SYLLABUS

FOR

B.Tech. DEGREE PRODUCTION ENGINEERING

CREDIT BASED CURRICULUM

(OPERATIVE FOR STUDENTS OF 2011 -2012 ADMISSION)

VISION

- **To establish a world class academy for manufacturing and industrial engineering**

MISSION

- **Curriculum development with state of art technologies.**
- **Pursue research interests of manufacturing and industrial engineering.**
- **Consultancy in design, manufacturing and industrial engineering.**
- **Industry-Institute interaction.**
- **Equipping laboratories with state-of-the-art equipment.**

DEPARTMENT OF PRODUCTION ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY TIRUCHIRAPPALLI-620 015

Programme Educational Objectives (PEOs)

1. Graduates formulate, analyze and solve Manufacturing and Industrial engineering problems.
2. Graduates take gainful employment for manufacturing functions.
3. Graduates become product and process design professionals for sustainable manufacturing.
4. Graduates become entrepreneurs in manufacturing engineering sector.

Programme Outcomes (POs)

1	Graduates will apply knowledge acquired in mathematics, science, engineering and humanities to production engineering problems.
2	Graduates will have the ability to define the problems and provide solutions by designing and conducting experiments, interpreting and analyzing data for manufacturing.
3	Graduates will design manufacturing systems that would encompass machining technology, welding technology, metal forming, foundry technology and thermal engineering infrastructure and would meet specifications and requirements as demanded by the customers.
4	Graduates will apply design and tooling for manufacturing, finite element methods, modeling of manufacturing systems to solve production engineering problems.
5	Graduates understand manufacturing technologies like computer controlled processes and management information systems, production management, SCM, ERP and new manufacturing concepts like TPS, agile manufacturing, pull & push system.
6	Graduates will have the confidence to apply engineering solutions in global and societal contexts.
7	Graduates will understand quantitative modeling and analysis of a broad array of systems-level decision problems concerned with economic efficiency, work design, productivity and quality with environmental focus.
8	Graduates should be capable of self-education and clearly understand the value of achieving perfection in their professional endeavors.
9	Graduates will participate as members of engineering and science laboratory teams, as well as members of multidisciplinary design teams.
10	Graduates will be proficient in English language in both verbal and written forms which will enable them to compete with graduates of international engineering institutions.
11	Graduates will demonstrate the ability to choose and apply appropriate resource management technique/s so as to optimally utilize resources in manufacturing systems.
12	Graduates will be broadly educated and will have an understanding of the impact of engineering on society and demonstrate awareness of contemporary issues.

DEPARTMENT OF PRODUCTION ENGINEERING
B.Tech. PRODUCTION ENGINEERING (CREDIT SYSTEM)

Curriculum Structure:
Total Minimum credits required for completing the Programme is 180

Semester - III

CODE	SUBJECTS	L	T	P	CREDITS
MA 201	Fourier Series and Partial Differential Equations	3	1	0	4
CE 293	Strength of Materials	2	1	0	3
EE 245	Applied Electronics	3	0	0	3
PR 201	Metallurgy and Materials Engineering	2	0	2	3
PR 203	Casting Technology	3	0	0	3
PR 205	Machining Technology	3	0	0	3
PR 211	Workshop Practice -1	0	0	3	2
CE 295	Strength of Materials Lab.	0	0	2	1
		16	2	7	22

Semester - IV

CODE	SUBJECTS	L	T	P	CREDITS
MA 202	Numerical Techniques	3	1	0	4
EE 242	Electrical and Control Systems Engineering	3	0	0	3
CE 282	Fluid Mechanics and Machinery	3	0	0	3
PR 202	Kinematics of Machines	2	1	0	3
PR 204	Metal Forming Processes	3	0	0	3
PR 206	Metal Joining Processes	3	0	0	3
PR 212	Workshop Practice – II	0	0	3	2
EE 244	Electrical and Electronics Engineering Lab.	0	0	2	1
CE 284	Fluid Machinery Lab.	0	0	2	1
		18	2	7	23

Semester - V

CODE	SUBJECTS	L	T	P	CREDITS
MA303	Applied Statistics	3	0	0	3
PR 301	Dynamics of Machines	2	1	0	3
PR 303	Design of Machine Elements	2	1	0	3
PR 305	Non Traditional Manufacturing Processes	3	0	0	3
PR 307	Metrology and Quality Assurance	3	0	0	3
ME 325	Thermal Engineering	3	0	0	3
PR 311	Machine Drawing Practice	1	0	2	2
ME 331	Thermal Engineering Lab. and Metrology Lab.	0	0	2	1
		19	1	4	21

Semester - VI

CODE	SUBJECTS	L	T	P	CREDITS
PR 302	Resource Management Techniques	2	1	0	3
PR 304	Computer Graphics and CAD	3	0	0	3
PR 306	Design for Manufacture and Assembly	3	0	0	3
PR 308	Reliability, Maintenance and Safety Engineering	3	0	0	3
PR 310	CNC Machines	3	0	0	3
-------	Elective – I	3	0	0	3
PR 312	Computer aided Drafting And Cost Estimation	1	0	2	2
PR 314	CNC Laboratory.	0	0	3	2
PR 316	Advanced Production Process lab	0	0	3	2
		19	2	8	24

Semester -VII

CODE	SUBJECTS	L	T	P	CREDITS
PR 401	Manufacturing System Simulation	3	0	0	3
PR 403	Fluid Power Control and Mechatronics	3	0	0	3
PR 405	Design of Production Tooling	2	1	0	3
PR 407	Automation and CIM	3	0	0	3
-------	Elective – II	3	0	0	3
-------	Elective -III	3	0	0	3
PR 411	Fluid Power Control and mechatronics.	0	0	2	1
PR413	Manufacturing System Simulation Lab.	0	0	2	1
PR 415	Colloquium	0	0	3	1
PR 447	Comprehensive Evaluation	0	3	0	3
		17	4	7	24

Semester –VIII

CODE	SUBJECTS	L	T	P	CREDITS
HM402	Industrial Economics	3	0	0	3
PR 402	Manufacturing Planning and Control	3	0	0	3
PR 404	Work Design and Facilities Planning	3	0	0	3
--------	Elective - IV	3	0	0	3
--------	Elective -V	3	0	0	3
PR 498	Project Work	-	-	15	6
	`	15	0	15	21

List of Electives:

CODE	SUBJECTS	L	T	P	CREDITS
Elective I					
Manufacturing Engineering Stream					
PR 352	Material Handling & Storage	3	0	0	3
PR 354	MEMS & Nanotechnology	3	0	0	3
Industrial Engineering Stream					
PR 356	Design and Analysis of Experiments	3	0	0	3
PR 358	Sustainable Manufacturing	3	0	0	3
Elective II & III					
Manufacturing Engineering Stream					
PR 451	Finite Element Methods	3	0	0	3
PR 453	Rapid prototyping, tooling And manufacture	3	0	0	3
PR 455	Machine Tool Technology	3	0	0	3
Industrial Engineering Stream					
PR 457	Agile Manufacturing	3	0	0	3
PR 459	Operations Management	3	0	0	3
PR 461	Supply Chain Management	3	0	0	3
General Stream					
ME 471	Automobile Engineering	3	0	0	3
Elective IV & V					
Manufacturing Engineering Stream					
PR 450	Industrial Robotics	3	0	0	3
PR 452	Manufacturing of composite Materials	3	0	0	3
Industrial Engineering Stream					
PR 454	Project Management	3	0	0	3
PR 456	Value Engineering	3	0	0	3
General Stream					
PR 458	Artificial Intelligence & Expert Systems	3	0	0	3
HM 412	Entrepreneurship Development	2	1	0	3

List of reserve Electives:

CODE	SUBJECTS	L	T	P	CREDITS
Manufacturing Engineering Stream					
PR 462	Manufacture and Applications of Polymer Composites	3	0	0	3
PR 463	Mechatronics	3	0	0	3
PR 464	Plant Engineering	3	0	0	3
Industrial Engineering Stream					
PR 465	Integrated Materials Management	3	0	0	3
PR 466	Lean Manufacturing	3	0	0	3
PR 467	Product Development Strategies	3	0	0	3
General Stream					
HM 352	Corporate Communication	3	0	0	3
MB 470	Financial Management	3	0	0	3
ME469	Refrigeration and Air Conditioning	3	0	0	3
PR 468	Manufacturing Costs & Analysis	3	0	0	3
PR 469	Total Quality Management	3	0	0	3
Or any other elective subject from any other department					

Note: *Students have to choose a minimum of 3 elective courses out of 5 electives from a particular stream*

Subjects offered to the other Departments

CODE	SUBJECTS	L	T	P	CREDITS
Mechanical Engineering					
PR 222	Production Technology - II	0	0	0	3
PR 232	Production Process Lab.	0	0	2	1
PR 472	Resource Management Techniques	3	0	0	3
Electrical & Electronics Engineering					
PR 287	Mechanics of Solids and Fluids	3	0	0	3

MA 201 FOURIER SERIES AND PARTIAL DIFFERENTIAL EQUATIONS

Course outcomes

- 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

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 series- Dirichlet's conditions-Half range Fourier cosine and sine series- Parseval's relation –Fourier series in complex form –Harmonic analysis.

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.

Formation of partial differential equation by eliminating arbitrary constants and functions- Solution of first order equation- Four standard types – Lagrange's equation- homogeneous and non-homogeneous type of second order linear differential equations with constant coefficients.

One dimensional wave equation and one-dimensional heat flow equation-method of separation of variables-Fourier series solution.

TEXTBOOKS:

1.B. S, Grewal, Engineering Mathematics, Khanna Publishers, 40th edition, 2007

2. Kreyszic E. Advanced Engineering Mathematics, 8th Edition, John Wiley and sons, 2008.

REFERENCES:

1. T. Veerarajan, Volume III, Tata McGraw Hill Edition private Ltd, 2009

2.Venkataraman, M. K. Engineering Mathematics Volume III, 13th Edition National Publishing Company, 1998.

CE 293 STRENGTH OF MATERIALS

Course outcomes

- Classify simple stresses and strains in simple, composite bars subjected to external loads and temperature changes and compute simple torsion.
- Determine Principal Stresses - corresponding planes and represent by Mohr's circle.
- Predict the behavior of horizontal and vertical structures subjected to loads

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.

Theory of simple torsion – assumptions – simple torsion formula for circular shafts – hollow shafts – power transmission – strength and stiffness of shafts – Springs -Analysis of Plane Frames – Method of Joints and Method of Sections

TEXT BOOKS

1.Ramamurtham, S, Narayan .R, "Strength of materials", 16th Edition, Dhanpat Rai Publishing Co, 2008.

2.Egor P Popov, "Engineering Mechanics of Solids",2nd Edition, Prentice Hall of India., 2008.

REFERENCES

1.Timoshenko S.P and J.M. Gere "Mechanics of Materials".2nd Edition, CBS Publishers and Distributors,2002

EE 245 APPLIED ELECTRONICS

Course outcomes

- Recall theorems and explain the principles of basic analog electronic devices.
- Summarize the application of OP AMPs
- Understands the fundamentals in digital electronics and memory variants

Theorems and Linear Electronic Circuits - Thevenin and Norton theorems, Review of junction diodes, Zener diodes, (BJT) and (FET) – applications.

Operational Amplifiers - Characteristics - applications as comparators, inverting amplifier, non-inverting amplifier. Adder, subtractor, differentiator, integrator, rectifiers, sample and hold circuit, Schmitt trigger.

Review of binary arithmetic (signed and unsigned), seven segment display .Boolean Algebra simplification of algebraic expression , Basic logic gates. Combinational Logic.

D/A and A/D Converters – Principles and various Techniques.

MEMORIES - Functions and types of memories - Read Only Memory (ROM) - Erasable Programmable RON (EPROM)- Electrically Erasable and Programmable ROM (EEPROM) - Random Access Memo (RAM) - a typical RAM static and dynamic RAM.

TEXT BOOKS

1.Jacob Millman and Christos C.Halkias: " Integrated Electronics ",1st Edition, Tata McGraw Hill Publishing Co Ltd.,2008.

REFERENCES

2.Ramakant A Gayakwad, "OP-amps and linear integrated circuit " 4th Edition, PHI Pvt. Ltd.,2008.

3.Morris Mano, " Digital Design W/CD" 4th Edition, Pearson Education Ltd., 2008.

PR 201 METALLURGY AND MATERIALS ENGINEERING

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

Art and science of metallurgy-structure of metals and alloys-phase and structural constitutions-Equilibrium diagrams

Ferrous metals and alloys-Fe-Fe_3C 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 and 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-polymers-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:

Microstructural study of carbon steels, Cast Iron

Jominy end quench test – Heat Treatments on steels – Hardening – Annealing – Normalizing – Tempering

Demonstration on SEM/XRD

TEXTBOOKS

1. *Raghavan V., 'Physical Metallurgy - Principles and Practice', 2nd Edition, Prentice - Hall of India, 2007.*
2. *Avner S.H., 'Introduction to Physical Metallurgy', 2nd edition, Tata McGraw Hill, 2008*

REFERENCES

1. *Dieter G. E., 'Mechanical Metallurgy', 1st Edition, McGraw Hill Co- Koga, 2002*
2. *Suryanarayana AVK, 'Testing of Metallic Materials', 2nd Edition, BS Publications, 2007.*

PR 203 CASTING TECHNOLOGY

Course outcomes

- Summarize the 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.

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.

Melting: Furnaces - Types and operational features. Application of CAD\CAM in foundry. Casting of complicated shapes: automotive components, casting of light alloys

TEXT BOOKS

1. Jain, P.L., "Principles of Foundry Technology", 4th Edition, Tata McGraw Hill Pub., Co. Ltd., 2008.
2. Heine, R.W.,Carl Loper, and Rosenthal, P.C., "Principles of Metal Casting", 2nd Edition, Tata McGraw Hill Pub. Co. Ltd., 2008.

REFERENCES

1. Banga, T.R. ,Agarwal RLand Manghnani, "Foundry Engineering",4th Edition, Khanna Pub., New Delhi, 2007.
2. Srinivasan, N.K., "Foundry Technology", 3rd Edition, Khanna Pub.,2009.
3.ASM Handbook "Welding"

PR 205 MACHINING TECHNOLOGY

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

Theory of metal cutting: Introduction – Machine tools – Cutting tools – Tool geometry - Orthogonal and oblique cutting – Mechanics of cutting – Types of chips – Cutting speeds and feeds – Tool failure, Tool life – Tool materials – Cutting fluids.

Turning operations: Introduction – Lathe – Types of lathes – Size of a lathe – Work holding devices – Lathe operations – Metal removal rate and machining time calculations.

Drilling and allied operations: Introduction – Drilling machines – Types – Drills – Drilling machine operations – Boring, Reaming and other operations – Boring machine – Types.

Milling operations: Introduction – Milling machine – Types – Milling cutters – Milling process – Milling machine operations.

Finishing processes: Introduction – Abrasive machining – Abrasives – Grinding wheel – Grinding machines – Types – Fine finishing operations.

TEXT BOOKS

1. Nagendra Parashar, and Mittal, R.K, "Elements of manufacturing processes",1st Edition Prentice Hall of India Private Limited, . 2003.
2. Hajra Choudhury SK, Bose HK,and Hajra Choudhury AK "Elements of Workshop Technology, Vol. II"12th Edition, Media promoters and Publishers Pvt. Ltd. 2007.

REFERENCES

1.Khanna, O.P and Lal, M, "A Text book of Production Technology" Vol.II",1st Edition Dhanpat Rai Publications (P) ltd.,2009.
2. H.M.T, "Production Technology" 1st Edition, Tata Mc GrawHill Publishing Co.Ltd, 2008.
3.ASM Handbook "Machining"

PR 211 WORKSHOP PRACTICE – I

Course outcomes

- Summarize the machine tool construction.
- Create work pieces by turning, boring using lathe and drilling machine.
- Utilize different machine tool attachments

(*Practical Exercises will be selected from the following*)

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

CE 295 STRENGTH OF MATERIALS LABORATORY

Course outcomes

- Determine the behavior of materials upon normal external loads.
- Determine the behavior of material using sieve analysis
- Determine the behavior of the material under impact conditions.

1. Tension test
2. Compression Test
3. Hardness Test
4. Torsion test
5. Deflection Test
6. Sieve Analysis
7. Impact Test

MA 202 NUMERICAL TECHNIQUES

Course outcomes

- Understand the applications of laplace method, Eulers method, Newton-Raphson method
- Solve linear and non linear equations.
- Apply the studied techniques for optimization

Solution of linear system - Gaussian elimination and Gauss-Jordan methods - LU - decomposition methods - Crout's method - Jacobi and Gauss-Seidel iterative methods - sufficient conditions for convergence - Power method to find the dominant eigenvalue and eigenvector.

Solution of nonlinear equation - Bisection method - Secant method - Regula falsi method - Newton- Raphson method for $f(x) = 0$ and for $f(x,y) = 0$, $g(x,y) = 0$ - Order of convergence - Horner's method - Graeffe's method.

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 and group averages.

Numerical Solution of Ordinary Differential Equations- Euler's method - Euler's modified method - Taylor's method and Runge-Kutta method for simultaneous equations and 2nd order equations - Multistep methods - Milne's and Adam's methods.

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.

TEXTBOOK

1 Engineering Mathematics, Khanna Publishers, 11th Edition**,** *2005.*

REFERENCES

1.Jain, M.K., Iyengar, S.RK. and Jain, R.K., Numerical Methods for Scientific and Engineering Computation, Vth edition, New Age international, 2009.

2. Kandasamy, P., Thilagavathy, K., and Gunavathy, S., Numerical Methods, 3rd edition, S.Chand and Company, 2008.

EE 242 ELECTRICAL AND CONTROL SYSTEMS ENGINEERING

Course outcomes

- Understand the concepts of transformer and DC machines
- Understand open and closed system

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.

TEXTBOOK

1.Boylestead, "Electronics Devices and Integrated Circuits", PHI Publishers, 2008.

REFERENCES

1.Palani, S. "Control Systems ", Shanmuga Priya Publishers, 1995.
2.Theraja, B.L., " Electrical Technology", Vol. 1 and 2, 23rd and 24th Edition, S.Chand and Co Ltd., 2009.

CE 282 FLUID MECHANICS AND MACHINERY

Course outcomes

- Understand properties of fluids.
- Determine flow through hydraulics machines and pipes
- Understand the mechanics of fluids, transportation of mass, momentum and energy

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.

TEXTBOOK

1. *Kothandaraman, C.P. and Rudramoorthy, R. "Basic Fluid Mechanics", 1st Edition, New Age International, 1999.*

REFERENCES

1. *Robert, W. Fox and Allan, T. McDonald. "Introduction to Fluid Mechanics", 5th Edn., John Willey and Sons (SEA) PTE LTD.,, 2009.*
2. *Bansal, R.K., "Textbook of Fluid Mechanics and Hydraulic Machines",9th Edition, Lakshmi Publications, 2008.*

PR 202 KINEMATICS OF MACHINES

Course outcomes

- Understand the basic concepts of machines and machinery
- Understand law of gearing
- Understand the laws of dry friction

Definitions and basic concepts: Kinematic link, pair and chain – constrained motion – slider crank and crank rocker mechanisms – inversions – applications – Kinematic analysis and synthesis of simple mechanisms – Determination of velocity and acceleration in Degrees of freedom – Grueblers criteria

Cams : Types of cams and followers –Computation of velocity and acceleration of followers by equivalent mechanism with lower pairs

Friction : Law of dry friction – co-efficient of friction – Angle of friction – wedges, square threaded screws. Friction in screw and nut – Pivot and collar – Thrust bearing – Plate and disc clutches – Belt (flat and V) and rope drives – Ratio of tensions

Law of gearing – tooth forms - involute gear, minimum number of teeth to avoid interference - contact ratio, Helical gears – overlap ratio. Types – speed ratio and torque calculations in epicyclic gear trains

Gyroscopic couple and effects in Cars, Scooters, Aero planes - Gyroscopic stabilization - Complex mechanisms - velocity and acceleration analysis, Geneva mechanism, Motion picture drive –Mechanism, Heavy sewing machine mechanism – characteristics.

TEXT BOOKS

1.Shigley, J.E. and Uicker, J.J., "Theory of Machines and Mechanisms", 3rd Edition, Oxford University Press, 2008.
2.Thomas Bevan, "Theory of Machines", 3rd edition, CBS Publishers. 2008.
3. Rattan S.S., "Theory of Machines" 2nd Edition, Tata McGraw Hill Pub Co, 2008.

REFERENCES

1.Rao, J.S., and Dukkipati, R.V., "Mechanism and Machine Theory",Second Edition, Wiley Eastern Ltd., 1992.
2. Ghosh A and Mallik A.K., "Theory of Mechanisms and Machines", Third Edition, Affiliated EWP Pvt. Ltd 2003.

PR 204 METAL FORMING PROCESSES

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

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.

TEXT BOOKS

1. Narayanasamy,R., "Metal forming technology"2nd Edition, Ahuja Pub,2000.
2. William F Hosford and Robert M Caddell " Metal Forming Mechanics and Metallurgy" Third Edition, Cambridge University Press,2008

REFERENCES

1.George E.Dieter , "Mechanical Metallurgy",1st edition McGraw Hill book Co.- Koga, 2002
2.ASM Handbook on Forming and Forging, Vol.14, 9th Edition ,ASM International.,1998

PR 206 METAL JOINING PROCESS

Course outcomes

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

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

Working Principle of resistance welding process-spot, seam, projection, upset and flash butt welding, electro slag and electro gas welding.

Radiant energy welding processes - equipment -electron beam welding (EBW) - laser beam welding (LBW) - applications of EBW and LBW- Friction Steel Welding-Defects in welding.

TEXT BOOKS

1. *Nadkarni S.V., 'Modern Arc Welding Technology', 1st Edition, IBH Publishing, 2005*
2. *Kearns W. H, 'Welding Hand Book (Welding Processes)', Volume II and III, 7th Edition, AWS, 1984*

REFERENCES

1. *Parmar R. S., 'Welding Engineering and Technology', 1st Edition, Khanna Publishers, 2008.*
2. *Jackson M.D. "Welding methods and metallurgy" Charles Griffin and Co. London 1967.*
3. *ASM Handbook "Welding"*

EE 244 ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

Course outcomes

- Conduct exercises to learn DC motor
- Conduct experiments for understanding VI characteristics of diodes
- Conduct experiments to learn about Logic Gates.

(Practical Exercises will be selected from the following)

1. No - load speed characteristics of D.C. shunt motor
2. Load test on D.C.shunt generator
3. Equivalent circuit of single - phase transformer
4. Swinburne's test
5. Starting of 3-phase induction motors

6 Semiconductor junction diode V-I characteristics

7 Semiconductor zener diode V-I characteristics

8 Inverting and Non-inverting Operational Amplifiers

9 Uni Junction Transistor (UJT) and Silicon Controlled Rectifier(SCR) characteristics

10 Logic gates

CE 284 FLUID MACHINERY LABORATORY

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 application

(Practical Exercises will be selected from the following)

Experiments involving the following machines/equipment.

1. Francis turbine
2. Pelton turbine
3. Submersible pump
4. Reciprocating pump
5. Jet pump
6. 'V' Notch
7. Centrifugal pump
8. Venturimeter
9. Friction factor
10. Gear pump.

PR 212 WORKSHOP PRACTICE – II

Course outcomes

- Hands on Experience on lathe machine, Milling machine, drilling machine
- Hands on experience on casting methods.
- Hands on experience on welding

1. Shaping rectangular block or cube

2. Slot cutting / Step-cutting / V-block

3. Milling rectangular block or cube

4. T - Slot milling

5. Spur gear cutting

6. Surface grinding

7. Single point tool grinding

8. Spur and Helical gear generation on hobbling machine

9.Complex shaped component production using EDM.

10.Drilling

MA 303 APPLIED STATISTICS

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

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

Random process – Markov Dependence, Markov Chains, definition, examples – ergodicity-Finite Markov Chain- Various States – Limiting Probability – Application of Markov Chain to Simple Problems.

Time Series Analysis- Introduction- Probability models for Time Series- moving average-method of least squares- auto regressive models-Application to simple problems.

TEXT BOOK

1. Gupta, S.C. and Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan Chand and Sons, Eleventh Revised Edition,June 2002.

REFERENCES:

1. Gupta, S.C. ,Fundamentals of Statistics , Himalaya Publishing House , Sixth Revised Edition , April,2004.

2. Medhi,J. , Stochastic Processes , New Age International(P) Ltd., Publishers,2nd Edition,2004

PR 301 DYNAMICS OF MACHINES

Course outcomes

- Understand all mechanisms of machines.
- To design various mechanisms of machines
- To evaluate various mechanisms of machines

Static And Dynamic Force Analysis -- Kinetostatic force analysis in mechanisms - Effect of friction at prismatic and revolute joints -- Dynamic force analysis in reciprocating engines - Calculation of crankshaft Torque

Flywheels - Function - mass of flywheel-- Governor - Function - calculations and determination of initial spring force in spring controlled governors - Effects of friction in governor mechanism

Balancing - Balancing of rotating and reciprocating masses in one plane and in several planes
Vibration - Longitudinal, Transverse and Torsional vibration

Two degree of freedom systems : generalized and principal co-ordinates - Lagrange's equations - vibration absorbers.

Multidegree of freedom systems : Calculation of natural frequencies by Rayleigh, Stodola, Matrix iteration and Holzer methods.

TEXT BOOKS

1.Shigley, J.E. and Uicker, J.J., "Theory of Machines and Mechanisms", 3rd Edition, Oxford University Press, 2008.
2.Thomas Bevan, "Theory of Machines", 3rd edition, CBS Publishers. 2008.
3. Rattan S.S., "Theory of Machines" 2nd Edition, Tata McGraw Hill Pub Co, 2008.

REFERENCES

1.Rao, J.S., and Dukkipati, R.V., "Mechanism and Machine Theory",Second Edition, Wiley Eastern Ltd., 1992.
2. Ghosh A and Mallik A.K., "Theory of Mechanisms and Machines", Third Edition, Affiliated EWP Pvt. Ltd 2003.

PR 303 METROLOGY AND QUALITY ASSURANCE

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

Introduction to Measurement – objectives – classification of methods of measurements - Precision and Accuracy - Standards and their evolution -Types of errors in measurements – Limit gauging

Comparators – types – applications – Linear, angular and form measurements – Surface roughness – methods of surface finish – Direct instrument measurements.

Screw Thread Measurement- Standard thread profiles, Effective diameter, Terminology of gear tooth – Gear measurement – Parkinson gear tester- Alignment testing of machine tools – Coordinate measuring machines – Machine vision – Nano measurements.

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

TEXTBOOKS:

1. Jain R. K., "Engineering Metrology", Khanna Publications, 2010
2. Douglas C. Montgomery, "Introduction to Statistical Quality Control", Wiley Publications, 2004.

REFERENCES:

1. Gupta. I.C., "Engineering Metrology", Dhanpat Rai and Sons, 1997.
2. Beckwith G. Thomas , Roy D. Marangoni, John H. Lienhard V, "Mechanical Measurements 6th Edition" Pearson publications, 2006.

PR 305 DESIGN OF MACHINE ELEMENTS

Course outcomes

- Understand the various theories of failures
- Design various machine components
- Design new components based on the 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.

TEXT BOOKS

1.Bhandari, V.B., "Design of Machine Elements", Tata McGraw-Hill, 2007.
2.Prabhu, T.J. "Design of Transmission Elements", Mani Offset, Chennai, 2005.

REFERENCES

1.Shigley, J.E. and Mischke, C.R. "Mechanical Engineering Design" Tata McGraw Hill, 2006.
2. Sharma, C.S. and Purohit, K. "Design of Machine Elements", Eurasia Publishing House (P) Ltd, New Delhi, 2005.

PR 307 NON-TRADITIONAL MANUFACTURING PROCESSES

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

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

Laser materials processing - Laser types - Processes - Laser beam machining (LBM) – Laser cutting (LC) – Laser drilling (LD) - Laser marking and engraving (LM) - Laser micromachining (LMM) - Laser engineered net shaping (LENS) - 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.

TEXT BOOKS

1. *Abdel, H. and El-Hofy, G. "Advanced Machining Processes", McGraw-Hill, USA, 2005.*
2. *Wellar, E.J. "Non-Traditional Machining Processes", Society of Manufacturing Engineers Publications, 2nd Edition, Michigan, 1984.*

REFERENCES

1. *Steen, W.M. and Watkins, K. "Laser Materials Processing", Springer London Ltd, 2003.*
2. Groover, M.P. "Fundamentals of modern manufacturing processes - Materials, Processes and Systems", 3rd Edition, John Wiley and Sons Inc., 2007.

ME 325 THERMAL ENGINEERING

Course outcomes

- Apply thermodynamic laws in engineering applications
- To calculate power requirements of gas turbines and flow rates through nozzles
- To calculate thermal efficiencies of steam turbines

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

Properties of steam: P – V, T - S and H - S diagrams- Rankine cycle, modifications to improve thermal efficiency - psychrometrics - various a/c processes - systems - refrigeration - Bell coleman and vapor compression cycles - vapor absorption cycle.

TEXT BOOKS

1. Nag,P.K. "Engineering Thermodynamics", 3rd Edition, Tata McGraw Hill, 2005.
2.Kothandaraman, C.P. and Domkundwar, S. "A Course in Thermodynamics and Heat Engines", Part - I, SI units, 3rd Edition, Dhanpat Rai and Sons, 1993.

REFERENCES

1. Ganesan, V., "Internal Combustion Engine", Tata McGraw Hill, New Delhi, 2004.

PR311 MACHINE DRAWING PRACTICE

Course outcomes

- To prepare the precise machine drawings for manufacturing of components.
- Facilitate better product design.
- Interpret and give suggestion about the 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.

TEXTBOOK

1.Gopalakrishna, K. R., "Machine Drawing", Subhas stores, Bangalore, 16th Edition,2002.

REFERENCES:

1. Varghese, P. L. and John, K.C., "Machine Drawing", Jovast Publishers, 1993.
2. BIS, "SP: 46 - 1988 - Engineering Drawing Practice for Schools and Colleges", 1992.
3.Faculty of Mechanical Engineering, PSG College of Technology, "Design Data Book", M/s.DPV Printers, Coimbatore, 1993.

ME 331 THERMAL ENGINEERING AND METROLOGY LABORATORY

Course outcomes

- To conduct experiments on various thermal systems.
- Support in development of energy field.

Thermal Lab.

1. Determination of Heating value of solid and liquid fuels.
2. Determination of heating value of gaseous fuels
3. Proximate analysis of solid and liquid fuels
4. Determinations of flash and fire point-lubricating oil.
5. Determination of effect of temperature on viscosity of lubricants.
6. Exhaust gas analysis and determination of AMF ratio
7. Valve timing and port timing diagram
8. Performance test for constant speed engine
9. Economical speed for a variable speed engine.
10. Heat balance test by airflow rate measurement
11. Heat balance test using exhaust gas calorimeter
12. Retardation test on single cylinder diesel engine
13. Morse test on multi-cylinder petrol engine
14. Performance test on gas turbine
15. Performance curve for air compressors.
16. Determination of COP using Refrigeration Test Rig.
17. A study on AMC test rig.
18. Heat transfer through pin fin.

Metrology Lab.

Course outcomes

- Take precise measurements using various instruments.
- Develop data for engineering analysis.

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

PR 302 RESOURCE MANAGEMENT TECHNIQUES

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.

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.

Introduction-Mathematical model for Transportation problem –balanced and unbalanced transportation problem. Methods to solve transportation problem-finding basic feasible solution-testing solution for optimality - Assignment problem-unbalanced assignment problem-maximisation problem-problem with assignment restrictions.

Introduction-characteristics of queueing problem-terminologies of queueing problem-applications of queuing model -single server model. Simulation-need for simulation-advantages and disadvantages. Random number generation-methods. Applications of simulation-maintenance, queueing and inventory.

Decision under uncertainty-Laplace criterion, Maximin criterion, Minimax criterion, Savage minimax regrert criterion, Hurwicz criterion. Decision making under risk-expected value criterion-decision tree, 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

TEXTBOOK

1.Gupta, P.K. and Hira, D.S "Operations Research", 3rd Edition, S.Chand and Company Ltd., New Delhi, 2008.

REFERENCES

1. Taha H.A "Operations research", 8th Edition, Prentice – Hall of India, New Delhi, 2006.
2. Panneerselvam, R "Operations Research", 2nd Edition, Prentice – Hall of India, New Delhi, 2006.

PR 304 COMPUTER GRAPHICS AND CAD

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.

Fundamentals of computer - configurations - workstations - data communications - input/output devices, display technology, CAD software. Interactive graphics - point *plotting* techniques.

Transformations techniques, Viewing operations : window, viewport and clipping, Visual realism : Hidden line/surface removal, shading and colour models. Computer drafting through high level languages.

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.

TEXTBOOKS

1. Newman, W.M. and Sproull, R.F., "Principles of interactive computer graphics", II Ed., McGraw Hill Pub., 1989.
2. Segerlind, L. J., "Applied Finite Element Analysis", John Wiley, 1984.

REFERENCES

1. Anand, V.B., "Computer Graphics and Geometric Modeling for Engineers" John Wiley and Sons, Inc., 2000.
2. Zeid,I and Sivasubramanian, R., "CAD/CAM", Tata McGraw-Hill, 2007.

PR 306 DESIGN FOR MANUFACTURE AND ASSEMBLY

Course outcomes

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

Engineering design – Kinds of design – Design process steps – Factors influencing design – Concurrent Engineering – Material selection process – Evaluation methods for material selection

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

Design for castings – Design for weldments – Design for forgings – Design for sheet metal formed parts – Design for powder metallurgy parts – Design for plastic parts

Design for machining – Design for economy – Design for clampability – Design for ease of assembly – Design for disassembly

Advances in DFMA- Design for robustness – Axiomatic design – Design for environment – DFA index – Poka Yoke – Lean principles – Six sigma concepts – Computer aided DFA using software.

TEXTBOOKS

1. Matousek , R. "Engineering Design" Blackie and Son Limited, Glasgow, 1967.
2. Dieter, G.E. "Engineering Design: A Materials and processing Approach", McGraw Hill Co. Ltd, 2000.
3. Boothroyd, G. "Assembly, Automation and product design' CRC press, 2005.

REFERENCES

1. Eggert, R.J. "Engineering Design" Pearson Education, Inc. New Jersey, 2005.
2. Peck, H. "Designing for Manufacture", Pitman Publications, London, 1983.
3. Kalandar Saheb, S.D and Prabhakar, O. "Engineering Design for Manufacture", ISPE 1999.
4. Boothroyd "DFMA"

PR 308 RELIABILITY, MAINTENANCE AND SAFETY ENGINEERING

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

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.

Maintenance and Maintenance Engineering Objectives, facts, Maintainability Terms and Definitions, Importance, Preventive Maintenance, Corrective Maintenance, Total Productive Maintenance, Reliability Centered Maintenance, Inventory Control in Maintenance.

Maintenance Planning & Condition Based Maintenance - on - load and Off-Level Monitoring-Maintenance of Mechanical and Electrical equipments.

Safety - Importance - Fundamental Concepts and Terms- Workers' Compensation - Product Liability - Hazards and their Control - Walking and Working Surfaces, Electrical Safety -Tools and Machines - Materials Handling.

Fire Protection and Prevention -Explosions and Explosives - Radiation -Biohazards - Personal Protective Equipment - Managing Safety and Health.

TEXTBOOKS:

1. *Reliability Maintainability and Risk; Practical methods for engineers - David J Smith, Butterworth-Heinemann, New Delhi, 2001*
2. *Maintainability, Maintenance and Reliability for Engineers, B.S. Dhillon, CRC Press, 2006*
3. *Safety and Health for Engineers - Roger L. Brauer, John Wiley Sons, 2006*

REFERENCES:

1. *Handbook of Reliability engineering - Hoang Pha, Springer Publication, 2003.*
2. *Engineering maintenance; a modern approach - B.S. Dhillon, CRC Press, 2002*
3. *Maintenance Fundamentals, R. Keith Mobley, II edition, Butterworth-Heinemann, 2004*

PR 310 CNC MACHINES

Course outcomes

- Understand the theory of metal cutting.
- 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.

Concepts and features of NC systems – Classification of NC systems - Design considerations of NC machine tools - Constructional features of CNC machine tools – Functions of MCU.

Machining center - Turning center – CNC EDM, Ball screws, Bearings, Centralized lubrication systems.

Manual part programming – Preparatory, Miscellaneous functions – Sinumeric, Fanuc controls – Computed aided part programming - Post processors - APT programming-CNC programming based on CAD

Feedback devices - tooling for CNC machine – Interpolators.

Point-to-point and contouring systems – Adaptive control – ACO and ACC systems.
Maintenance of CNC Machines- Economics of manufacturing using CNC machines

TEXT BOOK

1.Koren, Y. "Computer Control of Manufacturing Systems", McGraw Hill Book co. New Delhi, 1986.

REFERENCES

1.Radhakrishnan P., "Computer Numerical Control Machines", New Central Book Agency, Calcutta, 1992
2.Kundra T. K., Rao P. N., and Tiwari N. K., "CNC and Computer Aided Manufacturing", Tata McGraw Hill, New Delhi, 1991.
3.Fitzpatric,M. " Machining And CNC Technology" , McGraw-Hill College, 2004

PR 312 COMPUTER AIDED DRAFTING AND COST ESTIMATION

Course outcomes

- Summarize Standards & Conventions
- Perform calculations on tolerances, manufacturing drawings, tolerance charting and Cost estimation through Process chart, estimation of time, cost.
- Possess the knowledge of computer technology in all of the operational and information processing activities related to manufacturing.

Standards and Conventions : Current international standards (ISO) and Indian Standards (IS)- types of lines - principles of presentation - dimensioning - conventional representation of threaded parts, springs, and gears.

Dimensional and Form Tolerances : Limits and fits IT system of tolerances, deviation of fit - geometric tolerance-tolerancing of form, orientation, location and runout - datums and Datum systems-Dimensioning and tolerancing of profiles

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

Cost Estimation : Preparation of Process chart for a given component-estimation of setting time and machining time-estimation of material cost, labour cost and overhead cost based on supplied data.

TEXTBOOK

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

REFERENCES

1.Siddeshwar and Kanniah ,"Machine Drawing", Tata McGraw Hill 2001
2.Gopalakrishna, K.R., "Machine Drawing" 16th Edition, Subhas Stores, 2002.
3. Wade, O. "Tolerance Control in design and manufacturing", Industrial Press, 1972

PR 314 CNC LABORATORY

Course outcomes

- Explain the fundamentals, constructional features and working of CNC machines.
- Learn basics of CNC programming for complicate machining profiles and understand application of ACS in CNC machining.
- Perform hands-on CNC programming operations.

(Practical Exercise will be selected from the following)

Programming and operation of CNC Lathe, Turning center, Milling machine and Machining center.

1. EMCO PC TURN 55 (SinumeriK)

1.1. Study of EMCO CNC machine - programming codes - programs for simple components using linear interpolation, circular interpolation

1.2. Programs for components using canned cycle and for threaded operation

1.3. Absolute programming - mixed programming

2. HMT STC-15 TURNING CENTRE (SinumeriK)

2.1. Study of STC-15 CNC machine - programming codes -study of tool and zero offsets

2.2. Programs for simple components using linear interpolation and circular interpolation - tool

2.3. Programming for threaded components using subroutines- machining

3. T5 TURNING CENTRE (Fanuc – OT)

3.1. Study of T5 CNC machine - programming codes -study of tool and zero offsets

3.2. Programs for simple components using linear interpolation and circular interpolation - tool

3.3. Programming for threaded components using subroutines- machining

4. TRIAC 3AXES CNC MILLING MACHINE

4.1 Study of Triac CNC machine- programming codes - programs for simple profiles using linear interpolation, circular interpolation- tool path generation - machining

4.2 Programs for profiles using canned cycles - tool path generation – machining advanced programming

5. EMCO PC MILL 55 (SinumeriK)

5.1 Study of Triac CNC machine- programming codes - programs for simple profiles using linear interpolation, circular interpolation- tool path generation - machining

5.2 Programs for profiles using canned cycles - tool path generation - machining

5.3 Incremental programming and advanced programming

6. VMC 3 AXES CNC MACHINING CENTRE (Fanuc – OM)

Study of VMC CNC machine - programming codes - programs for simple profiles using linear interpolation, circular interpolation - Simulation - Machining Incremental programming

7. DEMONSTRATION ON MULTI-PROCESS MICROMACHINE

PR 316 ADVANCED PRODUCTION PROCESSES LABORARTORY

Course outcomes

- The measurement exercises on 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

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

PR 401 MANUFACTURING SYSTEM SIMULATION

Course outcomes

- Understand the basics of Discrete event system simulation
- Take decisions in the selection of manufacturing
- Acquire knowledge about the design/evaluation of different manufacturing systems using simulation modeling.

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 squareRuns 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-Out put 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.

TEXTBOOK

1. Banks, Carson, Nelson and Nicol : Discrete-Event System Simulation, Fourth Edition Prentice Hall of India ,2005

REFERENCES

1.A. M. Law and W. D. Kelton: Simulation, Modeling and Analysis, Third Edition, McGraw-Hill,2000.
2.Geoffrey Gordon: System simulation, second edition Prentice Hall of India

PR 403 FLUID POWER CONTROL AND MECHATRONICS

Course outcomes

- Know hydraulic devices and their applications.
- Produce and analyze the integrated product design
- Give electro-hydraulic, electro-pneumatic solutions

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

Hydraulic system, hydraulic components - pressure-flow-direction controls valves –proportional , servo, cartridge(logic) valves- accumulator, accessories. Hydraulic components symbols- Design and application of hydraulic circuits of machine tool, press, Mobile hydraulic.

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,

TEXTBOOKS

1.Michael J. Pinches and John G. Ashby" Power Hydraulics", Prentice Hall, 1989
2. Dudleyt A. Pease and John, J. Pippenger, " Basic Fluid Power", Prentice Hall, 1983
3.Achei-rican, "Machine Tool Design" Vol.2 and 4,MIR Pub., 1983

REFERENCES

1. Doeblin, E.O. Measurement Systems, McGraw Hill, 1995.
2. Mechatronics 3/e - W. Bolton (Addison Wesley) ISBN 981-235-874-9
3. Assembly Automation and Product Design Geoffrey Boothroyd (Hardcover - 1992)
4. Rexroth- hydraulic training manual.

PR 405 DESIGN OF PRODUCTION TOOLING

Course outcomes

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

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

Press tools: power presses – die cutting operations – centre of pressure – scrap strip lay out for blanking – press tonnage calculations – Progressive & Compound dies – die design for simple components. Drawing dies – blank development – estimation of drawing force – blank holders & blank holding pressure – design & sketching of drawing dies for simple components – Bending dies & Combination tools.

TEXT BOOKS

1. Cyril Donaldson, Lecain and Goold: Tool Design – Tata Mc Graw Hill publications
2. A Bhattacharyya: Metal Cutting – Theory and Practice – Central Book Agency Kolkata

REFERENCES

1. ASTME: Fundamentals of Tool Design – Prentice Hall
2. F W Wilson: Hand Book of Fixture Design - Mc Graw Hill publications

PR 407 AUTOMATION AND CIM

Course outcomes

- Understand the basic principles of automation
- Identify the applications of robotics
- Understand application of computers for manufacturing operations.

Automation – Principles and strategies - Elements of an automated system – Levels of automation –- Automation in production systems – Automated manufacturing systems – Types – Reasons for automation

Industrial robotics – Joints and links – Configurations – Robot control systems – End effectors – Grippers, Tools – Accuracy and repeatability - Applications of industrial robots – Robot programming – Lead through – Programming languages – Simulation and offline programming.

Material handling systems – Types – Design considerations – AGVs – Types and applications – Vehicle guidance technology - Storage systems – Performance –Methods – Automated storage systems.

Manufacturing systems – Group technology – Part families – Parts classification and coding – Production flow analysis – Cellular manufacturing – Composite part concept – Machine cell design – FMS – Types – Components – Applications and benefits.

Automatic data capture - Barcode technology – Radio frequency identification – Fundaments of automated assembly systems – Inspection technologies – Coordinate Measuring Machine

TEXT BOOK

1.Mikell P.Groover, "Automation, Production Systems and Computer Integrated Manufacturing" Pearson Education Asia, 2001

REFERENCES

1.Donatas Ti junclis, Keith E.Mekie, "Manufacturing High Technology Handbook", Marcel Decker.

2.Ranky Paul, "Computer Integrated Manufacturing", Prentice Hall, 2004.

PR 411 FLUID POWER CONTROL AND MECHATRONICS.

Course outcomes

- Design and simulate PLC circuits for engineering applications
- Familiarize MAT Lab /SCI Lab
- Understand the engineering applications of Hydraulic and Electro hydraulic circuits

(Practical Exercise will be selected from the following)

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

PR413 MANUFACTURING SYSTEM SIMULATION LAB.

Course outcomes

- Model and simulate using ARENA,SIMQUICK,WITNESS, Flexsim
- Familiarize QUEST, UGRIP, Systat
- Simulate job shop system and queuing system

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

PR 415 COLLOQUIUM

Course outcomes

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

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.

HM 402 INDUSTRIAL ECONOMICS

Course outcomes

- Interpret and analysis Demand, Supply and Consumption Laws
- Manage business organizations and marketing strategies.
- Perform human resource management tasks

Micro Economics -Demand and supply analysis - elasticity of demand - problem demand forecasting - Consumption Laws - of Diminishing Marginal Utility Consumer Surplus - Macro And Monetary Economics

Keynesian Employment Theory - National Income computation - General Management

Contributions of Fayol and Taylor - Managerial functions - Types of Business organizations - Types of Business organizations

Marketing Management-Introduction: Definition, in importance, Evolution - Buyer Behavior - Market segmentations

Personnel Management- Personnel management: - Definition, Scope, Task - Recruitment and selection - Training and Development - Job Evaluation Merit rating - wage and salary administration - time rate, Piece rate, Halsey and Rowans plane - trade union - Collective bargaining - workers Participation in Management - Industrial Fatigue and Accident- Performance appraisal system.

TEXT BOOKS

1. Dewett. K.K. - "Modem Economic Theory", S. Chand and Co. Ltd., 1999 Edition.
2. Burton Genie, Thakur Manab, "Management Today" Tata Mc Graw Hill Pub Co.- 1996 Edition.
3. V.S. and Namakmaris "Marketing Management Planning Implementation and Control" Macmillan,1996 Edition.
4.Nair N.G., Latha Nair., "Personnel Management and Industrial Relations", S. Chand and Co. Ltd., 1999 Edition.

REFERENCES

1.Craig Petersen H. Cris Lewis W. "Managerial Economics", Prentice Hall of India, 1996 Edition.
2 .Koutsionnis , "Modem Economic Theory", PHI, 1996 Edition.
3.Maheswari S.N., "An Introduction to Accountancy" Vikas publishing House Pvt. Ltd., 1999 Edition.

PR 402 MANUFACTURING PLANNING AND CONTROL

Course outcomes

- Perform production management tasks.
- Perform forecasting and inventory problems.
- Perform process planning tasks

Production systems overview, Production Management objectives, Manufacturing strategy, Technological Innovations on Manufacturing, Corporate strategic choices, Management of Technology- Product design and development- break even analysis

The forecasting process, Time series forecasting models – moving averages, exponential smoothing- multi-item forecasting- regression models, qualitative methods, forecasting system controls

Classification of Inventory - Inventory costs - deterministic and probabilistic models – Inventory control systems.

Production batch and allocation problems - Objectives and Activities of Production Activity Control, Flow-shop, intermittent flow shop, Job shop, Shop floor control – High volume Production Activity Control, Job-shop Production Activity Control

Just-in-time systems-Push and Pull systems-Kanban Production system, Theory of constraints and synchronous manufacturing, Process Planning-Steps-CAPP

TEXT BOOKS

1. *Buffa, E.S., "Modern Production/Operations Management", 8th edition, John Wiley sons, 2003.*
2. Elsayed A Elsayed, Thomas O. Boucher, "Analysis and control of Production System", Prentice Hall, 2002.

REFERENCES

1. Samuel Eilon, "Elements of Production Planning and control", Universal Book Corp., 1999.
2. Krajervaki and Ritzman, "Operations management", Prentice Hall, 2009
3. Norman Gaither, Greg Frazier, Operations Management, Thomson Learning, 9th Edition, 2002.
4. Monks J.G. Operations Management, McGraw Hill, 2004

PR 404 WORK DESIGN AND FACILITIES PLANNING

Course outcomes

- Perform ergonomic analysis
- Perform computerized layout planning
- Perform work measurements

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

TEXTBOOKS

1.Barnes, "Motion and time study", John Wiley, New York, 1990.
2.Apple, J.M. "Plant Layout and Materials Handling", Ronald Press Company,NewYork,1977

REFERENCE

1.ILO, "Introduction to workstudy", ILO,Geneva,1974

PR 352 MATERIAL HANDLING AND STORAGE

Course outcomes

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

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 - Conveyers-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

TEXTBOOK

1.Groover, M.P. "Automation ,Production systems and computer integrated manufacturing" Part V , P HAll Inc.New Delhi, 2007

REFERENCES

1. Apple, J.M. "Materials handling systems design", The Ronald Press Co.N.Y. 2001
2. White,J.A. "Production handling". 4th. edition, Parts 4,5- 4,7,5.2 and 5.4 John Wiley and Sons, Newyork,1987

PR 354 MEMS AND NANOTECHNOLOGY

Course outcomes

- Understand the evolution of micro machining
- Know about nano materials and various nano measurements techniques
- Identify the recent trends in manufacturing micro components and measuring systems to nano scale.

Precision Engineering – Concepts and significance – Micro fabrication – Types - Top down – Bottom up approaches – LIGA process – Lithography steps – X ray Lithography – Masks – Mask materials

Micromachining – Theory of micromachining – Types – Concepts – Tools used in micromachining – Micro EDM – Micro wire cut EDM – Abrasive Jet Micromachining - Ion beam milling

Laser based micromachining – Types of Lasers – Diode, Excimer and Ti: Sapphire lasers – Nanosecond pulse micro fabrications – Shielding gas

Nano-engineering – its concepts – significance and applications – Nano surface generation – Diamond turning – ELID grinding – Electron beam nano fabrication

Nano Metrology – Surface texture measurement – Surface integrity measurement – Talysurf profilometer – Scanning Electron Microscope – Atomic Force Microscope - Commercialization issues of micro-nano technology

TEXT BOOK

1. *M. J. Madou, "Fundamentals of Micro Fabrication", CRC Press, 2nd edition, 2002*

REFERENCES

1. *Mark J, Jackson, "Micro fabrication and Nanomachining", Taylor and Franci Group, 2006.*
2. *Serope Kalpakjain, "Manufacturing Engineering and Technology", Pearson Education, 4th edition, 2005*

PR 356 DESIGN AND ANALYSIS OF EXPERIMENTS

Course outcomes

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

Introduction- Planning of experiments – Steps – Need - Terminology: Factors, levels, variables, experimental error, replication, Randomization, Blocking, Confounding.

Single Factor Experiments- ANOVA rationale - Sum of squares – Completely randomized design, Randomized block design, effect of coding, Comparison of treatment means – Newman Kuel's test, Duncan's Multiple Range test, Latin Square Design, Graeco-Latin Square Design, Balanced incomplete design.

Factorial Experiments-Main and interaction effects –Two and three Factor full factorial Designs, 2^k deigns 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.

TEXT BOOK

1. Montgomery, D.C. "Design and Analysis of Experiments", John Wiley and Sons, 5^{th} Edition,2002.

REFERENCES

1. Hicks,C.R. "Fundamental concepts in the Design of Experiments", Holt, Rinehort and Winston, 2000.

2. Bagchi, T.P. "Taguchi Methods explained", PHI, 2002.

3. Ross, P.J. "Taguchi Techniques for quality Engineering", Prentice Hall, 2000.

PR 358 SUSTAINABLE MANUFACTURING

Course outcomes

- Summarize the tools and techniques in sustainable manufacturing
- Recognizing various EIA methods
- Design Eco friendly products

Sustainable Manufacturing - Concept of Triple bottom line, Environmental, Economic and Social Dimensions of Sustainability, Sustainable Product Development – Various Phases.

Tools and Techniques – Environmental Conscious Quality Function Deployment, Life cycle assessment, Design for Environment, R3 and R6 cycles, Design for Disassembly.

EIA Methods –CML, EI 95 and 99, ISO 14001 EMS and PAS 2050 standards, Environmental Impact parameters.

Design for recycling – Eco friendly product design methods – Methods to infuse sustainability in early product design phases.

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

Textbooks

a. G. Atkinson, S. Dietz, E. Neumayer, "Handbook of Sustainable Manufacturing". Edward Elgar Publishing Limited, 2007.
b. D. Rodick, Industrial Development for the 21st Century: Sustainable Development Perspectives, UN New York, 2007.

References

c. P. Lawn, Sustainable Development Indicators in Ecological Economics, Edward Elgar Publishing Limited.
d. S. Asefa, The Economics of Sustainable Development, W.E. Upjohn Institute for Employment Research, 2005.

PR 451 FINITE ELEMENT METHODS

Course outcomes

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

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.

TEXTBOOK

1. *Larry J Segerlind ," Applied Finite Element Analysis", John Wiley, 1984*

REFERENCES

1. *K.J.Bathe, "Finite Element Procedures", Prentice Hall, 1994.*
2. *Huebner and E.A.Thornton, "The Finite Element Method for Engineers", John Wiley,2008*

PR 453 RAPID PROTOTYPING, TOOLING AND MANUFACTURE

Course outcomes

- Understand the principle, parameters and applications of R P processes
- Recognize various types of rapid tooling
- Identify different allied processes

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

Principle, process parameters, process details and applications of various RP processes - Stereo lithography systems, Selective Laser Sintering, Fused Deposition Modeling, Laminated Object Manufacturing, Solid Ground Curing, Laser Engineered Net Shaping, 3D Printing.

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.

Rapid Manufacturing Process Optimization- Factors influencing accuracy, data preparation errors, part building errors, errors in finishing, influence of part build orientation.

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

TEXTBOOK:

1. Pham D T and Dimov S S, "Rapid Manufacturing", Verlag, 2001.
2. Paul F Jacobs, "Stereo lithography and other RP&M Technologies", SME, 1996.

REFERENCES:

1. Terry Wohlers, "Wohlers Report 2001", Wohlers Associates, 2008.

PR 455 MACHINE TOOL TECHNOLOGY

Course outcomes

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

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-

Vibration of machine - sources of vibration

Semi automation - automatic machines with mechanic controls.

TEXTBOOK

1. Sen, G.C. and Bhattacharya, A., "Principles of machine tools", New Central Book Agency, Calcutta, 2006.

REFERENCES

1. Chernov N Machine Tools, Mir publishers Moscow, 1984.
2. Mehta, N.K., "Machine tool design", Tata McGraw Hill Co., N.Delhi , 2008.

PR 457 AGILE MANUFACTURING

Course outcomes

- Know about modern trend of manufacturing
- Customization of product for the manufacturing
- Implementation of new technology

Types of Production- The Agile Production Paradigm- History of Agile Manufacturing- Agile Manufacturing Vs Mass Manufacturing, Agile Manufacturing Vs Mass Customization- Agile Manufacturing Research Centers.

Agile Practices- Agile practice for product development - Manufacturing agile practices - understanding the value of investing in people, Concept models of Agile Manufacturing- Infusing managerial principles for enabling agility.

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.

Performance Measurement and Costing: Measurement of agility – methods – Scoring and Fuzzy approaches – Costing for Agile Manufacturing practices – Activity Based Costing.

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.

TEXTBOOK

1. *Gunasekaran A, "Agile Manufacturing, 21st Strategy Competitiveness Strategy", Elsevier Publications, 2001.*
2. *Montgomery J C and Levine L O, "The Transition to Agile Manufacturing – Staying Flexible for Competitive Advantage", ASQC Quality Press, Wisconsin, 1995.*

REFRENCES

3. *Goldman S L, Nagal R N and Preiss K, "Agile Competitors and Virtual Organizations", Van Nostrand Reinhold, 1995.*
4. *Brian H Maskell, "Software and the Agile Manufacturer, Computer Systems and World Class Manufacturing, Productivity Press, 1993*

PR 459 OPERATIONS MANAGEMENT

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, production scheduling, line balancing.
- know the recent trends like manufacturing requirement Planning (MRP II) and Master production schedule(MPS)

Overview of Production System, Objectives of Operation Management, Scope of Operations Management, Operations Management Frame work, Relationship of operations with other Functional areas, Manufacturing Vs Service sector, Operations Decision making, Production Design Process and Process choices

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

TEXTBOOKS

1.Analysis and control of Production System by Elsayed A Elsayed, Thomas O. Boucher, Prentice Hall publications, 1993
2.Buffa, E.S., "Modern Production/Operations Management", 7th edition, John Wiley sons,2007.

REFERENCES

1.Krajervaki and Ritzman, "Operations management", Addison Wesley Pub. Co, 2007
2.Norman Gaither, Greg Frazier, Operations Management, Thomson Learning, 9th Edition,2002.
3.Monks J.G. Operations Management, McGraw Hill, 2004

PR 461 SUPPLY CHAIN MANAGEMENT

Course outcomes

- Define structure of supply chain
- Design supply chain configuration
- Analyze the role of Transportation in SCM

Evolution of supply chain-essentials of SCM-structure of supply chain, examples-process views-decision phases, issues - aligning supply chain with business strategy –supply chain decision variables, performance measures- new challenges - reverse logistics.

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.

Role of IT in supply chain -IT infrastructure-CRM-SRM-e-business-RFID-supply chain collaboration-Decision Support System (DSS) for supply chain- selection of DSS for supply chain.

TEXTBOOKS

1.Supply Chain Management: Strategy, Planning and Operations-Sunil Chopra, Peter Meindl, Prentice Hall India , 3rd ed., 2007.

REFERENCES

1.Designing and Managing the Supply Chain: Concepts, Strategies, and Cases-David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, Tata McGraw Hill, 3rd ed, 2007.

2.Modeling the supply chain, J. Shapiro, Thomson, 2nd ed., 2002

ME 471 AUTOMOBILE ENGINEERING

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
- Know the basic concepts of mechanisms and machinery

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.

TEXTBOOK

1.Narang, G.B.S., "Automobile Engineering", Khanna Publishers, 1991.

REFERENCES

1.Joseph Heitner., "Automotive Mechanics", 2nd Edition, East West press. 2004.
2.Kirpal Singh, "Automobile Engineering", Vol I and Vol II, Standard Publishers,Delhi, 1998.

PR 450 INDUSTRIAL ROBOTICS

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

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.

Robot Applications: Robot applications in manufacturing - material transfer and machine loading / unloading - Processing operations like welding and painting - Assembly operations - Inspection Automation. Robot cell layouts - multiple robots and machine interference.

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

TEXTBOOKS

1. Keramas,J.G. " Robot Technology Fundamentals", Delmer Publisher, 2002
2. Jain, K.C, and Aggarwal, L.N., "Robotics Principles and Practice", Khanna Publishers, 2001

REFERENCES

1. Groover, M.P., "Industrial Robotics", McGraw Hill International Editions, 1986.
2. Deb, S.R., "Robotics Technology and Flexible automation", Tata McGraw Hill Pub., New Delhi, 1994.

PR 452 MANUFACTURING OF COMPOSITE MATERIALS

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.

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

TEXTBOOKS

1. *.Mein Schwartz., "Composite Materials Handbook", McGraw Hill, 1992*
2. *2.Autar K.Kaw, "Mechanics of Composite Materials", CRC Press, 2005.*

REFERENCES

1. *"ASM Hand book on Composites", Volume 21, 2001*
2. *Vanviack L.H, "Physical Ceramics for Engineers", Addison Wesley Publication, 1964.*

PR 454 PROJECT MANAGEMENT

Course outcomes

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

Analysis of fiber reinforced Laminate design for different combinations of plies with different

Introduction - Project Management: An Overview – Types, Characteristics of Projects – Project life cycle. Identification of investmen t opportunities - Screening and Selection, Project Appraisal

Market and demand analysis- market survey-demand forecasting methods-Technical analysis – manufacturing process, materials-product mix, plant location-project charts and layouts.

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

TEXTBOOK

1.Prasanna Chandra, "Projects – Planning, Analysis, Financing, Implementation and Review", Tata McGraw Hill,4th Ed, 1997

REFERENCES:

1.Mike Field and Laurie Keller, "Project Management", Thompson Business press, 2002
2.Gido and Clements, "Successful project management", 2nd edition; Thompson south-western, 2003
3.John M Nicholas, "Project Management for business and technology", 2nd edition, Pearson Education Asia, 2001
4.Bhavesh M Patel, "Project Management – Strategic Financial planning, Evaluation and control", Vikas publishing house, 2000
5.S.Choudry "Project Management", ", Tata McGraw Hill,27th edition, 2006

PR 456 VALUE ENGINEERING

Course outcomes

- Define 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

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.

TEXTBOOK

1.Parker, D.E., "Value Engineering Theory", Sundaram publishers, 1990.

REFERENCES

1.Miles, L.D., "Techniques of Value Engineering and Analysis", McGraw Hill Book Co., 2nd End., 1972
2. Khanna, O.P., "Industrial Engineering and Management", Dhanpat Rai and Sons, 1999.

PR 458 ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

Course outcomes

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

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.

TEXTBOOK

1.Simons, G.L., "Introducing Artificial Intelligence", NCC Publications, 1984

REFERENCES

1.Maus, R and Keyes J Handbook of Expert Systems in manufacturing McGraw Hill, 1991
2. Ernest R Tello, "Mastering AI tools and techniques"

HM 412 ENTREPRENEURSHIP DEVELOPMENT

Course outcomes

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

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

Accounting Principles-Accounting principles - conventions and concepts - balance sheet - profit and loss account - accounting rate of return, pay back period, SSI duty practice.

TEXTBOOK

1.Udai Pareek and T.V.Venkateswara Rao, Developing Entrepreneurship - A Hand book Learning systems, N.D., 1978.

REFERENCES

1.EDI-1 Faculty and Experts, A Handbook for new entrepreneur, Entrepreneurship Development Institute of India, 1986.
2.Saravanavel, Entrepreneur Development, Ess Pee Kay Publishing House, Madras, 1987.

PR 462 MANUFACTURE AND APPLICATION OF POLYMER COMPOSITES

Course outcomes

- Design and manufacture of PMCs for automotive aerospace and marine application
- Perform machining, forming, and joining processes on PMC
- Synthesis biopolymers and nano composite polymers for environmental, health care and energy application

Polymer matrix –classification- thermoplastics and thermosetting plastics, types of matrix material, reinforcement material- fiber- particulate- whisker, properties of reinforcements and matrix. Composite material-Types-MMC-PMC-CMC, Advantages and Disadvantages. Manufacturing of PMC material– Lay-up, Autoclave Molding filament Winding, Pultrusion, etc..

Machining of polymeric composite material, Forming methods for Polymers and polymeric composite material- component design consideration.

Joining of PMC-Friction Welding of PMC, Thermal Welding of PMC, Electromagnetic Welding of PMC-Process-Processing Parameters-Materials-Advantages & Disadvantages and Applications. Mechanical fastening of PMC, Chemical bonding of PMC, Joint design, equipment and application methods, Advantages and disadvantages, Applications adhesive bonding

Application of Polymers and PMC material- Automotive Industry- Marine Industry- Materials Handling- Chemical Industry- Electrical & Electronics Industry- Aerospace Industry- Biomedical field.

Recent advancements in polymeric materials- Blends and composites- conducting polymer - nanofibers- Polymeric nanocomposites-Biodegradable Polymeric Nanofibers for Biomedical Applications- nanotube based Conducting Polymer Composite- polymeric nanomaterials in piezoelectric sensors- Biodegradable Polymers to improve new Antifouling coating ,Polymer in health care, Environmental issues concerning polymers and polymer in energy application.

TEXTBOOKS

1. Schwartz, M. "Composite Materials Handbook", 2nd Edition, McGraw Hill, 1992.
2. "ASM Hand book on Composites", Volume 21, 2001

REFERENCES

1. "Handbook of Plastics Joining- A Practical Guide" Plastics Design Library, Morris, NewYork, 1997.
2."Handbook of Polymer Composites for Engineers" by Leonard Hollaway, British Plastics Federation, Woodhead Publishing, 1994.
3.Swift,K.G. and Bookes, J.D. "Process Selection from design to manufacture", Butterworth-Heinemann, 2003.

PR 463 MECHATRONICS

Course outcomes

- Know hydraulic and Pneumatic devices and their applications.
- Describe the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical and Electronic Systems
- Produce and analyze the integrated product design

Introduction- Evolution, scope, components of mechatronic systems, overview of mechanical, hydraulic & pneumatic actuators. Control Systems: Automatic control, open loop and closed loop control, servomechanism, block diagram algebra, concept of transfer function. System Modeling: Mechanical, Electrical, Fluid systems, D.C. motor, hydraulic motor. Types of standard inputs (signals).

Sensors & Transducers -Performance, terminology, characteristics, types, binary and analog. Position Sensors, Displacement sensors and Velocity sensors.

Electromagnetic Actuators and control - Types, Specifications and Control, Characteristics, AC Motors, DC Motors, SCR (Silicon Controlled Rectifiers) motors, factors for selecting motor, piezoelectric actuators, solenoids, torque motors. Programmed Control- Review of logic gates, programmable logic controllers (PLC): basic structure, programming and applications. Signal Conditioning & Interfacing Microcontroller- Comparison between microprocessor and micro controller, organization of a microcontroller system, architecture of controller and Applications. Computer Numerical Control systems (a) Position and velocity control loops (b) Adaptive Control applications for m/c tools like lathe, grinding etc

MEMS- Overview of MEMS & Microsystems, Typical MEMS & Micro system products & applications. (i) Micro sensors and micro actuators: (ii) Micro manufacturing.

Design of Mechatronic systems-The design process, traditional and mechatronic designs, A few case studies like piece counting system, pick and place manipulator, simple assembly task involving a few parts, part loading / unloading system, automatic tool and pallet changers etc.

TEXTBOOKS

1.Ogata, "Modern Control Engineering", 4th Edition, Pearson Education, 2001
2.Pesses, D.W. "Industrial Automation", John Wiley and Sons, 1989.
3.Moriss, S.B. "Automated Manufacturing Systems: Sensors, Actuators", McGraw Hill, 1994.
4."Mechatronics- A Multi-disciplinary approach", 3rd Edition, Pearson-Prentice Hall, 2008.

REFERENCES

1.Alciatore, D.G. and Histand, M.B. "Introduction to Mechatronics and Measurement System", Tata Mc Graw Hill .
2.N.P.Mahalik , "Mechatronics Principles, Concepts and Applications,
3.Necsulescu, D. "Mechatronics", Pearson Education,
4.Ayala, K.J. "The 8051 Microcontroller: Architecture, Programming and Applications", 2nd Edition, Penram International
5.Koren, Y. "Computer Control Of Manufacturing systems", McGraw Hill
6.Tai Ran Hsu, "MEMS and Microsystems Design and Manufacture".

PR 464 PLANT ENGINEERING

Course outcomes

- Describe 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

Organization of the plant engineering function-Classification of maintenance work- Electric power supply systems-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.

TEXTBOOK

1. *Rosaler, R.C. "Standard HandBook of Plant Engineering", 3rd Edition, McGraw Hill, 2002.*

REFERENCE

1.Lindley and Higgins, "Maintenance Engineers Hand Book", 7th Edition, McGraw Hill Professional, 2008.

PR 465 INTEGRATED MATERIALS MANAGEMENT

Course outcomes

- Familiar with the various concepts and functions of material management
- Classification of inventory management
- Summarize Material handling and Logistic

Introduction to Integrated Materials Management – need, scope, functions and objectives of Materials Management. Purchasing function – purchase budget and materials budget – Source selection and development -Negotiations in purchasing - public buying - JIT concept

Inventory Management- Functions – Associated Costs – Classification – ABC – VED – FSN analysis - Basic EOQ model. Inventory control systems – Periodic Review – P system and Continuous review systems – Q systems – Lead-time analysis – Reorder point level Calculations.

MRP – Introduction – Terminology – Types of demand input to the MRP – Working Principle of MRP – Output of MRP – advantages and disadvantages. Stores Management: Stores function – types of stores – storage procedures- stock verification and stock accounting – stores records

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

TEXTBOOKS

1. Gopalakrisnan, P. "Purchasing and Materials Management", Mc Millan Company, 2006
2. Telsang, M."Industrial Engineering and Production Management", S.Chand and Company, 2006

REFERENCES

1. Chary, S.N."Production and Operations Management", Tata McGraw Hill, 2006
2. Chopra, S. "Supply chain management", Prentice Hall,2008

PR 466 LEAN MANUFACTURING SYSTEM

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

Objectives of lean manufacturing-key principles and implications of lean manufacturing-traditional Vs lean manufacturing. Value creation and waste elimination- main kinds of waste-pull production-different models of pull production-continuous flow-continuous improvement/Kaizen- worker involvement -cellular layout- administrative lean.

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.

Team establishment, transformation process, Project Management, Lean implementation, Reconciling lean with other systems- lean six sigma-lean and ERP-lean with ISO 9001:2000.

TEXTBOOK

1. *Askin R G and Goldberg J B, "Design and Analysis of Lean Production Systems", John Wiley and Sons Inc., 2003.*
2. *Hobbs, D.P. "Lean Manufacturing implementation", Narosa Publisher, 2004.*

REFERENCES

1. Micheal Wader, "Lean Tools: A Pocket Guide to Implementing Lean Practices", Productivity and Quality Publishing Pvt Ltd, 2002.

2. Michael L George, David T Rowlands, Bill Kastle, "What is Lean Six Sigma", McGraw Hill, New York, 2004.

3. *Kenichi Sekine, "One-Piece Flow", Productivity Press, Portland, Oregon, 1992.*

4. Alan Robinson "Continuous Improvement in Operations", Productivity Press, Portland, Oregon, 1991.

5. Poke - Yoke, "Improving Product Quality by Preventing Defects", Productivity Press, 1992.

PR 467 PRODUCT DEVELOPMENT STRATEGIES

Course outcomes

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

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.

TEXTBOOK

1. Kevin Otto and Kristin Wood, "Product Design – Techniques in Reverse Engineering and New Product Development", Pearson Education, 2004.
2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", McGraw Hill, 1994.

HM 352 CORPORATE COMMUNICATION

Course outcomes

- Appropriate decision for business improvement through group discussion
- Improve the business electively by having good communication with internal and external customers
- Prepare different reports and circulars of decision making process

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.

Speech mechanics – Mental process of speaking – Extempore speech practice –Body Language – Group discussion practice – Group dynamics – Seminar skills and interview strategies – Presentation skills – Use of Power point-- Techniques to make people listen.

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.

Reader-writer relationship - Varieties of styles and registers- Mechanics of technical writing – Reports of different kinds – Oral and written reports – Executive summary and abstract –Memos and IOMs-- Use of charts, graphs etc.

Circulars and notices – Proposals , Agenda and Minutes – Marketing language – Corporate Branding - 'You' tone - Captions and Eye catchers - Interoffice memos Communication in a crisis.-

TEXT BOOKS:

1 .Basic Business Communicaion – Raymond V. Lesikar and Marie E. Flatley - Tata McGraw-Hill,2005
2. Business Communication Strategies – M. Monippally Tata McGraw-Hill.,2001

REFERENCES*:*

1. A Guide to Scientific Writing – David Lindsay– Macmillan,1995.
2. Business Listening Tasks - Patrick Hanks and Jim Corbett (CUP),1986.
3. New International Business English – Leo Jones and Richard Alexander, Cambridge University Press. (CUP),1996.
4.Social Psychology – James A. Wiggins, Beverly B. Wiggins and James Vander Zanden McGraw Hill,1987.
5. What do you say after you say Hello – Dr. Eric Berne – Corgi books.

MB 470 FINANCIAL MANAGEMENT

Course outcomes

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

Financial management – Nature, Scope, Objectives, Decisions

Management of current asset

Short and intermediate financing

Capital investment and evaluation

Long term financing

TEXTBOOK

1. *Prasanna Chandra, K., "Fundamendals of Financial Management" Tata McGraw Hill Publishing Company,1993.*

REFERENCES

1. Van Horne, J.C., Fundamental of financial management, P.Hall.p.Ltd.,1977

ME 469 REFRIGERATION AND AIR-CONDITIONING

Course outcomes

- Designing of Air - conditioning units for different application
- Design and development of refrigeration devices
- Apply of refrigeration principle for food preservation industry

Refrigeration-Principles, ideal cycle, Bell Coleman and Boot dtrap air cycles, COP, power calculations, refrigerants, Vapour absorption Refrigeration Systems

Refrigeration Devices - Expansion devices- Evaporators - condenser and cooling towers- capacity-system balancing- types of refrigerating compressors- Air – Conditioning

Effective temperature, comfort conditions - Psychrometry, Psychrometer, Psychometric processes

Air - Conditioning cycles-Design-Duct design and selection of fan or blower, Fluidized bed drying system, design of freezers and cold storages—Applications

Modern techniques in food preservation -IQF techniques, LN2 sprays Air-conditioning systems.

TEXTBOOK

1.Manohar Prasad "Refrigeration and Air-conditioning", New Age International, 1996.

REFERENCES

1.Kothandaraman, C.P. "Refrigeration and Air-conditioning", Dhanpat Rai and Sons, 1991.
2.Arora, S.C. and Domkundwar, S. "Refrigeration and Air- Conditioning", Dhanpat Rai and Sons, New Delhi, 1997.

PR 468 MANUFACTURING COSTS AND ANALYSIS

Course outcomes

- Monitor prices of end product through cost estimation
- Electively compete with other competitors in the market
- Electively manage inventory cost of raw materials for end use

Cost Estimation Function- importance of estimation -purpose of estimation- types of costs- types of estimates- Break-even Analysis

Methods and Control For Cost Estimation-cost request from marketing, product engineering, and manufacturing engineering. Estimating methods-controlling estimate deviations

Estimating Procedure- part analysis - preliminary manufacturing plan-total manufacturing and selling price

Estimation Of Fabrication Cost- estimating welding, forging and plastic parts costs-

Estimation Of Machining Cost-Estimating machining costs - capital cost and inventory criteria - common criteria for comparing economic alternatives - cost - benefit analysis.

TEXTBOOK

1. Narang and Kumar, "Production and Costing", Khanna publishers, New Delhi, 1978.

REFERENCES

1. Buffa, "Modern Production and Operations Management", 8th Edition, John Wiley and sons, 2007.

2. Ivan R.Vounon, "Realistic cost estimating or manufacturing", Society of manufacturing engineers, USA, 1968.

PR 469 TOTAL QUALITY MANAGEMENT

Course outcomes

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

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.

Human Resource Management - Introduction – strategic alignment of HRM policies – effective communication – employee empowerment and involvement – training and development – teams and team work – review, continuous improvement and conclusions – organizing people for quality – quality circles or kaizen teams.

Quality and Environmental Management Systems: Benefits of ISO registration - ISO 9000 series of standards ISO 9001 requirements – implementation – documentation – writing the documents – internal audits – registration - ISO 14000 series standards – concepts of ISO 14001 – requirements of ISO 14001 – benefits of EMS – integrating ISO 14000 with ISO 9000 – relationship between health and safety.

REFERENCES:

1. Oakland J S, “Total Quality Management - Text with Cases”, Butterworth – Heinemann – An Imprint of Elseiver, First Indian Print, 2005.
2. Besterfield D H et al, “Total Quality Management”, Pearson Education Private Limited, 2004.

PR 222 PRODUCTION TECHNOLOGY – II

Course outcomes

- Describe about different type of machine like different type of 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.
- Know about Computer aided part programming

Lathes. Capstan and ferret lathe. Drilling and boring machine. Classification. Principles of working components. Work holding and tool holding devices.

Shaper, planner and slotter machines. Classification. Principles of working components. Work holding & tool holding devices.

Milling. Hobbing. Broaching. Grinding machines. Classification. Principles of working components. Work holding & tool holding devices.

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

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

REFERENCES

1. *Khanna,O.P., and Lal,M., " A Text Book of Production Technology" , Vol II , Dhanpat Rai & Sons.*
2. *Yoram Koren, " Computer Control of Manufactuting Systems " , McGraw Hill.*
3. *Choudhry, S.K.H., "S.K.H.,Elements of Work Shop Technology, VoL II", MPP. 1.*
4. *HMT , "Production Technology" , Tata McGraw Hill ,*
5. *Kundra, T.K., Rao., P.N., and Tiwari,NLK.,, "Numerical Control and Computer Aided Manufacturing", Tata McGraw Hill.*

PR 472 RESOURCE MANAGEMENT TECHNIQUES

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.

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

Transportation & assignment models -Mathematical model for Transportation problem – balanced and unbalanced problem –Assignment problem.

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.

REFERENCES

1. *Gupta and Hira, Problems on operations research, S.Chand & Co.Ltd., New Delhi, 1991.*
2. *Taha H.A., Operations research, Prentice – Hall of India, New Delhi,2001.*
3. *Panneerselvam, R, Operations Research, Prentice – Hall of India, New Delhi, 2002*

PR 287 MECHANICS OF SOLIDS AND FLUIDS

Course outcomes

- Perfume stress and strain analysis for machine component and structural members
- Design machine components like circular and hollow shaft
- Analysis and monitor the fluid flows and applying the principle of fluid mechanics to design pumps and turbines

Stress – Strain – Elastic constants – Stress in Composite bars – Beams – Types – Shear force and bending moment diagrams for simply supported and overhanging.

Columns Long column – Euler's Theory – Short column – Empirical formulae – Torison of Circular shafts – Hollow Shafts – Power transmission

Vapour Pressure – Pressure at a point its variation – Measurement with Piezometer, manometers and gauges.

Continuity equation in one dimension – Bernoulli's equation – Venturimeters and Orificie meters – Flow through pipes – Laminar Turbulent flow Major losses.

Pumps – General principles of displacement and Centrifugal pumps – Efficiency and Perofrmance Curves of Pumps – Caviation in Pumps – Turbines – Efficiency – Governing of turbines.

REFERENCES

1. *Ramamirtham, S., `Strength of Materials ', Dhanpat Rai and Sons, New Delhi, 2003.*
2. *Rajput , R.K., 'Strength of Materials ', S.Chand & Co Ltd., New Delhi, 1996.*
3. *Nagarathnam, S. 'Fluid Mechanics', Khanna Publishers,New Delhi, 1995*