2nd ed.., Peragamon Press,Oxford.
2. Robert, D. Cook., David, S. Malkins, and Michael E. Plesha, Concepts and Application of Finite Element Analysis 3rd ed., John Wiley.
3. Chandrupatla, T.R. anBelegundu, A.D., Introduction to Finite Elements in Engineering, Prentice Hall of India Pvt. Ltd.

4. Zienkiewicz O C, The Finite Element Method, 3rd ed, Tata McGraw Hill.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Industrial Production Engineering, VI-Semester

Open Elective IP- 604 (A) Operations research

1. Introduction : History and Development of O.R. present trend& Linear Programming - Simplex method, Big-M-Method, Two-phase method, Degeneracy, Unrestricted variables, Duality in LP, Revised simplex, Sensitivity Analysis.

2. Allocation :
    (i)   Assignment Model.
    (ii)   Transportation - Optimality Test, Degeneracy Unbalanced Problems, Trans-shipment.

3. Introduction to Integer Programming. Branch and Bound Algorithm. Dynamic Programming : Characteristics of Dynamic optimisation Model Bellman's Principle problem, Salesmen problem, Forward and Backward recursion. Non Linear Programming : Introduction, Computer Application in Operations Research.

4. Waiting Line Models : Introduction, Classification, States in queue, Probability distribution of arrivals and service times, Single server model (M/M/l). Multiple server model (M/M/S). Single server model with finite capacity.

5. Game Theory : Rectangular, Two persons Zero sum games, Maxmin and Minimax Principles, Saddle point, Dominance, Graphical and Algebraic methods of solution, Solution by transforming into Linear Programming Problem. Simulation: Building a simulation model, Monte Carlo simulation as applied to descrete system.

Books & References Recommended:

1. Taha H. A., Operation Research, Mc Millian.
2. Banerjee B., Operation Research, Business Publicity, Bombay.
3. Hira & Gupta, Operation Research, S. Chand.
4. Sharma S. D., Kedarnath, Operation Research, Ramnath& Co., Meerut.

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Industrial Production Engineering, VI-Semester

Open Elective IP- 604 (B) Heat & Mass transfer

Unit-1 Basic Concepts: Modes of heat transfer, Fourier's law, Newton's law, Stefan Boltzman law; thermal resistance and conductance, analogy between flow of heat and electricity, combined heat transfer process; **Conduction:** Fourier heat conduction equation, its form in rectangular, cylindrical and spherical coordinates, thermal diffusivity, linear one dimensional steady state conduction through a slab, tubes, spherical shells and composite structures, electrical analogies, critical-insulation-thickness for pipes, effect of variable thermal conductivity.

Unit 2 Extended surfaces (fins): Heat transfer from a straight and annular fin (plate) for a uniform cross section; error in measurement of temperature in a thermometer well, fin efficiency, fin effectiveness, applications; **Unsteady heat conduction:** Transient and periodic conduction, heating and cooling of bodies with known temperatures distribution, systems with infinite thermal conductivity, response of thermocouples.

Unit 3 Convection: Introduction, free and forced convection; principle of dimensional analysis,
Buckingham 'pie' theorem, application of dimensional analysis of free and forced convection, empirical correlations for laminar and turbulent flow over flat plate and tubular geometry; calculation of convective heat transfer coefficient using data book.

Unit 4 Heat exchangers: Types- parallel flow, counter flow; evaporator and condensers, overall heat transfers coefficient, fouling factors, log-mean temperature difference (LMTD), method of heat exchanger analysis, effectiveness of heat exchanger, NTU method;
Mass transfer: Fick's law, equi-molar diffusion, diffusion coefficient, analogy with heat transfer,
diffusion of vapour in a stationary medium.

Unit 5 Thermal radiation: Nature of radiation, emissive power, absorption, transmission, reflection and emission of radiation, Planck's distribution law, radiation from real surfaces; radiation heat exchange between black and gray surfaces, shape factor, analogical electrical network, radiation shields.
Boiling and condensation: Film wise and drop wise condensation; Nusselt theory for film wise
condensation on a vertical plate and its modification for horizontal tubes; boiling heat transfer phenomenon, regimes of boiling, boiling correlations.

References:
1. Sukhatme SP; Heat and mass transfer; University Press Hyderabad
2. Holman JP; Heat transfer; TMH
3. Nag PK; heat and Mass Transfer; TMH
4. Dutta BK; Heat Transfer Principles And App; PHI Learning
5. Mills AF and Ganesan V; Heat transfer; Pearson
6. Cengel Yunus A; Heat and Mass transfer;TMH

7. Yadav R; Heat and Mass Transfer; Central India pub-Allahabad
8. Baehr HD;Stephan K; Heat and Mass Transfer; MacMillan Pub
9. Incropera FP and Dewitt DP; Heat and Mass transfer; Wiley

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Industrial Production Engineering, VI-Semester

Open Elective IP- 604 (C) IPR (Intellectual Property Rights)

Course Objective
Acquaint the students with the basic concepts of Intellectual Property Rights; and sensitize the students with the emerging issues in IPR and the rationale for the protection of IPR.

UNIT I   Introduction
Introduction and Justifications of IPR, Nature of IP, Major forms of IP- *Copyright, Patent, Trade Marks Designs, Geographic indication, layout design of Semi conductors, Plant varieties, Concept & Meaning of Intellectual Property.*
Major international documents relating to the protection of IP - *Berne Convention, Paris Convention, TRIPS.* The World Intellectual Property Organization (WIPO).

UNIT II   Copyright
 Meaning and historical development of copyright , Subject matter , Ownership of copyright, Term of copyright, Rights of owner, Economic Rights, Moral Rights. Assignment and licence of rights, Infringement of copyright, Exceptions of infringement, Remedies, *Civil, Criminal, Administrative*, Registration Procedure.

UNIT III Patents
Meaning and historical development,. Criteria for obtaining patents, Non patentable inventions, Procedure for registration, Term of patent, Rights of patentee, Compulsory licence, Revocation, Infringement of patents, Exceptions to infringement, Remedies, Patent office and Appellate Board.

UNIT IV – Trade Marks, Designs & GI
Trade Marks: Functions of marks, Procedure for registration, Rights of holder, Assignment and licensing of marks, Infringement, Trade Marks Registry and Appellate Board.
Designs: Meaning and evolution of design protection, Registration, Term of protection, Rights of holder, unregistered designs.
Geographical Indication: Meaning and evolution of GI, Difference between GI and Trade Marks, Registration, Rights, Authorised user.

UNIT V   Contemporary Issues & Enforcement of IPR
IPR & sustainable development, The Impact of Internet on IPR. IPR Issues in biotechnology, E-Commerce and IPR issues, Licensing and enforcing IPR, Case studies in IPR
Course Outcome:
1. Students will be able to understand Primary forms of IPR
2. Students will be able to asses and critique some basic theoretical justification for major forms of IP Protection
3. Students will be able to compare and contrast the different forms of IPR in terms of key differences and similarities.
4. Students will be able understand the registration procedures related to IPR.
5. Students will be exposed to contemporary issues and enforcement policies in IPR.

References:
1. P. Narayanan, Intellectual Property Law, Eastern Law House
2. . Neeraj Pandey and Khushdeep[Dharni, Intellectual Property Rights, PHI, 2014
3. N.S Gopalakrishnan and T.G. Agitha, Principles of Intellectual Property, Eastern Book Co. Lucknow, 2009.
4. Anand Padmanabhan, Enforcement of Intellectual Property, Lexis Nexis Butterworths, Nagpur, 2012.
5. Managing Intellectual Property The Strategic Imperative, Vinod V. Sople, PHI.
6. Prabuddha Ganguli, " Intellectual Property Rights" Mcgraw Hill Education, 2016.