NATIONAL INSTITUTE OF TECHNOLOGY

TIRUCHIRAPPALLI-620 015

B.Tech. DEGREE

(PRODUCTION ENGINEERING)

8 SEMESTER PROGRAMME

CODE: PR

New CODE : 1141XXXXX

SYLLABUS

FOR

CREDIT BASED CURRICULUM

OPERATIVE FOR STUDENTS OF 2006 -2007 ADMISSION

DEPARTMENT OF PRODUCTION ENGINEERING

JUNE 2006

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

Curriculum Structure:
Total Minimum credits required for completing the programme is 176

Semester - III

CODE	SUBJECTS	L	T	P	CREDITS
MA 205	Transforms and Partial Differential Equations	3	1	0	4
MT 251	Engineering Materials	3	0	0	3
CE 293	Strength of Materials	2	1	0	3
EE 245	Applied Electronics	3	0	0	3
PR 201	Foundry Technology	3	0	0	3
PR 203	Machining Technology - I	3	0	0	3
PR 211	Workshop Practice -1	0	0	3	1
CE 295	Strength of Materials Lab.	0	0	3	1
		17	2	6	21

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
ME 224	Theory of Machines - I	3	1	0	4
PR 202	Machining Technology - II	3	0	0	3
PR 204	Welding Technology	3	0	0	3
EE 244	Electrical & Electronics Engineering Lab.	0	0	3	1
CE 284	Fluid Machinery Lab.	0	0	3	1
PR 212	Workshop Practice – II	0	0	3	1
		18	3	9	23

Semester - V

CODE	SUBJECTS	L	T	P	CREDITS
MA 303	Applied Statistics	3	0	0	3
PR 301	Mechanical Measurements and Metrology	3	0	0	3
PR 303	Design of Machine Elements	3	1	0	4
PR 305	Advanced Manufacturing Processes	3	0	0	3
ME 321	Theory of Machines - II	3	1	0	4
ME 325	Thermal Engineering	3	0	0	3
ME 331	Thermal Engineering Lab. and Metrology Lab.	0	0	3	1
PR 311	Computer Aided Drafting of Machine Elements	1	0	3	2
		19	2	6	23

Semester - VI

CODE	SUBJECTS	L	T	P	CREDITS
PR 302	Resource Management Techniques	3	1	0	4
PR 304	CAD/CAM	3	0	0	3
PR 306	Design of Production Tooling	3	1	0	4
PR 308	Metal Forming Processes	3	0	0	3
PR 310	CNC Machines	3	0	0	3
-------	Elective – I	3	0	0	3
PR 312	CNC Laboratory.	0	0	3	1
PR 314	CAD/CAM Laboratory	0	0	3	1
		18	2	6	22

Semester -VII

CODE	SUBJECTS	L	T	P	CREDITS
HM 401	Industrial Economics	3	0	0	3
PR 401	Manufacturing System Simulation	3	0	0	3
PR 403	Machine Tool Control & Mechatronics	3	0	0	3
-------	Elective – II	3	0	0	3
-------	Elective -III	3	0	0	3
PR 411	Computer Aided Drafting And Cost Estimation	1	0	3	2
PR 413	Mechatronics Lab. and Manufacturing System Simulation Lab.	0	0	3	1
PR 447	Comprehensive Evaluation	-	3	-	3
		16	3	7	21

Semester –VIII

CODE	SUBJECTS	L	T	P	CREDITS
PR 402	Manufacturing Planning & Control	3	0	0	3
PR 404	Automation and CIM	3	0	0	3
PR 406	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					
PR 352	Quality, Reliability & Maintenance	3	0	0	3
PR 354	Design for Manufacture	3	0	0	3
Elective II & III					
PR 451	Newer Trends in Manufacturing	3	0	0	3
PR 453	Material Handling & Storage	3	0	0	3
PR 455	Operations Management	3	0	0	3
ME 471	Automobile Engineering	3	0	0	3
Or any other elective subject from any other department					
Elective IV & V					
PR 454	Artificial Intelligence & Expert Systems	3	0	0	3
PR 460	Project Management	3	0	0	3
PR 462	Plant Engineering	3	0	0	3
HM 412	Entrepreneurship Development	2	1	0	3
Or any other elective subject from any other department					

List of reserve Electives :

CODE	SUBJECTS	L	T	P	CREDITS
PR 452	Industrial Robotics	3	0	0	3
PR 456	Mechatronics	3	0	0	3
PR 457	Manufacturing Costs & Analysis	3	0	0	3
PR 458	Value Engineering	3	0	0	3
PR 459	Machine Tool Technology	3	0	0	3
ME 471	Refrigeration and Air Conditioning	3	0	0	3
ME 472	Finite Element Method	3	0	0	3
MB 471	Financial Management	3	0	0	3
HM 352	Corporate Communication	3	0	0	3

Subjects offered to other Departments

CODE	SUBJECTS	L	T	P	CREDITS
Mechanical					
PR 221	Production Technology - I	3	0	0	3
PR 222	Production Technology - II	3	0	0	3
PR 232	Production Process Lab.	0	0	3	1
PR 331	Production Drawing and Cost Estimation	1	0	2	2
PR 471	Advanced Machining Processes	3	0	0	3
PR 472	Resource Management Techniques	3	0	0	3
Metallurgy					
PR 322	Metal Forming	3	1	0	4
PR 331	Foundry and Welding Lab.	0	0	3	1
PR 460	Project Management	3	0	0	3

MA 205 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

Laplace Transform 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 - Fourier cosine and sine transforms - inverse transforms - convolution theorem and Parseval's identity for Fourier transforms - Finite cosine and sine transforms.

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

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

REFERENCES

1. *Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers.*
2. *Kandasamy, P. Thilagavathy, K. and Gunavathy, K., Engineering Mathematics, Vol. III, Chand and Company.*
3. *Venkataraman, M.K., Engineering Mathematics Vol.III, National Publishing Company.*

MT 251 ENGINEERING MATERIALS

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

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 alloya-Non Metallic Metals and alloys-ceramic material-polymers-composite material

Testing of materials-mechanical properties of materails

Testing of materials-Fatique testing.

REFERENCES

1.Serope kalpakjian, "Manufacturing process for engineering materials" Addison Wesley publishing company,1997
2.Suryanarayanan, A.V.K. "Testing of Metalic materials" TataMcGraw Hill,1993
3.Srinivasan, N.K & Ramakrishanan,S.S "The science of engineering materials" Oxford publishing Co. Ltd. 1992

CE 293 STRENGTH OF MATERIALS

Simple Stresses And Strains-Types of stresses-types of 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 Relationship between loading - Shear force and bending moment diagrams for cantilever, simply supported and overhanging beams subjected to concentrated load and Uniformly Distributed Load(UDL)

Deflection equation elastic line of a beam – Different methods to find deflection and slope of beams like Macauly's method, moment area method and conjugate beam method.

Theory of simple torsion – assumptions – simple torsion formula for circular shafts – hollow shafts – power transmission – strength and stiffness of shafts.

REFERENCES

1 *Ramamurtham, S, "Strength of materials", Dhanpat Rai & Sons, 1991.*
2 *Popov ,E.P., "Mechanics of Materials", Prentice Hall inc., 1976.*
3 *Timoshenko S.P and Gere J.M "Mechanics of materials".*

EE 245 APPLIED ELECTRONICS

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 & 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.

REFERENCES

1. *Millman and C.Halkias: " Integrated Electronics ", TMH*
2. *Ranmkant A Gayakwad, "OP-amps and linear integrated circuit technology"*
3. *Morris Mano, " Digital Design" PH Stoeker, W.I and Stoeker P.A , "Microcompuetr control of thermal and mechanical systems".*

PR 201 FOUNDRY TECHNOLOGY

Patterns - types of patterns - core boxes.

Molding and core sands - sand control tests - sand preparation - types of sands - applications.

Casting techniques - description of various sand casting techniques - features - applicability and economical considerations.

Casting design consideration - types of gating system, - design of gating system for different metals.

Furnaces -types and operational features for melting - different metals and their alloys - foundry practices - foundry mechanization - features of automatic handling of foundry operations.

REFERENCES

1. *Heine, R.W., Loper, C.R., and Rosenthal, P.C., "Principles of Metal casting" 2nd Edn., Tata McGraw Hill Pub. Co. Ltd., New Delhi, 1997.*
2. *Banga, T.R. and others, "Foundry Engineering", Khanna Publishers, New Delhi, 1987.*
3. *Srinivasan, N.K., "Foundry Technology", Khanna Publications, 1996*

PR 203 MACHINING TECHNOLOGY - I

Lathe - Classification of machining processes and machine tools. Types - specifications mechanism - operations -special attachments, tools material – geometry

Capstan, turret and automatic lathes - Specification - mechanism principle of operation types of work

Drilling machine - Types - specifications - main parts - mechanism- twist drill nomenclature and geometry

Boring machine -Types - specifications. Work set ups – operations.

Shaping, slotting and planning - Types and specifications - main parts - drives

REFERENCES

1. *HMT, " Production Technology", Tata McGraw Hill Publishing Co. Ltd., 1996.*
2. *Khanna, O.P, Lal, M., "A Textbook of Production Technology", Vol II, Dhanpat Rai & Sons, 1992.*
3. *Hajra choudhry - "Elements of Workshop technology vol.II", Media Promoters & Publishers Pvt. Ltd, 1994.*

PR 211 WORKSHOP PRACTICE – I

(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

1. Tension test
2. Compression testing machine
3. Hardness pest
4. Cement test
5. Torsion test
6. Deflection of Mild Steel flat
7. Sieve Analysis.

MA 202 NUMERICAL TECHNIQUES

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 - Bairstow'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 2^{nd} order equations - Multistep methods - Milne's and Adams' 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.

References.

1. *Gerald, C.F., and Wheatley, P.O., Applied Numerical Analysis, Addison Wesley.*
2. *Jain, M.K., Iyengar, S.R. and Jain, R.K., Numerical Methods for Scientific and Engineering Computation, Wiley Eastern.*
3. *Kandasamy, P., Thilagavathy, K., and Gunavathy, S., Numerical Methods, Chand and Company.*

EE 242 ELECTRICAL AND CONTROL SYSTEMS ENGINEERING

DC machines - Characteristics - Starting and speed control of DC motors. Transformers: (Single phase only)- equivalent circuit & 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.

REFERENCES

1. *Boylestead, "Electronics Devices &Integrated Circuits", PHI Publishers, 1997.*
2. *Palani, S. "Control Systems ", Shanmuga Priya Publishers, 1995.*
3. *Theraja, B.L., " Electrical Technology", Vol. 1 & 2, Nitia Construction & development Co.Ltd., 1988.*

CE 282 FLUID MECHANICS AND MACHINERY

Introduction-Units and Dimensions - Fluid properties. Fluid static's : 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 - vane pump - gear pump – screw pump

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

REFERENCES

1. *Kothandaraman, C.P. and Rudramoorthy, R. "Basic Fluid Mechanics", New Age International, 1998.*
2. *Robert, W. Fox and Allan, T. McDonald. "Introduction to Fluid Mechanics", 4th Edn., John Willey & Sons, 1995.*
3. *Bansal, R.K., "Fluid Mechanics and Hydraulic Machines", Lakshmi Publications, 1993.*

ME 224 THEORY OF MACHINES - I

Definitions and basic concepts: Position, velocity and acceleration of a particle in rectilinear motion, curvilinear motion-Velocity and Acceleration: Analysis of simple mechanisms using graphical and analytical methods

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

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.

REFERENCES

1. *Ballaney, P.L., "Theory of Machines", Khanna Publications, 1996*
2. *R.S. Kurmi & Gupta "Theory of machines".*
3. *Shigley, J.E. and Uicker, J.J., "Theory of Machines and Mechanisms", McGraw Hill, 1995.*

PR 202 MACHINING TECHNOLOGY – II

Milling machine - types - specification - attachments - operations - milling cutters - nomenclature and geometry. Indexing methods

Broaching machines - types - specifications - Broach classification nomenclature

Abrasive machining - Designation of grinding wheel, ISI specification - theory of grinding - Honing - Lapping -applications.

Gear manufacturing - Kinds of gears, gear terminology, methods of gear cutting - Gear generation - principle - gear hobbling - gear shaping - specifications - process principle- applications.

Bevel gear generation and gear finishing methods

REFERENCES

1. *Hajra choudhry - "Elements of Workshop technology vol.II", Media Promoters & Publishers Pvt., Ltd, 1994.*
2. *Khanna, O.P. and Lal, M. "A Text book of Production Technology", Vol II, Dhanpat Rai & Sons, 1992.*
3. *HMT, " Production Technology", Tata McGraw Hill Publishing Co. Ltd., 1991.*

PR 204 WELDING TECHNOLOGY

Gas welding - process variations - equipment - welding of cast iron, aluminium and stainless steels - principle of gas cutting

Arc welding processes - equipment - electrodes -function and characteristics of electrode coatings.

Resistance welding processes and equipment - applications Special welding processes

Radiant energy welding processes - equipment -electron beam welding (EBW) - laser beam welding (LBW) - applications of EBW and LBW. Other allied processes and Brazing and soldering

Thermit welding process. Applications.

REFERENCES

1. *Khanna, O.P., "A text book on Welding Technology", Dhanpat Rai & Sons, Delhi, 1993.*

2. *Jackson M.D. "Welding Methods and Metallurgy" Charles Griffin & Co. London 1967.*
3. *Parmar, R.S., "Welding Process and Technology", Khanna Publishers, Delhi, 1992.*

EE 244 ELECTRICAL & ELECTRONICS ENGINEERING LABORATORY

(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

(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.Screw pump
11.Gear pump.

PR 212 WORKSHOP PRACTICE – II

Shaping rectangular block or cube - Slot cutting / Step-cutting / V-block - Milling rectangular block or cube - T - Slot milling - Spur gear cutting - Surface grinding - Single point tool grinding - Spur and Helical gear generation on hobbling machine - Temperature measurement during turning - Cutting dynamics for drilling - Complex shaped component production using EDM.

MA 303 APPLIED STATISTICS

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

Sampling distributions – confidence interval estimation of population parameters – testing of hypotheses – Large sample tests for mean and proportion – t-test, F-test and Chi-square test – curve fitting-method of least squares

Regression and correlation – rank correlation – multiple and partial correlation – analysis of variance-one way and two way classifications – experimental design – Latin square design – Time series analysis.

Chebyshev's Inequality - Law of Large Numbers – Central Limit theorem – Random process – Markov Dependence, Markov Chains, definition, examples - ergodicity.

Finite Markov Chain - Various States – Limiting Probability - Introduction to Markov Process - M/M/1 Queues with finite and infinite waiting space.

REFERENCES.

1. *Bowker and Liberman, Engineering Statistics, Prentice-Hall.*
2. *Gupta, S.C. and Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan Chand and Sons.*
3. *Hogg, R.V., and Craig, A.T., Introduction to Mathematical Statistics, Macmillian Publishing Company.*

PR 301 MECHANICAL MEASUREMENTS AND METROLOGY

General concepts of measurements - Elements of measurement - Standards, Errors in measuring instruments - static and dynamic characteristics of measuring instruments

Measurement of displacement, force strain, temperature, pressure, flow and torque

Linear and angular measuring instruments and calibration

Measurement of surface and geometric properties

Metrology of threads and gears -Errors in threads measurement of major, minor and effective diameter, Measurement and testing of gears gear tooth terminology - coordinate measuring machine.

REFERENCES

1. *Beckwith, T.G. and Buck, N.L., "Mechanical Measurements" Narosa Publishing House, New Delhi, 1995.*
2. *Jain, R.K., "Engineering Metrology", Khanna Pub., 1996.*
3. *Gupta, I.C., "Engineering Metrology", Dhanpat Rai &Sons, 1994.*

PR 303 DESIGN OF MACHINE ELEMENTS

Product development principles -mechanical properties of materials Stresses - Theories of failure -Stress concentration factor -factor of safety

Design of shafts based on bending moment, twisting moment, combined of bending & twisting moments, axial loads in addition to combined torsional and bending loads, rigidity and stiffness. Design of Coil Spring

Design of couplings, keys and belts, chains and bearings.

Design of welded and riveted joints - types of joints.

Design of spur and helical gears - Design of gear box-layout diagram, speed diagram

REFERENCES

1. *Shigley, J.E. and Mischke "Mechanical Engineering Design" McGraw Hill, 1994.*
2. *Prabhu, T.J. "Fundamentals of machine design", 1997*
3. *Khurmi,R.S &Gupta,J.K "Atext Book of Machine Design", Eurasia Publishing House (P) Ltd,New Delhi,1993.*

PR 305 ADVANCED MANUFACTURING PROCESSES

Classification NTM processes – process economy – quality – material and shape applications

Electro Chemical Machining – types of chemical material removal – operating principle – process parameter and limitation in drilling, grinding and honing

Thermo electrical machining – Types –EDM –EBM –IBM -PAM –principles –parameters – merits and demerits –applications and limitations.

Mechanical machining – types –USM-AJM –AFM –WJM-operating principle process parameter-application and limitations

special manufacturing process – polygonal turning –deep hole drilling –shaped tube electrolytic machining – electrical discharge wire cutting –micro machining –RPT and rapid tooling

REFERENCES

1. *"HMT production technology" TataMcGraw Hill 1991.*
2. *"Production technology" R.K.Jain Kanna publishers 2001.*
3. *"Modern machiningn processes" Pandey PC TataMcGraw Hill Co. 1993*

ME 321 THEORY OF MACHINES II

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

Fluctuation of energy and speed - mass of flywheel-Function of a governor - to control the speed for varying loads - calculations and determination of initial spring force in spring controlled governors, Effects of friction in governor mechanism

Balancing of rotating and reciprocating masses in one plane and in several planes

Longitudinal ,Transverse and Torsional vibration

Two degree of freedom systems : generalized coordinates -principal co-ordinates - co-ordinate coupling - Lagrange's equations - vibration absorbers. Multidegree of freedom systems : Calculation of natural frequencies by Rayleigh, Stodola, Matrix iteration and Holzer methods.

REFERENCES

1. *Ballaney, P.L., "Theory of Machines", Khanna Publications, 1996*
2. *Shigley, J.E. and Uicker, J.J., "Theory of Machines and Mechanisms", McGraw Hill, 1995.*
3. *Thomas Bevan, "Theory of Machines", CBS Publishers, 1987.*

ME 325 THERMAL ENGINEERING

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 & CI engines

Reciprocating compressor - effect of clearance volume, single and multistage compressor - Volumetric efficiency - calculation of power requirement - gas turbines - open and closed cycle - intercolling, 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.

REFERENCES

1. *P.K. Nag, "Engineering Thermodynamics"*
2. *Kothandaraman, C.P. & Domkundwar, S. "Engineering Thermodynamics", Part - I, SI units, Dhanpat Rai & Sons, 1989.*
3. *Ganesan, V., "Internal Combustion Engine", Tata McGraw Hill, New Delhi, 1995.*

ME 331 THERMAL ENGINEERING AND METROLOGY LABORATORY

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 multicylinder 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.

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 311 COMPUTER AIDED DRAFTING OF MACHINE ELEMENTS

Conventions -Understand drafting package and practice with regard to parts and assemblies. Code of practice for engineering drawing -methods of dimensioning Tolerance and surface finish representations -Limits, fits and tolerances - calculation of minimum and maximum clearances and allowances, surface finish symbols Fasteners and joints - Types of fasteners and joints - practices. Part drawing practice - Flange coupling - Plummer block - wall bracket - universal coupling - locomotive piston - stuffing box - cross head - Assembly drawing practice.

PR 302 RESOURCE MANAGEMENT TECHNIQUES

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 304 CAD/CAM

Fundamentals of CAD – design process and application -Geometric modeling techniques

graphics standards - application of solid models Graphic standards - GKS - DXF and IGES standards - Parametric design programmes.

Finite element analysis and database - types of analysis - assembly procedure - Design of database - concepts - SQL. CFD.

Computer aided manufacturing and process monitoring - control - modeling - analysis.

Systems for manufacturing support - production systems at the operation level - cutting conditions optimization - production planning - capacity planning

REFERENCES

1. *Groover, M.P. & Zimmerman, I.P.A., "CAD/CAM" Prentice Hall of India, 1996.*

2. *Newman, W.M. & Sproull, R.F., "Principles of interactive computer graphics", II Ed., McGraw Hill Pub., 1989.*
3. *David D Bedworth, Mark R Henderson & Philip M Holfe "Computer integrated design and manufacturing", McGraw Hill int.edn., 1991*

PR 306 DESIGN OF PRODUCTION TOOLING

Objectives of tool design -tool design process - Design of tooling for machining

Chip formation - types, mechanism, tool wear, tool life, machinability, cutting force - tool material - single and multipoint point tool.

Jigs and fixtures - Principles of jigs & fixtures - principles of location and clamping, types of locators and clamps - types of fixtures

Design of tooling for forming - types of operation types of power press principles of forging and extrusion dies.

Special tooling modular fixtures - tooling for inspection -design of gauges tool manufacturing machines - tooling for CMM

REFERENCES

1. *Sharma,P.C., "A Text Book of Production Engineering", S.Chand & Company Ltd., 1997.*
2. *Parsons, W.J., "Production tooling equipment", Macmillan & Co. Ltd., 1966*
3. *Donaldson, C., "Tool Design", Tata McGraw Hill Pub.Co., III Ed., 1986*

PR 308 METAL FORMING PROCESSES

Flow theories – yield criteria for ductile metals - 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.

REFERENCES

1. *Surendra Kumar, "Metal Forming", Khanna Pub.,1988.*
2. *Narayanasamy,R., "Metal forming technology" Ahuja Pub,2000.*
3. *Serope Kalpakjian, "Manufacturing Processes for Engineering Materials" Addison Wesley Publishing Company, 3rd Edn. 1997.*

PR 310 CNC MACHINES

Concepts and features of NC systems - Design considerations of NC machine tools - Constructional features of CNC machine tools

Machining center - Turning center

Manual part programming – Preparatory, Miscellaneous functions – Sinumeric, Fanuc controls - Post processors, APT programming

Feedback devices - tooling for CNC machine – Interpolators

Point-to-point and contouring systems – Adaptive control.

REFERENCES

1. *Radhakrishnan, P., "Computer Numerical Control Machines", New Book Agency, Calcutta, 1991*
2. *Yoram Koren., "Computer Control of Manufacturing Systems", McGraw Hill Book co. New Delhi, 1986.*
3. *Kundra, T.K., Rao.,P.N., and Tiwari, N.K., "CNC and Computer Aided Manufacturing", Tata McGraw Hill, New Delhi., 1991.*

PR 312 CNC LABORATORY

(Practical Exercise will be selected from the following)

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

PR 314 CAD/CAM Laboratory

Pro/ENGINEER – Part Modeling, Assembly & Manufacturing.

UNIGRAPHICS – Part Modeling, Assembly & Manufacturing.
I – DEAS – Part Modeling, Assembly, Manufacturing & Analysis
NISA – FEM Analysis
CATIA - Part Modeling, Assembly, Manufacturing & Analysis

HM 401 INDUSTRIAL ECONOMICS

Micro Economics -Demand & 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 & Taylor - Managerial functions - Types of Business organisations - Types of Business organisations

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.

REFERENCES

1. *Dewett. K.K. - "Modern Economic Theory", S. Chand & Co. Ltd., 1999 Edition.*
2. *Burton Genie, Thakur Manab, "Management Today" TMH - 1996 Edition.*
3. *V.S. and Namakmaris "Marketing Management Planning Implementation & Control" Macmillan, - 1996 Edition.*

PR 401 MANUFACTURING SYSTEM SIMULATION

Components of a system – Models, types of models - Steps in simulation - Monte Carlo Simulation - Discrete event simulation examples – Simulation packages - GPSS, SIMAN V, MODSIM III, ARENA, QUEST, VMAP-

Statistical models – discrete distribution, continuous distribution

Techniques for generating random numbers – Tests for random numbers – Random variate generations - verification and validation of simulation models – Measure of performance and their estimation

Input and output analysis

Simulation of queuing models, inventory models.

REFERENCES

1. *Jerry banks, john S Carson, Discrete –event system simulation, Prentice hall of India.*
2. *2.Law AM & WD Kelton, simulation, Modeling and analysis, McGraw Hill,1982.*
3. *Mitrani L, Simulation Techniques for Discrete –event system, Cambridge university*

PR 403 MACHINE TOOL CONTROL AND MECHATRONICS

Concepts of drives - principles of applications of hydraulic, pneumatic, electric controls- - hydraulic pumps- characteristics

Hydraulic valves-pressure-flow-direction controls -applications-hydraulic fluids-symbols-design of hydraulic circuits for machine tools- Electro pneumatic circuits –

Microprocessor architecture – Overview of PLC system – PLC Programming procedures

Micro sensors - examples of mechatronics systems from robotics.

Manufacturing machine diagnostic – Testing of mechatronics elements

REFERENCES

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

PR 411 COMPUTER AIDED DRAFTING AND COST ESTIMATION

(Use of design data Book permitted in the examination)

Standards and Conventions
Dimensional and Form Tolerances
Manufacturing Drawings
Redimensioning and Tolerance Charting
Cost estimation.

PR 413 MECHATRONICS AND MANUFACTURING SYSTEM SIMULATION LAB.

(Practical Exercise will be selected from the following)

Mechatronics Lab.

1. Design and testing of the circuits such for pressure control, flow control direction, direction control and driving circuit with PLC.
2. Sensors-pressure, flow sensor, interfacing with PC.
3. Use of MAT Lab,SCI Lab for the design of (i) basic hydraulic (ii) pneumatic (iii) electric circuit using.
4. Programming and operation of robot and vision system

Manufacturing System Simulation Lab.

1.General system modeling and simulation exercises using ARENA
2.Robot work cell simulation using UGRIO
3.CNC Machine simulation using Virtual NC
4.Manufacturing system modeling and simulation exercises using GPSS
5.Manufacturing system modeling and simulation using QUEST
6.Machine monitoring system

PR 402 MANUFACTURING PLANNING AND CONTROL

Demand forecasting - time series forecasting models - delphi method of forecasting -forecast errors

Functions of production control, -product development and design - standardisation, simplification and specialisation-break even analysis- process planning steps-CAPP

Inventory control- need for inventory-purchase order model-model with and without shortages

Production batch and allocation problems - minimum cost batch size- production range-maximum profit batch size - Allocation of work to machine

Problems of scheduling-expediting

REFERENCES

1. *Samuel Eilon, "Elements of Production Planning and control", Universal Book Corp., 1984.*
2. *Buffa, E.S., "Modern Production/Operations Management", 7th edition, John Wiley sons, 1983.*
3. *Scheele,etal, "Principles & Design of Production Control Systems", Prentice Hall Inc.*

PR 404 AUTOMATION AND CIM

Automation and Control Systems – Features of Numerical control - industrial Robotics- Discrete Control using programmable - logic controllers and personal Computers

Material handling Systems - Storage systems - Automatic Data Capture

Manufacturing Systems - Group Technology and cellular Manufacturing systems- Flexible Manufacturing - Automated assembly systems –

Inspection Principles - Design and CAD/CAM in the Production system - Concurrent Engineering - Production Planning and Control Systems

Lean Production and Agile Manufacturing

REFERENCES

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

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

3 Ranky Paul, "Computer Integrated Manufacturing", Prentice Hall, 1986.

PR 406 WORK DESIGN AND FACILITIES PLANNING

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 & CORELAP

REFERENCES

1. *Barnes, "Motion and time study", John Wiley, New York, 1990.*
2. *Apple, J.M. "Plant Layout and Materials Handling", Ronald Press Company, New York, 1977*
3. *ILO, "Introduction to workstudy", ILO,Geneva,1974*

PR 352 QUALITY, RELIABILITY AND MAINTENANCE

Control Charts-Quality- basic concepts- concepts of control charts-types of control charts- $\overline{X}$ and R charts - p charts- c charts

Acceptance Sampling-Acceptance sampling-concepts of sampling-constructing operating characteristics curve-single, double multiple and sequential sampling plans

Quality Systems-Quality systems- principles - certification and accreditation schemes Development of quality circles -Process of total quality management and Taguchi's method-

Reliability- mean time between failures (MTBF)-mean time to failure (MTTF) Failure data analysis

Maintenance Planning& Condition Based Maintenance-on - load and off-level monitoring-methods of condition monitoring.

REFERENCES

1. *Govil, "Reliability Engineering", Tata McGraw Hill Co., New Delhi, 1983.*
2. *Srimath, "Concepts of Reliability", Affiliated East-West Pvt. Ltd., 1975.*
3. *Kelly & Harris, "Management of Industrial Maintenance", Newres Butterworth, 1978.*

PR 354 DESIGN FOR MANUFACTURE

Engineering design - kinds of design - Design process Steps - Factors influencing design - concurrent engineering

Materials selection process -evaluation methods for material selection

Design for castings - form design of steel, grey iron, malleable iron and aluminum castings. Form design of welded fabrications

Design for forgings - design for sheet metal forming - design for powder metallurgy - design for plastics

Design for machining, design for economy - design for clampability: Design for ease of assembly.

REFERENCES

1. *Matousek, "Engineering Design", Blackie & Sons Ltd., Glasford, 1967.*
2. *Dieter, "Engineering Design", McGraw Hill Co.Ltd, 1987.*
3. *Asimov, "Introduction to design" Prentice Hall, New Delhi, 5th Edn.*

PR 451 NEWER TRENDS IN MANUFACTURING

Agile manufacturing - Lean manufacturing - Virtual Reality

Precision Engineering - its concepts and significance – Micro machining – High speed machining - manufacturing of integrated circuits

Nano engineering- its concepts, significance and applications-molecular and atomic level machining and applications - Rapid prototyping – sterolithography – 3D Printing

Advanced CAD

Advanced Assembly - assembly constraints- creating sub assembly

REFERENCES

1. *Proceedings of the Seminar on "Significance of Precision Engineering in the Indian Context" Sep'98.*
2. *Serope Kalpakjian, "Manufacturing Process for Engineering Materials" Addison - wesley Publishing Company, 1997.*
3. *Massood Tabid - Azar, "Micro actuators - electrical, Magnetic, thermal, Optical, Mechanical, Chemical and Smart Structures", Khuwer Academic Publishers, 1997.*

PR 453 MATERIAL HANDLING AND STORAGE

Introduction to material handling- Fixed Path Equipment- flexible-path equipment - conveyers-automated guided vehicles (AGV)

Production line equipments-pick and place robots-transfer devices-feeder lines, robotic devices

Principle of material handling equipment-layout and aerial handling systems-

Conveyors-storage equipments

Small containers - unit load containers - rack and shelving -automated storage and retrieval systems-methods of protecting materials for packages - auxiliary equipments -automated identifications systems

REFERENCES

1. *Mickell P.Groover,"Automation ,Production systems and computer integrated manufacturing" Part V , P HAll Inc.New Delhi 1987*
2. *James M.Apple, "Materials handling systems design" ,The Ronald Press Co.N.Y. 1972*
3. *John A White, "Production handling". 4th. edition, Parts 4,5- 4,7,5.2 & 5.4 John Wiley and Sons Newyork,1987*

PR 455 OPERATIONS MANAGEMENT

Capacity Planning-Technology and the designing of products and services - product and process innovation- mature and new products-aggregate planning-

Aggregate planning - transportation model structure for aggregate planning varying and constant work force method

Materials requirement planning- engineering change MRP system-lot sizing –lot by lot –Wagner & whiten algorithm-MRP versus MRPII-KANBAN System- JIT

Job sequencing and operation scheduling-Job sequencing, sequencing Job on Parallel machine(Kaspi-Montreuil algorithm, mean tardiness)

Assembly Line Balancing & Financial Analysis-Mathematical Programming Formulation-Kilbridge & wester heuristic -capital cost investment criteria-common criteria for comparing economic alternative.

REFERENCES

1. *Analysis & control of Production System by Elsayed A Elsayed, Thomas O. Boucher*
2. *Buffa, E.S., "Modern Production/Operations Management", 7th edition, John Wiley sons, 1983.*
3. *Krajervaki & Ritzman, "Operations management", Addison Wesley Pub. Co, 1987*

ME 471 AUTOMOBILE ENGINEERING

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.

REFERENCES

1. *Narang, G.B.S., "Automobile Engineering", Khanna Publishers, 1991.*
2. *Joseph Heitner., "Automotive Mechanics", 2nd Edition, East West press. 1989.*
3. *Kirpal Singh, "Automobile Engineering", Vol I & Vol II, Standard Publishers,Delhi, 1998.*

PR 454 ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

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

Requirements of AI languages - Languages Lisp & 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.

REFERENCES

1. *Simons, G.L., "Introducing Artificial Intelligence", NCC Publications, 1984*
2. *Maus, R and Keyes J Handbook of Expert Systems in manufacturing Mcgraw hill, 1991*
3. *Ernest R Tello, "Mastering AI tools and techniques"*

PR 460 PROJECT MANAGEMENT

Project Development Cycle- identification of investment opportunities -Market and demand analysis

Technical analysis-Technical analysis - materials and inputs - Production technology - product mix - plant capacity - location and site - machinery and equipment - structures and civil works - project charts and layouts

Cost of project and means of financing- term loans - cost of production-estimation of tax burden-

Financial and economic appraisal-mathematical programming approach - LP, ILP and goal programming model-Portfolio theory and network techniques

Portfolio theory and capital asset pricing model approaches to risk analysis. Network techniques for project management - PERT, CPM.

REFERENCES

1. *Prasanna chandra , projects , Tata Mcgraw Hill, 1986*
2. *Choudhury, S., project Mgt., Tata Mcgraw Hill, 1988*

PR 462- PLANT ENGINEERING

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 & 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 & electrical protection & prevention security equipment

Lubrication and corrosion- Synthetic & solid lubricants -lubrication systems - causes & control deterioration - paints & protective coatings.

REFERENCES

1. *Robert C. Rosaler, "Standard HandBook of Plant Engineering", Second Edition, 1995.*
2. *Lindley and Higgins, "Maintenance Engineers Hand Book", McGraw Hill Book Company, 1977.*

HM 412- ENTREPRENEURSHIP DEVELOPMENT

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.

REFERENCES

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

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

PR 452 INDUSTRIAL ROBOTICS

Fundamentals Of Robotics - robot classification

General characteristics - classification - special purpose tools - assembly fixtures - multiple end effectors systems. Typical designs, compliance in Wrists. End Effectors

Robot Programming And Languages - Robot language development, language classification

Robot Applications-Robot Applications in Manufacturing: Material Transfer & Machine Loading / Unloading - Processing operations like welding & painting - Assembly operations - Inspection Automation. Robot Cell Design & Control-Recent Developments

Recent developments in advanced Robotics - Special applications of Robotics: Nuclear Industry, Surgery, Food Manufacturing, Milking - Miniature and micro robotics: Technologies and applications.

REFERENCES

1. *Aggrawel – Robotics, Khanna Publishers 2001*
2. *Groover, M.P., "Industrial Robotics", McGraw Hill Book Co., Singapore, 1986.*
3. *Deb, S.R., "Robotics Technology & Flexible automation", Tata McGraw Hill Pub., New Delhi, 1994.*

PR 454 MECHATRONICS

Introduction-Definition of Mechanical Systems-Application of Specific ICs, Automatic Control and Real Time Control Systems, Fuzzy logic control

Systems And Design- Product Design, Modeling, Analysis and Simulation, Man - Machine Interface

Sensors and transducers-Signal processing, Opto electronics - Shaft Encoders, CCD Sensors, Optical Probe for Metrology, Vision System

Hydraulic and pneumatic drives- Drive Circuits, open and closed loop control, Piezoelectric and magnetostrictive actuators

Micro mechatronics systems-Case studies - examples of Mechatronic systems from Robotics, Manufacturing, Machine diagnostics, Road vehicles and medical technology.

REFERENCES

1. *Massood Tabib- Azar, "Microactuators- Electrical, Magnetic, Thermal, Optical, Mechanical, Chemical and smart structures", Kluwer Acadmic Publishers, 1997.*
2. *Banks, H.T., Smith, R.C., and Wang, Y., "Smart material structures - Modeling, Estimation and Control", John Wiley & Sons,1996.*
3. *Stadler, "Analytical Robotics and Mechatronics", McGraw Hill International Edition, 1995.*

PR 457 MANUFACTURING COSTS AND ANALYSIS

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

Methods & 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 & 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.

REFERENCES

1. *Naran and Kumar, "Production and Costing", Khanna publishers, New Delhi, 1978.*
2. *Buffa, "Modern Production & Operations Management", John wiley and sons, 1983.*
3. *Ivan R.Vounon, "Realistic cost estimating or manufacturing", Society of manufacturing engineers, USA.*

PR 458 VALUE ENGINEERING

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.

REFERENCES

1. *Parker, D.E., "Value Engineering Theory", Sundaram publishers, 1990.*
2. *Miles, L.D., "Techniques of Value Engineering and Analysis", McGraw Hill Book Co., 2nd End., 1972*
3. *Khanna, O.P., "Industrial Engineering and Management", Dhanpat Rai & Sons, 1993.*

PR 459 MACHINE TOOL TECHNOLOGY

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 stepless 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.

REFERENCES

1. *Sen, G.C. & Bhattacharya, A., "Principles of machine tools", New Central Book Agency, Calcutta, 1988.*
2. *Chernov N Machine Tools Mir publishers Moscow, 1984.*

3. *Mehta, N.K., "Machine tool design", Tata McGraw Hill Co., N.Delhi , 1989.*

ME 471 REFRIGERATION AND AIR-CONDITIONING

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.

REFERENCES

1. *Manohar Prasad "Refrigeration and Air-conditioning", New Age International, 1996.*
2. *Kothandaraman, C.P. "Refrigeration and Air-conditioning", Dhanpat Rai & Sons, 1991.*
3. *Arora, S.C. and Domkundwar, S. "Refrigeration and Air- Conditioning", Dhanpat Rai & Sons, New Delhi, 1997.*

ME 472 FINITE ELEMENT METHOD

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.

REFERENCES

1. *Larry J Segerlind ," Applied Finite Element Analysis", John Wiley, 1984*
2. *K.J.Bathe, "Finite Element Procedures", Prentice Hall, 1994.*
3. *Huebner and E.A.Thornton, "The Finite Element Method for Engineers", John Wiley, 1982.*

MB 471 FINANCIAL MANAGEMENT

Financial management – Nature, Scope, Objectives, Decisions

Management of current asset

Short and intermediate financing

Capital investment and evaluation

Long term financing

REFERENCES

1. *Prasanna Chandra, K., "Fundamendals of Financial Management" Tata McGraw Hill Publishing Company, 1993.*
2. *Van Horne, J.C., Fundamental of financial management, P.Hall.p.Ltd., 1977*

HM 352 CORPORATE COMMUNICATION

Communication in the corporate world – Communication process – Networks and channels of Communication – Technology for Communication

Role of psychology – Motivation speech mechanics – Mental process of speacking – Extempore speech practice

Group dynamics – seminar & presentation skills and interview strategies – Listening skills & practice – Familiarity to accents and tones – Varieties of styles & Registers

Mechanics of technical writing – report & Executive summary – Abstracts, Circulars & Notices – Proposals, Agenda & Minutes

Papers for Presentation – Marketing language.