

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Industrial Production Engineering, VI-Semester

IP- 6001 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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Industrial Production Engineering, VI-Semester

IP- 6002 Mechatronics

1. **Open loop and closed loop control systems:** Dynamic modelling of simple mechanical, electrical, electromechanical, thermal and fluid systems. Transfer function and block diagram representation of control system. Zero order, first order and second order systems and their dynamic response, Routh Hurwitz stability criteria, Introduction to Bode plot and root locus method. System modelling using MATLAB
2. **Measurement Systems:** Generalized measurement system. Sensors and transducers, intermediate elements, indicating and recording elements. Static and dynamic characteristics of measuring instruments. Amplitude linearity, phase linearity, bandwidth, frequency response. Proximity sensors and switches, potentiometers, optical encoders, electrical strain gages, load cells, thermocouples, piezoelectric accelerometers, pressure and flow sensors, semiconductor sensors.
3. **Signal Conditioning & Data Acquisition:** Amplification. Filters. Operational amplifier and its applications. Analog to digital conversion. Data acquisition. Interfacing with micro-controller and micro-processor.
4. **Actuators:** Electro-mechanical actuators, solenoids and relays, types of electric motors and their characteristics, speed control of electric motors. Stepper motors and their control. Electro-hydraulic and electro-pneumatic actuators, Servomotor.
5. **Controllers:** Basic control actions. Proportional, integral and derivative control. Op Amp based PID controller. Combinatorial and sequential logic. Simple logic networks. Introduction of micro-controllers.

Books & References Recommended:

1. Beckwith and Buck, *Mechanical Measurement*.
2. K. Ogata, *Modern Control Theory*
3. Nakra&Choudhary, *Instrumentation, Measurement and Analysis*
4. Alciatore and Histan, *Introduction to Mechatronics & Measurement Systems*
5. Bolton, *Mechatronics*

IP- 6003 PRINCIPLES OF MACHINE TOOLS

1. **Basic Features and Kinematics of Machine Tools:** Classification of machining operations and machine tool used for them. Basic features of machine tool construction. Classes of machine tool motions, Drive systems, Conversion of motion, Rotation to rotation and rotation to translation.
2. **Strength, Rigidity and Design Analysis:** Kinematic structures of machine tools, elementary, complex and compound structure. Strength, Rigidity and Design Analysis of Machine Tool Spindle etc. Elements compliance of machine tool. Force analysis, Bearing Slides and guide ways of machine tools, Hydrostatic bearings.
3. Speed regulation, stepped regulation, cone pulley, change gear drive, gear box drive constructional features of sliding, clutched & clutch drives, Norton sample as regulation by electrical, mechanical friction and hydraulic system drives. Principles of speed regulation, selection of speed & feeds speed loss in stepped regulation. Design of gear boxes for speeds and feeds.
4. Kinematic features of gear, shapers, Hobbers& bevel gear generating machines.
5. Automation in Machine Tool: Capstan and turret lathes and their process layouts, Single spindle automates, multiple spindle automates. There types and construction. CAM design for single spindle automates. Indexing and Bar feeding and clamping arrangement.

Books & References Recommended:

1. Sen & Bhattacharya, Machine tool.
2. Basud S. K., Design of Machine Tools, Oxford IBH.
3. Mehta N. K., Machine Tool Design, T.M.H.

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, Springer-Verlag
9. Volume 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

Elective –II IP-6005 (1) 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/1). 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 discrete 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.

Industrial Production Engineering, VI-Semester

Elective –II IP-6005 (2) 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. 1D spar and beam elements, 2D rectangular and triangular elements, Axisymmetric elements.

3. Assembly of Elements and Matrices

Concept of element assembly, Global and local co-ordinate systems, Band width and its effects, Banded and skyline assembly, Boundary conditions, Solution of simultaneous equations, Gaussian elimination and Cholesky decomposition methods, Numerical integration, One and 2D applications.

4. Higher Order and Isoparametric Elements

One dimensional quadratic and cubic elements, Use of natural co-ordinate system, Area co-ordinate system continuity and convergence requirements, 2D rectangular and triangular requirement.

5. Static & Dynamic Analysis

Analysis of trusses and frames, Analysis of machine subassemblies, Use commercial software packages, Advantages and limitations Hamilton's principle, Derivation of equilibrium, Consistent and lumped mass matrices, Derivation of mass matrices for 1D elements, Determination of natural frequencies and mode 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. and Belegundu, 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.

Elective –II IP-6005 (3) Hydraulics 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 Cylinder and Motors, Safety circuit, Accumulators, types, construction and applications with circuits.
4. **Introduction to Pneumatic Control and Actuators:**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

Industrial Production Engineering, VI-Semester

Elective-II IP-6005 (4) 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.**

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IP- 6007 Creativity and Entrepreneurship Development

Course Objective:

- Understand and use tools for generating entrepreneurial ideas and problem solving.
- Understand and use tools for the selection of ideas.
- Understand and gain the skills that are needed to implement ideas in today's society
- Understand Entrepreneurship's part in process that includes idea generation and implementation.
- Understand the concept of Entrepreneurship and its place in today's society

Course Outcomes:

- Recognize an opportunity for a user group and frame an appropriate design challenge that addresses the need for the user.
- Practice observation, interview and empathy skills to evolve a thorough understanding of the needs of the user.
- Share and integrate team leanings.
- Generate, develop and describe creative ideas that address the design challenge.

Syllabus:

1. The concept of Entrepreneurship, its history and its place in society.
2. The concept of Entrepreneurship and its relation to concept of innovation.
3. Creative processes for idea generation and problem solving.
4. Business plan.
5. Role of creativity, innovation and business research.
6. Entrepreneurship opportunities in contemporary business environment.

Reference Books :

1. Dollinger M.J. "Entrepreneurship strategies and resources," 3rd edition Pearson Education New Delhi.
2. Panda, Shiba charan "Entrepreneurship development", Anmol publication New Delhi.
3. Richard Blundel & Nigel locket, "Exploring Entrepreneurship : practices & perspectives Oxford.
4. Charles E. Banford & Garry D. Bruton, "Entrepreneurship – A small business Approach, Mcgrawhill Education.
5. P. Narayana Reddy, "Entrepreneurship" : Text and cases, Cengage learning
6. Rajeev Roy, "Entrepreneurship" Oxford.