APPROVED

SCHEME & SYLLABUS

FOR

B.TECH.
INDUSTRIAL ENGG AND MANAGEMENT
BATCH 2010 ONWARDS

PUNJAB TECHNICAL UNIVERSITY

Approved Scheme for B.Tech.(Industrial Engg& Management) Batch 2010 onwards

3rd Semester B.Tech. Industrial Engg & Management

CODE	TITLE	L	T	P	INT	EXT	TOTAL	EX TIME
IE 201	Strength of Materials	3	1	--	40	60	100	3 hrs
IE 211	Strength of Materials Lab	--	--	2	30	20	50	
IE 203	Theory of Machines	3	--	--	40	60	100	3 hrs
IE 213	Theory of Machines Lab	--	--	2	30	20	50	
ME 205	Engineering Materials &Metallurgy	3	1	--	40	60	100	3 hrs
ME 213	Engineering Materials &Metallurgy Lab	--	--	2	30	20	50	
ME 207	Machine Drawing	1	--	6	40	60	100	4hrs
IE 205	Applied Thermodynamics	3	1	--	40	60	100	3 hrs
IE 215	Applied Thermodynamics Lab	--	--	2	30	20	50	
IE 209	Manufacturing Process - I	3	--	--	40	60	100	3 hrs
IE 217	Workshop Training*	--	---	--	60	40	100	
	Advisory Meeting	--	--	1				
	TOTAL	16	3	13	390	480	850	

Total Contact hours: 32

* Workshop Training will be imparted in the Institution at the end of second semester for 04 weeks duration (Six hours per day and six days a week). Industrial tour will also form part of this training.

4th Semester B.Tech. Industrial Engg & Management

CODE	TITLE	L	T	P	INT	EXT	TOTAL	EX TIME
IE 202	Probability and Statistics (**same as IE 306)**	3	1	--	40	60	100	3 hrs
IE 208	Production Planning & Control	3	1	--	40	60	100	3 hrs
IE 210	Manufacturing Processes - II	3	--	--	40	60	100	3 hrs
IE 218	Manufacturing Processes Lab	--	--	2	30	20	50	
IE 206	Principles of Engg Economics and Management Techniques	3	1	--	40	60	100	3 hrs
IE 222	Machine Design	3	1	--	40	60	100	4 hrs
IE 224	Machine Design Practice	--	--	2	30	20	50	
IE 226	Fluid Mechanics	3	1	--	40	60	100	3 hrs
IE 228	Fluid Mechanics Lab	--	--	2	30	20	50	
IE 230	Comp. Aided Drafting Lab	--	--	2	30	20	50	
	General Fitness	--	--	--	100	--	100	
	Advisory Meeting	--	--	1				
	TOTAL	18	5	9	460	440	900	

Total Contact hours: 32

Industrial Training in reputed industries will be arranged for 6 weeks duration at the end of fourth semester

5th SemesterB.Tech. Industrial Engg & Management

CODE	TITLE	L	T	P	INT	EXT	TOTAL	EX TIME
IE 303	Product Design & Process Planning	3	--	--	40	60	100	3 hrs
IE 313	Product Design & Process Planning Lab	--	--	2	30	20	50	
IE 305	Inspection & Quality Control	3	1	--	40	60	100	3 hrs
IE 315	Inspection & Quality Control Lab	--	--	2	30	20	50	
IE 307	Facility Layout and Design**(same as IE 1.01)**	3	1	--	40	60	100	3 hrs
IE 325	CAD/CAM	3	1	--	40	60	100	3 hrs
IE 327	CAD/CAM Lab	--	--	2	30	20	50	
ME 307	Mechanical Measurements & Metrology	3	--	--	40	60	100	3 hrs
ME 317	Mech Measurements & Metrology Lab	--	--	2	30	20	50	
	Department Elective - I	3	1		40	60	100	3 hrs
IE 323	**Industrial Training	--	--	--	60	40	100	
	Advisory Meeting	--	--	1				
	TOTAL	18	4	9	420	480	900	

Total Contact hours: 31

*** Industrial Training in reputed industries will be arranged for 6 weeks duration at the end of fourth semester*

6th SemesterB.Tech. Industrial Engg & Management

CODE	TITLE	L	T	P	INT	EXT	TOTAL	EX TIME
IE 310	Materials Management**(same as IE 1.04)**	3	1	--	40	60	100	3 hrs
IE 320	Operation Research	3	--	--	40	60	100	3 hrs
IE 304	Work Study and Ergonomics	3	--	--	40	60	100	3 hrs
IE 314	Work Study and Ergonomics Lab	--	--	2	30	20	50	
	Department Elective – II	3	1	--	40	60	100	3 hrs
IE 308	Simulation Modeling and Analysis	3	1	--	40	60	100	3hrs
IE 318	Simulation Modeling and Analysis Lab	--	--	2	30	20	50	
IE 322	Industrial Automation and Robotics	3	1	--	40	60	100	3 hrs
IE 324	Industrial Automation and Robotics Lab	--	--	2	30	20	50	
	General Fitness	--	--	--	100	--	100	
	Advisory Meeting	--	--	1				
	TOTAL	18	4	7	430	420	850	

Total Contact hours: 29

7th/8th SemesterB.Tech. Industrial Engg & Management

Course	Internal	External	Total
Industrial Training for one semester	500	500	1000

7th/8th Semester B.Tech. Industrial Engg& Management

CODE	TITLE	L	T	P	INT	EXT	TOTAL	EX TIME
IE 404	Maintenance & Reliability Engg	3	1	--	40	60	100	3 hrs
	Department Elective – III	3	--	--	40	60	100	3 hrs
	Department Elective – IV	3	1	--	40	60	100	3 hrs
	Open Elective	3	1	--	40	60	100	3 hrs
IE 416	Supply Chain Management **(same as IE 2.04)**	3	1	--	40	60	100	3 hrs
IE 408	Marketing and Financial Management **(same as IE 1.06 and IE 309)**	3	1	--	40	60	100	3 hrs
IE 414	Project	--	--	6	120	80	200	
	General Fitness	--	--	--	100	--	100	
	Advisory Meeting	--	--	1				
	TOTAL	18	5	7	460	440	900	

Total Contact hours: 30

List of Departmental Electives - I

IE 351 Total Quality Management
IE 353 Networks and Project Management **(same as IE 204)**
IE 355 Technology Management
IE 357 Value Engineering
IE 359 Knowledge Management
IE 361 Emerging Trends in Manufacturing Technology

List of Departmental Electives - II

IE 352 Smart Materials and Nano Technology
IE 354 Advanced Industrial Inspection and Non Destructive Testing
IE 356 Automobile Engineering
IE 358 Vibration & Noise Control
IE 360 Jigs, Fixtures and Tool Design
IE 362 Industrial Instrumentation and Control
CE216 Environmental Science (Compulsory for 2010 batch only)

List of Departmental Electives - III

IE 451 Strategic Management
IE 452 Lean Management
IE 453 Industrial Safety & Environment
IE 454 Organizational Behavior
IE 455 Operation Research-II
IE 456 Advanced Industrial Psychology

List of Departmental Electives - IV

IE 461 Soft Computing
IE 462 Management Information System
IE 463 Design of Experiments
IE 464 Management & Entrepreneurship
IE 465 Design for Manufacturing / Assembly
IE 466 Finite Element Analysis

Syllabus of **IE 202** is same as the syllabus of **IE 306**
Syllabus of **IE 307** is same as the syllabus of **IE 1.01**
Syllabus of **IE 310** is same as the syllabus of **IE 1.04 and IE 2.14**
Syllabus of **IE 416** is same as the syllabus of **IE 2.04**
Syllabus of **IE 408** is same as the syllabus of **IE 1.06 and IE 309**
Syllabus of **IE 208** is same as the syllabus of **IE 302**

IE 201 STRENGTH OF MATERIALS

1. **Simple stresses and strains :** Concept of stress and strain; stress and strain diagram, Hooke's law, Young's modulus, Poisson ratio, stress at a point, stress and strains in bars subjected to axial loading. Modulus of elasticity, stress produced in compound bars subject to axial loading. Temperature stress and strain calculations due to applications of axial loads and variation of temperature in single and compound walls. Compound stress and strains, the two dimensional system, stress at a point on a plane, principal stresses and principal planes; Mohr's circle of stress.
2. **Bending moment and shear force diagrams:** S.F and B.M definitions. BM and SF diagrams for cantilevers, simply supported beams with or without overhangs and calculation of maximum BM and SF under the following loads: Concentrated loads, Uniformity distributed loads over the whole span or part of span, Combination of concentrated loads and uniformly distributed loads, Relation between rate of loading, shear force and bending moment.
3. **Theory of bending:** stresses in beams due to bending, assumptions in the simple bending theory, derivation of formula: its application to beams of rectangular, circular and channel sections.
4. **Torsion:** Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts torsional rigidity, combined torsion and bending of circular shafts principal stress and maximum shear stresses under combined loading of bending and torsion.
5. **Spring and Strain energy:** Analysis of close and open coiled-helical springs, Introduction to leaf and spiral spring (theory only), Strain energy, calculation of strain energy of different basic systems, Castigliano's theorem.
6. **Thin and thick cylinders:** Derivation of formulae and calculation of hoop stress, longitudinal stress in a thin cylinder and sphere subjected to internal pressure. Derivation of Lame's equations, calculation of radial, longitudinal and hoop stresses and strains due to internal pressure in thick cylinders, compound cylinders.
7. **Theories of Failure:** Maximum principal stress theory, maximum shear stress theory, Total strain energy theory, shear strain energy theory, graphical representation of these theories.(Theory only)

BOOKS RECOMMENDED:

1. Strength of Materials by DS Bedi
2. Strength of Materials by Sadhu Singh
3. Mechanics of Materials by SI Version, end edition by Ferdinand P. Beer and E Russel Johnston (Jr); McGraw Hill, India

IE 211 STRENGTH OF MATERIALS LAB

1. To perform tensile test in ductile and brittle materials and to draw stress-strain curve and to determine various mechanical properties.
2. To perform compression test on C.I. and to determine ultimate compressive strength.
3. To perform shear test on different materials and determine ultimate shear strength.
4. To perform any one hardness test (Rockwell, Brinell & Vicker's test) and determine hardness of materials.
5. To perform impact test to determine impact strength.
6. To perform torsion test and to determine various mechanical properties.
7. Study of performance of Fatigue & Creep tests
8. To perform bending test on beam (wooden or any other material) and to determine the Young's modulus and Modulus of rupture
9. To perform Torsion test and close coiled helical spring in tension and compression and to determine modulus of rigidity/stiffness
10. Determination of Bucking loads of long columns with different end conditions.

IE 203 THEORY OF MACHINES

1. **Basic Concept of machines:** link, mechanism, kinematic pair and chain, principles of inversion, inversions of a four bar chain, slider-crank-chain and double slider-crank chain, kinematic pairs, Graphical method for finding: Displacement, velocity, and acceleration of basic mechanisms.
2. **Belts, Ropes and Chains**: Material, types of drives, idler pulley, intermediate or counter shaft pulley, angle drive, quarter turn drive, velocity ratio, crowning of pulleys, loose and fast pulley, stepped or cone pulleys, ratio of tension on tight and slack sides of belts. HP transmitted by belts including consideration of creep and slip, centrifugal tensions and its effect on HP transmitted. Length of belt, rope and chain drives.
3. **Brakes, Dynamometers and Clutches**: Types of brakes, principle, function of brakes of various types. Problems to determine braking capacity, types of dynamometer: absorption, transmission and driving. Function of Clutches. Disc and Cone clutches.
4. **Gears & Gear Trains**: Toothed gears and spur gears, types of toothed gears, definitions: pitch circle diameter, pitch surface, pitch point, circular pitch, module, pitch, diametrical pitch, addendum, dedendum, clearance, outside and internal diameters, root diameter, base circle diameter, face and flank of tooth, pressure angle, path of contact, arc of contact, conditions for correct gearing, Types of gear trains, simple, compound and epicyclic gear trains, problems involving their applications.
5. **Balancing**: Classifications, need for balancing, balancing of single and multiple rotating masses, static and dynamic balancing, primary and secondary balancing for reciprocating masses, partial balancing of locomotives, swaying couple, hammer blow, variation in tractive effort, balancing of V-engine, concept of direct and reverse crank.
6. **Cams:** Types of cams and follower, definitions of terms connected with cams, displacement velocity and acceleration diagrams for cam followers. Analytical and Graphical design of cam profiles with various motions (SHM, uniform acceleration and retardation, cycloidal).
7. **Flywheels**: Turning moment and crank effort diagrams for reciprocating machines Fluctuation of speed, coefficient of fluctuation of speed and energy, Determination of flywheel effect.
8. **Gyroscopic motion and gyroscopic couples:** Effect on supporting and holding structures of machines, Effect on 2 and 4 wheeled vehicles,

BOOKS RECOMMENDED:

1. Theory of Machines by SS Rattan,Tata Mc. Graw Hill
2. Theory of Machines by Shigley, McGraw Hill
3. Theory of Machines by R.S.Khurmi, S.Chand and Sons
4. Theory of Machines by PL Ballaney, Khanna Publishers
5. Theory of Machines by W. G. Green, Blackie& Sons
6. Theory of Mechanisms & Machines by JagdishLal, Metropolitan Book Co. Pvt. Ltd, New Delhi.

IE 213 THEORY OF MACHINES Lab

1. Study of various links and mechanisms.
2. Study and draw various inversions of 4- bar chain and single slider crank chain.
3. Draw velocity and diagram of engine mechanism using graphical methodsincluding Klien's construction.
4. Conduct experiments on various types of governors and draw graphs betweenheight and equilibrium speed of a governor.
5. Determination of gyroscopic couple (graphical method).
6. Balancing of rotating masses (graphical method)
7. Determination vibration characteristics of free and forced spring mass systemwith and without damping.
8. Cam profile analysis (graphical method)
9. Determination of gear- train value of compound gear trains and Epicyclic geartrains.
10. Study pressure distribution in a full journal bearing.

ME-205 ENGINEERING MATERIALS & METALLURGY

1. Atomic structure of metals crystal structure, crystal lattice of (i) Body centeredcubic (ii) face centered cubic (iii) closed packed hexagonal, crystallographicnotation of atomic planes, polymorphism and allotropy, solidification ofcrystallization (i) nuclear formation (crystal growth) (ii) crystal imperfectionElementary treatment of theories of plastic deformation, phenomenon of sliptwinning, dislocation, identification of crystallographic possible slip planes anddirection in FCC, BCC, C.P., recovery, re-crystallization, preferred orientationcauses and effects on the property of metals.
2. Introduction to Engineering materials, their mechanical behaviour, testing andmanufacturing properties of materials, physical properties of materials,classification of engineering materials.
3. General principles of phase transformation in alloys, phase rule and equilibriumdiagrams, Equilibrium diagrams of Binary system in which the componenets forma mechanical mixture of crystals in the solid state and are completely mutuallysoluble in both liquid state. Equilibrium diagrams of a systems whosecomponents have complete mutual solubility in the liquid state and limitedsolubility in the solid state in which the solid state solubility deceases withtemperature. Equilibrium diagram of alloys whose components have completemutual solubility in the liquid state and limited solubility in solid state(Alloy with aperitectic transformation) Equilibrium diagrams of a system whose componentsare subject to allotropic change. Iron carbon equilibrium diagram. Phasetransformation in the iron carbon diagram (i) Formation of Austenite (ii)Transformation of austenite into pearlite (iii) Martensite transformation in steel,time temperature transformation curves.
4. Principles and applications of heat treatment processes viz. annealing,normalizing hardening, tempering; harden ability & its measurement, surfacehardening processes. Defects in heat treatment and their remedies; effectsproduced by alloying elements (Si, Mn. Ni. Cr. Mo. Wc. Al) on the structures andproperties of steel. Composition of alloy steels.

BOOKS RECOMMENDED:

1. Engg. Physical Metallurgy Y. Lakhin, Mir Publishers
2. Heat treatment of metals B. Zakharv
3. Engineering Metallurgy V. Raghavan

ME-213 ENGINEERING MATERIALS & METALLURGY LAB

1. Study of different Engineering materials and their mechanical properties.
2. To study the microstructures of the following materials
   i) Hypo Eutectoid & Hyper Eutectoid steels.
   ii) Hypoeutectic cast iron and hyper eutectic cast iron.
   iii) Grey and white cast iron
   iv) Non – ferrous metals i.e. Al. Mg. Cu. Ni. Son.And their alloys.
3. Study of iron carbon diagram and its engineering applications.
4. Annealing of steel, effect of annealing temperatures and time on hardness.
5. Study of microstructure and hardness of steel at different rates of cooling.
6. Hardening of steel, effect of quenching minimum and agitation of the medium onhardness.
7. Effect of carbon percentage on the hardness of steel.
8. Harden ability test by Jominy's End quench test.
9. Normalizing tempering of steel components.
10. To study the case hardening processes i.e. carburizing, Nitriding, cyaninding etc.
11. To study and construct the T-T- T diagram for steels.

ME-207 MACHINE DRAWING

1. Principles of drawing, requirements of production drawing, , sectioning and conventional representation, dimensioning, symbols of standard tolerances ,machining symbols, Introduction and familiarization of the code IS:296.
2. FASTENERS : Various types of screw threads, types of nuts and bolts, screwed fasteners, welding joints and riveted joints
3. Assembly and Dis-assembly of the following manually and using computer aided drafting.
   a) Couplings: Solid or rigid Coupling, Protected type flange coupling, Pin type flexible coupling, muff coupling, Oldham, universal coupling, claw coupling, cone friction clutch, free hand sketch of single plate friction clutch.
   b) Knuckle and cotter joints
   c) Pipe and Pipe fittings: flanged joints, spigot an socket joint, union joint, hydraulic and expansion joint
   d) IC Engine Parts : Piston, connecting rod
   e) Boiler Mountings : steam stop valve, feed check valve, safety valve, blow off cock.
   f) Bearings : swivel bearing, thrust bearing, plummer block, angular plumber block
   g) Miscellaneous : Screw Jack, Drill Press Vice, Crane hook.
4. Drafting of simple mechanical components on computer.

NOTE :

1. Drawing Practice is to be done as per IS:296 code.
2. First angle projection to be used. Drawings should contain bill of materials and should illustrate finish. The syllabus given above indicates the broad outlines and the scope of the subject to be covered. It is not necessary to cover all the drawing exercises of the types of machine tools mentioned above.

BOOKS RECOMMENDED::

1. Text-book of Machine Drawing by V Lakshmi Narayanan and Mathur
2. Machine Drawing by PS Gill, BD Kataria and Sons, Ludhiana
3. Machine Drawing by ND Bhatt, Charotar publications
4. Machine Drawing by N Sidheshwar, Tata McGraw Hill

IE 205 APPLIED THERMODYNAMICS

1. **Properties of Steam and Steam Generators**: Pure substance constant pressure formation of steam, steam tables, constant volume, constant pressure and isentropic processes, simple Rankine cycle. Steam Generators Classification, Fire and water tube boilers; Description of Cochran, Locomotive, Lancashire, Babcock and Wilcox boilers, Stirling Boiler, mountings and accessories, Modern high pressure boilers, boiler performance-equivalent evaporation, boiler efficiency.
2. **I.C Engines & Gas Turbines**: Classifications of I.C. engines Working of two and Four stroke petrol and diesel engines, Measurement of BHP, IHP, mechanical and thermal efficiency, Specific fuel consumption. Elementary idea of combustion phenomenon in S.I. and C.I. engines. Description of simple carburetor, fuel pump and injector. Magneto and battery ignition system. Simple Brayton Cycle, Description of open cycle Gas turbines, comparison of I.C. Engines and gas turbines and their applications.
3. **Air Compressors:** Use of compressed air in industry, Classification of air compressors, Operation of single stage reciprocating compressors, comparison of rotary compressors with reciprocating processors; Comparison of axial flow compressor with centrifugal compressor, field of application of axial and centrifugal flow compressors.
4. **Steam turbines**: Classification, Impulse Steam Turbines**,** General description, Pressure and velocity compounding, Velocity diagram and work done, Effect of blade friction on velocity diagram, Stage efficiency and overall, efficiency, Reheat factor and condition curve, Reaction Turbines, Degree of reaction, velocity diagrams; Blade efficiency and its derivation; calculation of blade height; losses in steam turbines; Governing of steam turbines.
5. R**efrigeration and Air conditioning**: Description of simple Vapour compression and Vapor absorption cycles, relative merits and demerits, Properties of refrigerants, Elementary idea of ozone friendly refrigerants, Concept of Psychrometry, Definitions of psychometric terms i.e. dry air, moist air and saturated air, absolute humidity, relative humidity ratio or specific humidity, degree of saturation, Dew point temperature, Dry bulb temperature and wet bulb temperature. Psychometric charts.
6. Heat transfer: Concept of heat transfer, Difference between the subject of "Heat Transfer" and its parent subject "Thermodynamics". Different modes of heat transfer – conduction: Fourier's law of heat conduction, coefficient of thermal conductivity, effect of temperature and pressure on thermal conductivity of solids, liquids and gases. Convection: Introduction to free and forced convection. Radiation: Process of heat flow, definition of emissivity, absorptivity, reflectivity and transmissivity. Concept of black and grey bodies.

Recommended Books:

1. Fundamentals of Engg. Thermodynamics by John R.Howell & Richrd O Buckius McGraw Hill International
2. Heat Engineering by VP Vasandani and DS Kumar; Metropolitan Book Co. Pvt Ltd., Delhi
3. Thermodynamic and Heat Engines, Vol II by R Yadav
4. Applied Thermodynamics by TD Eastop & A Mc Conkey, ELBS Publications
5. Refrigeration & Air Condition by C.P. Arora
6. Fundamentals of Heat and Mass transfer by DS Kumar, SK Kataria and Sons, Delhi

IE 215 APPLIED THERMODYNAMICS Lab

1. To Study 2 stroke and 4 stroke Petrol and Diesel engines
2. To draw valve timing diagram of a diesel engine and study of its impact on the performance of an IC Engine.
3. Study of various circuits of a carburettor fitted on Indian Make Vehicle.
4. Study of various types of Boilers, Boiler trial: Estimation of equivalent evaporation and efficiency of a fire tube/ water tube boiler.
5. Determination of dryness fraction of steam and estimation of brake power, Rankine efficiency, relative efficiency, generator efficiency, and overall efficiency of a steam engine/ steam turbine unit and plotting of William line.
6. Determine the brake power, indicated power, friction power and mechanical efficiency of a multi-cylinder petrol engine running at constant speed (Morse Test).
7. Performance of a diesel/ semi diesel engine from no load to full load (at constant speed) for a single cylinder/ multi- cylinder engine in terms of brake power, indicated power, mechanical efficiency and SFC (Specific fuel consumption) and further obtain power consumption curves and draw the heat balance sheet.
8. Performance of single stage/ multi stage reciprocating compressor.

IE 209 MANUFACTURING PROCESS –I

CASTING PROCESSES

Introduction to metal casting types of patterns, their materials and allowances.

Moulding materials: Moulding sand compositions and moulding sand properties, sand testing types of moulds, moulding machines cores core sands, types of cores, core banking elements of gating system, and risers and their design. Cupola and its operation charge calculations types of furnaces,

Casting processes: sand casting, shell mould casting investment casting, permanent mould casting, full mould casting, vacuum casting. Die casting. Centrifugal casting, Continuous casting.

Casting defects, their causes and remedies.

Metallurgical considerations in casting, Solidification of metals and alloys, directional solidification, segregation, nucleation and grain growth, critical size of nucleus, casting of copper alloys.

Cleaning and finishing of castings, Testing and Inspecting of castings.

WELDING

Welding introduction and classification of welding, processes, welding terminology, general principles, welding positions, filler metals.

Gas welding and gas cutting, principle, oxyacetylene welding equipment oxyhydrogen welding. Flame cutting.

Electric arc welding: Principle, equipment, types- MIG, TIG submerged arc and others.

Welding electrodes, classification and selection of electrodes, welding arc and itscharacteristics, arc stability, arc blow. Thermal effects on weldment. Heat affected zone grain size and its control.

Resistance welding- principle and their types i.e. spot, seam, projection, upset and flash

Thermit welding, electro slag welding, friction welding, plasma are welding electron beam welding, atomic hydrogen welding. Basic considerations in joint design,

Welding defects, their cases and remedies.

Brazing, braze welding and soldering.

BOOKS RECOMMENDED::

1. Heine, R.W. C.R. Loper and P.C. Rosenthal, Principles of metal casting McGraw Hill New York- 1967
2. Welding Technology by R.S. Parmar, Khanna Publishers.

IE 202 PROBABILITY AND STATISTICS

Concept of statistics, collection and representation of data, frequency distribution, graphical representation of data, measure of central tendency and dispersion, coefficient of dispersion, moments, factorial moments, skewness and kurtosis.

Different approaches to probability, addition and multiplication theorem of probability, Boole's inequality, conditional probability, Bayes theorem and applications, Moment generating functions

Random variables – discrete and continuous, distribution function, probability mass function, probability density function, two dimensional random variables, mathematical expectation, expectation of discrete and continuous random variables, properties of expectation, conditional expectation.

Discrete and Continuous Probability Distribution: Binomial, Poisson, Normal, Exponential.

Correlation analysis, Regression analysis, Curve fitting using least square method.

Sampling and sampling distribution: chi-square, student-t and F-test.

BOOKS RECOMMENDED::

1. Bhattacharya G.K. and Johnson R.A.: Statistical Concepts and Methods, John Wiley, New Delhi, 2002.
2. Hogg R. V. And Elliot A.T," Probability and Statistical Inference", Pearson Education, 6th Edition.
3. Hogg R V, Craig A T ,"Introduction to Mathematical Statistics", Siixth Edition, Pearson Education, Delhi

IE 208 PRODUCTION PLANNING & CONTROL

Production Planning: Production planning objectives and functions Bill of material. Capacity and manpower requirement planning; Operation analysis and process planning, long range planning, Aggregate planning: objectives, strategies, Master Production Scheduling (MPS), MRP & MRP II systems.

Production control: Objectives of production control, Production control functions: Routing, scheduling, dispatching, expediting and follow up. Techniques of production control in Job shop production, batch production and mass production systems.

Process Planning: Basic types of processes, Manufacturing operations and their analysis, Basic factors influencing process planning, Procedure for process planning, Advantages of process planning

Forecasting: characteristics of demand over time, forecasting qualitative model: Delphi, naïve quantitative models: simple average, simple moving average, weighted moving average, exponential smoothing, smoothing coefficient selection, adaptive exponential smoothing, incorporating trend and seasonal components, linear regression, selection of forecasting models.

Material Management: Objectives: Scope and functions of material management, planning, procurement, storing, handling and Inventory control. Purpose of inventories, Inventor y costs, Inventory control systems; Selective inventory control system, Determination of E.O.Q., lead time and recorder point: Methods of physical stock control.

Maintenance Systems: Types of Maintenance, objectives of maintenance, planned maintenance strategies: preventive maintenance, condition monitoring and total productive maintenance.

Manufacturing planning & Control systems: JIT, CIM and WCM.

Learning curves in services and manufacturing: Applying the learning curve, arithmetic approach, logarithmic approach, learning - curve coefficient approach; strategic implications & limitations of learning curves.

BOOKS RECOMMENDED:

1. Vollmann Thomas E, Bery William L, Why bark D Clay, "*Manufacturing Planning and Control Systems*" Galgotia Publications, New Delhi (2002).
2. Buffa, "*Modern Production/operations Management*", Wiley Eastern, New York (1999).
3. Muhlemann Alan, Oakland John and Lockyer Keith, "*Production and Operations Management*", Macmillan India Publications Ltd. (2001)
4. PanneerSelvanR,"*Production and Operation Management*", Prentice Hall India, New Delhi (2002).
5. Aswathappa K and Bhat K Shridhara, "*Production and Operations Management*", Himalaya Publishing House, Mumbai (2002).

IE 210 MANUFACTURING PROCESSES-II

Metal Forming:

Introduction : Classification of forming processes,

Rolling : Classification of rolling processes, rolling mills, products of rolling and mainvariables, rolling defects,

Drawing : Drawing of rods, wires and tubes, Draw benches, main variables in drawing operations.

Forging : Open and closed die forging, forging operations, hammer forging, press

forging and drop forging, forging defects, their causes and remedies.

Extrusion : Classification of extrusion processes, extrusion equipment, variables in extrusion process.

Introduction to high velocity forming.

Sheet metal forming operations : Spinning, deep drawing, bending.

Introduction to press working. Types of presses, press working operation, Press working tools.

Introduction to powder metallurgy, methods of producing powders, briquetting and sintering, sizing and finishing operations,

Metal cutting and Machine tools

Cutting tool materials, high carbon steels, alloy carbon steels, high speed steel, cast alloys, cemented carbides, ceremics and diamonds, CBN etc. Geometry of single point cutting tools, Twist Drill and milling cutter, cutting speeds and feeds

Coolants: Classification, purpose, its effect on speed and feed

Lubricants: Function and properties

Lathe: Machine and its accessories, Lathe operations, Turning, Taper Turning and Thread cutting, kinematic scheme of lathe, shaping and planing Machine, Drive Mechanisms, slotting machine, cutting speeds and feeds

Milling machine and its classification, upmilling and down milling

Indexing: Simple compound and differential
Sawing Machine and Drilling Operation
Boring Operation and boring machines
Grinding: Cylindrical, surface and centreless grinding
Composition and nomenclature of grinding wheels
Introduction to broaching machine

Recommended Books

1. Manufacturing Technology: Foundry, Forming and Welding by Rao, Tata McGraw Hill, New Delhi.
2. Principles of Manufacturing Materials and Processes by J.S. Campbell, Tata McGraw Hill.
3. Metal forming fundamentals and applications by Alton.

IE 218 MANUFACTURING PROCESSES LAB

1. To study ingredients of molding sand and core sand.
2. To determine clay, moisture content and shatter index of a moulding sand sample.
3. To test tensile, compressive, transverse strength of moulding sand in dry condition.
4. Determination of permeability of a moulding sand sample.
5. Specimen preparation and making of lap joint, Butt, T- joints with oxy- acetylene gas welding.
6. Making of lap, Butt, T- joints etc. with electric arc welding.
7. Study of lubrication system in the machine tools.
8. Advanced exercises on Lathe where the students will work within specified tolerances, cutting of V- threads and square threads (internal as well as external).
9. Production of machined surfaces on shaper and planner.
10. Exercises on milling machines; generation of plane surfaces, production of spur gears and helical involute gears, use of end mill cutters.
11. Grinding of single point cutting tool, cutter and drills.
12. Identification of different cutting tool and work materials.

IE 206 PRINCIPLES OF ENGG ECONOMICS AND MANAGEMENT TECHNIQUES

Cost analysis: Break-even analysis, two and three alternatives, graphical solution. Breakeven charts, effects of changes in fixed and variable costs. Minimum cost analysis, economics order quality. Effect of risk and uncertainty on lot size.

Replacement Studies: Reasons for replacement, factors to be considered in replacement Studies, discounted cash flow analysis, economic life of a project, challenger and defender.

Economic Analysis of Investment Alternatives : Basic economy study patterns and their comparison, decision making in selection of alternative by present worth methods, rate of return method, payout period method and uniform annual cost method, economic analysis of new projects, effect of taxation on economic studies.

Cost Estimation: Difference between cost estimation and cost accounting, qualifications of an estimator. Estimating procedure, Estimate of material cost and labour cost. Estimation of cost in various manufacturing operations.

Depreciation : Types of depreciation and their Methods.

Human Resource Management : Introduction to Human Resource Management and its definition, Functions of Human Resource Management & its relation to other managerial. Importance of Human Resource in Industry.

Procurement And Placement : Need for Human Resource Planning process of Human Resource Planning, Method of Recruitment, Psychological tests and interviewing, Meaning and Importance of placement and Induction.

Training &Development : Difference between Training and Development, Principles of Training, Employee Development, Promotion merit V/S seniority performance appraisal

Job Satisfaction : Job satisfaction and its importance, Motivation Factor affecting motivation, Introduction of motivation Theory, workers participation, Quality of working like.

Integration & Maintenance: Introduction to Integration and Maintenance.

RECOMMENDED BOOKS

1. Drawin B. Flippo Principles of personnel Management (MC Graw Hill)
2. Michael J. Jucius Personnel Management (Richard D. Inwin, Homewood)
3. R.C.SaxenaLabour Problems and Social Welfare (K. Math & Co. Meerut)
4. T.N. Bhagooiwal Economics of Labour and Industrial Relations (SahityaBhawan Agra)
5. Engineering Economy : ThuesenPnentice Hall
6. A. Minappa and Personnel Managements M.S. Saiyada (Tata McGraw Hill)
7. C.B. Mamoria Personnel Management (Himalaya publishing house Bombay)
8. Engg. Economics Analysis Bullinger
9. Introduction to Econometrics : Kliwen Prentice Hall

IE 222 MACHINE DESIGN

Meaning of design with special reference to machine design. Definition and understanding of various types of design, Elaborated Design process

Design and creativity ; Systematic design conceptualization, product design definition, underlying principles of design in Aesthetics and ergonomics, free body diagram for components design

General Design Considerations:

a) Concept of tearing, bearing, shearing, crushing, bending etc.

b) Selection of materials, Basic criteria of selection of material, their designation, mechanical properties of those materials in brief.

c) Study of Stress concentration, factor of safety under different loading conditions, **Basic Design:**

Design for static loading, design for variable loading for both limited and unlimited life, concept of fatigue and endurance strength.

Design of fasteners:

a) RIVETS: Desing of rivets for boiler joints, lozenge joints (uniform strength joint), eccentrically loaded riveted joints

b) BOLTS: Understanding the various stresses/ failure in bolted joints, design of cylindrical covers, basic and eccentrically loaded bolts

c) WELDS: Design for various loading conditions in torsion, shear or direct load, eccentrically loaded welded joints.

d) MISCELLENEOUS: Design of spigot and socket cotter joint, Gib and Cotter joint and knuckle joint.

Design of Transmission Shaft

Design of both solid and hollow shafts for transmission of torque, bending moments and axial forces, Design of shaft for critically speed, Design of shaft for rigidity and Design of stepped shafts for assembly

Design of Keys and Couplings:

Design of sunk keys under crushing and shearing, design of splines, design of sleeve and solid muff coupling, clamp or compression coupling, rigid and flexible flange coupling, design of universal joint

Design of spur, helical, straight bevel gears, worm and worm wheel

Design of Close-coil, Helical and Leaf springs

BOOKS RECOMMENDED:

1. Machine Design by Shigley Tata McGraw hill
2. Machine Design by Juvinal, John-Wiley Publishers
3. Machine Design by Spots, Prentice hall
4. Machine Design by Norton, Prentice Hall
5. Machine Design by Khurmi
6. Machine Design by Goyal and Bahl, Standard Publishers
7. Product Design and Development, Prentice Hall
8. Design Data Book Compiled by PSG College of Engineering & Technology, Coimbatore

Note: Design data book is not allowed in examination.

IE 224 MACHINE DESIGN PRACTICE

Select a daily use product and design the conceptual design by applying the design process talking the controlling parameters

Make a list of mechanical components and know their materials and suggest some alternative materials for the each on of them

Design a wall bracket, which is being used in real life by actual measurement of load

a. Welded joints
b. Riveted and bolted joints

and justify your findings

4. Find a flange coupling in the college laboratory and justify its design by actual measurements
5. Design a shaft used in some practical application, by actual working and loading conditions
6. Select a braking system lever (both hand and foot lever) and justify the design parameters
7. Justify the design of single plate clutch of a engine assembly
8. Design a software in some high level language or excel sheets for design of a component

IE 226 FLUID MECHANICS

1. Fluid and their properties: Concept of fluid, difference between solids, liquids and gases; ideal and real fluids; capillarity, vapour pressure, compressibility and bulk modulus; Newtonian and non-Newtonian fluids.

2. Fluid Statics: Concept of pressure, Pascal's law and its engineering applications, Hydrostatic paradox. Action of fluid pressure on a plane (horizontal, vertical and inclined) submerged surface, resultant force and center of pressure, force on a curved surface due to hydrostatic pressure.

Buoyancy and flotation, stability of floating and submerged bodies, metacentric height and its determination, periodic time of oscillation, pressure distribution in a liquid subjected to constant horizontal/ vertical acceleration, rotation of liquid in a cylindrical container.

3. Fluid Kinematics : Classification of fluid flows, velocity and acceleration of fluid particle, local and convective acceleration, normal and tangential acceleration, streamline, path line and streak line, flow rate and discharge mean velocity, continuity equation in Cartesian and cylindrical, polar coordinates. Rotational flows, rotation velocity and circulation, stream and velocity potential functions, flow net.

4. Fluid Dynamics : Euler's equation, Bernoulli's equation and steady flow energy equation; representation of energy changes in fluid system, impulse momentum equation, kinetic energy and momentum correction factors, flow along a curved streamline, free and forced vortex motions.

5. Dimensional Analysis and Similitude : Fundamental and derived units and dimensions, dimensional homogeneity. Rayleigh's and Buckingham's Pi method for dimensional analysis. Dimensionless numbers and their significance, geometric, kinematic and dynamic similarity, model studies. Laminar and Turbulent Flows: Flow regimes and Reylods number, critical velocity and critical Reynolds number, laminar flow in circular cross- section pipes. Turbulent flows and flow losses in pipes, Darcy equation, minor head losses in pipes and pipe fittings, hydraulic and energy gradient lines.

6. Flow Measurement: Manometers, pitot tubes, venturi meter and orifice meters, orifice, mouthpieces, notches and weirs, rotameter.

BOOKS RECOMMENDED::

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar : S.K. Kataria and Sons Publishers.
2. Mechanics of Fluids by Massey BS; Van Nostrand Reinhold Co.
3. Fluid Mechanics by Douglas JF, Gasiorek JM, Swaffield JP; Poitman
4. Fluid Mechanics by Streetes VL and Wylie EB; Mcgraw Hill Book Co.

IE 228 FLUID MECHANICS LAB

1. To determine the metacentric height of a floating vessel under loaded and unloaded conditions.
2. To study the flow through a variable area duct and verify Bernoulli's energy equation.
3. To determine the coefficient of discharge for an obstruction flow meter (venture meter/ orifice meter)
4. To determine the discharge coefficient for a Vee- notch or rectangular notch.
5. To study the transition from laminar to turbulent flow and to ascertain the lower critical Reynolds number.
6. To determine the hydraulic coefficients for flow through an orifice.
7. To determine the friction coefficients for pipes of different diameters.
5. To determine the head loss in a pipe line due to sudden expansion/ sudden contraction/ bend.
6. To determine the velocity distribution for pipeline flow with a pitot static probe.

IE230 COMPUTER AIDED DRAFTING LAB

1. Learn the basic initial setting and viewing of the drafting software's interface.
2. Learn the basic options of drawing aids like grid, snap, ortho etc. and other aids for distance and mass properties calculations
3. Learn and draw the basic entities in 2D
4. Learn and use the various modify commands of the drafting software
5. Learn and use the layers and blocks in drafting software
7. Use hatching and dimensioning to detail out a component drawings
8. Understand different coordinate system and do a exercise on drafting software using this
9. Draw the different types of 3D modeling entities using viewing commands to view them
10. Draw the different Surface model with different editing commands
11. Learn and use shading and rendering techniques for better visual appearance
12. Use and learn import/export techniques and customization of drafting software

IE 303 PRODUCT DESIGN AND PROCESS PLANNING

Introduction to Product Design: Design by Evolution and Innovation, Essential factors of product design, Production consumption cycle, Flow and value addition in Production consumption cycle, The Morphology of Design, Primary design phases and flowcharting, Product Life cycle, Modular design.

Product Design and Industry: The Designer- his role, myth and reality, the industrial design organization, basic design considerations, role of aesthetics and ergonomics in product design, Functional design practice.

Economic Factors Influencing Design: Product value, Design for safety, reliability and Environmental considerations, Manufacturing operations in relation to design, Economic analysis, profit and competitiveness, break even analysis, Economics of a new product design (Samuel Eilon Model)

Modern Approaches to product Design: Concurrent Design, Quality Function Deployment, reverse engineering, Rapid Prototyping.

Process Planning: Introduction and concept, the role of process engineer, procedure, process analysis, charts and flow diagrams, manual v/s automated process planning, Group Technology.

BOOKS RECOMMENDED:

1. Product Design and Development by Kail T Ulrich and Steven D Eppinger
2. Product Design and Development by AK Chitale and Gupta
3. Design of Systems and Devices by Middendorf Marcel Dekker

IE 313 PRODUCT DESIGN AND PROCESS PLANNING LABORATORY

1. Case studies on design of some latest consumer/industrial products.
2. Virtual testing / analysis of simple products using computer software.
3. Requirements in the design of machine components, forging design, casting design for economical molding, and features to aid handling,
4. Design for machining ease, Ease of location and Clamping,
5. Process planning for a few components.

IE 305 INSPECTION AND QUALITY CONTROL

Inspection: Objectives and functions of inspection industry: Production/inspection and problems: Organization industrial inspection: Stages of inspection: Inspection procedures and their application: Economic aspect of Inspection.

Quality Control: Concept of quality in engineering; Quality control function; inspection versus quality control, Quality control techniques: Organization for quality control; Economic and marketing aspects of quality control.

Statistical Quality Control: Fundamental of statistical quality control: Theory of control charts: Charts for variables and attributes; application of control charts for average, range, standard deviation, fraction defectives and number of non-conformities per unit. Process capability studies and process control.

Tolerances: concept of tolerance, Statistical nature of tolerances: setting the tolerances.

Acceptance sampling: elementary concepts, OC Curves, Sampling by attributes; single, double and multiple sampling plans; Use of IS standard sampling tables Construction and use of operating characteristic curves:

Quality engineering and Quality assurance: Factors affecting quality and its design , Life testing O.C. curve for stipulated life. 4. Reliability: Introduction, failure rate curve, reliability study and analysis, synthesis of system reliability, measurement of reliability, designing for reliability.

BOOKS RECOMMENDED:

2. Statistical Quality Control by EL Grant
3. Total Quality Control by Feigen Baum
4. Quality Planning & analysis by Juran
5. An Introduction to Reliability and Control by Thompson; Machinery Publishing.
6. Statistical Methods, by Dr. S. P. Gupta, Sultan Chand and Sons Publication

IE 315 INSPECTION AND QUALITY CONTROL LAB

1. To test the Goodness of fit for the given quality characteristic using Normal distribution
2. Assessing Process Capability of the given manufacturing process using Normal Probability paper method and process capability indices
3. Experiments on Application of 7 QC Tools as applied to Manufacturing and Service Operations.
4. Construction of control chart for attribute quality characteristic
5. Attribute sampling Plans – Single, Double and Multiple sampling plans.
6. Experiments on correlation and Simple linear regressions
7. Experiments on multiple linear regressions

IE 307 FACILITY LAYOUT & DESIGN

Introduction: Introduction to facilities planning and design, plant layout, material handling and their interrelationship.

Site Location: Importance of location, hierarchy of location problems, factors affecting site location; factors in heavy manufacturing location, light industry location, warehouse location, retail location.

Various theories/models of site location like bid rent curves, Weber's isodapanes, Weber's classification of industries, Hoover's tapered transport rates, agglomeration, factor rating method, single facility location, load-distance model, break-even analysis, transportation method. New plant location and shut down under dynamic conditions.

Plant Layout: Objectives of a good plant layout, principles of a good layout, classical types of layouts like product layout, process layout, fixed-position layouts, cellular layouts and hybrid layouts. Factors affecting plant layout: man, material, machine, movement, waiting, service, building and change, features and considerations of each factor. P - Q chart, systematic layout planning, relationship (REL) chart, traditional layout configuration, production space requirements, manual CORELAP algorithm and examples, preparing process layouts and the considerations thereon.

Product Layouts: basic features of mass manufacturing, advantages & disadvantages of flow-line production, product-oriented layout – assumptions & types, assembly line layout, assembly line balancing. Design of an assembly line, layout heuristics for assigning tasks in assembly line balancing, assembly line balancing equations.

Computerized Layout: Evaluation of layout, computerized layout, flowcharts of various techniques like CRAFT, ALDEP and CORELAP.

Material Handling: Concept of material handling, principles of material handling, factors affecting material handling, objectives, material handling equation.

Material Handling Equipments: Selection of material handling systems and equipments: Automated Guided Vehicles, types, features, usage. Conveyors: basic functionality requirements, types of Conveyors, application considerations, operational considerations. Cranes, hoists and industrial trucks.

BOOKS RECOMMENDED:

1. James Apple, "Plant Layout & Material Handling", The Ronalt Press Co., New Delhi, 1998.
2. Francis, McGinnis and White, "Facilities Layout & Location –an analytical Approach" Prentice Hall of India Pvt Ltd., New Delhi, 2001.
3. Richards Muther, "Practical Plant Layout", McGraw Hill Book Co., New York, 1982.
4. Ronald H Ballou, "Business Logistics", Pearson Education, Inc. New Delhi, 2004.
5. Tompkins J A & J A White, "Facilities Planning", John Wiley & Sons, Inc. New York, 1984

IE 325 CAD/CAM

1. Fundamentals of CAD: Introduction: Design Process: Application of computers in design: Creating manufacturing database: benefits of CAD.

2. Computer Hardware; Graphic input devices; display devices; Graphics output devices; Central processing unit (CPU)

3. CAD software and Database: Software configuration of a graphics system: functions of a graphics package: geometric modeling: Database structure and control; Graphics standard: GKS and IGES.

4. Geometric Transformations: Mathematics preliminaries, matrix representation of 2 and 3 dimensional transformation: Concatenation of transformation matrices. Application of geometric transformations.

5. Representation of curves and surfaces: Polygon, meshed and ruled surfaces: Bezier curves; B-spline curves.

6. Geometric Modeling: Wireframe model: solid modeling: representation, volumetric properties, surface modeling, concepts of hidden-line removal and shading: Kinematics analysis and simulation.

7. Application of CAD techniques to finite Element Mesh Generation.

8. Introduction: Basic concepts of manufacturing system and CAD/CAM.

9. NC/CMNC Machine Tools; NC machine tools- basic components, coordinate systems; features of NC machine tools. Computerized Numerical Control (CNC): Tooling for NC machines - tool presetting equipment, flexible tooling, tool length compensation, tool path graphics; NC motion control system; Manual part programming, fixed/floating zero. Block format and codes: Computer assisted part programming. DNC and Adaptive Control: Direct numerical control: Adaptive control in machining system; Combined DNC/CNC system.

10. Group Technology (GT): Part families; part classification and coding system: Group technology machine cells: Advantages of GT.

11. Computer Aided Process Planning: Introduction and benefits of CAPP. Types of CAPP systems, machinability data selection systems in CAPP.

12. Flexible Manufacturing System (FMS) and Computer integrated manufacturing system: FMS and its advantages, components of a FMS system. Introduction to CIMS.

BOOKS RECOMMENDED::

1. CAD/CAM by Groover & Simmers, Prentice Hall of India
2. Automation, Production Systems and computer integrated manufacturing by Groover, Prentice Hall of India
3. Computer Integrated Design and Manufacturing by D.D. Bedworth, M.R Henderson & P.M. Wolfe, Tata MCGraw Hill Pub. Co.
4. CAD/CAM - theory and Practice by Zeid Ibraham, Tata McGraw Hill Pub Co.

IE 327 CAD/CAM LAB

1. CAD exercises using Auto Cad software
2. Part-programming on CNC machines
3. Execution of part programme for machining given profile.
4. Programming of robots for various applications.
5. Part modeling using some of the modeling technique
6. Component assembly in CAD and generating and modifying drawings

ME-307 MECHANCIAL MEASUREMENT AND METROLOGY

1. General Concepts - Need and classification of measurements and instruments; basic and auxiliary functional elements of a measurement system; Mechanical versus electrical / electronic instruments; primary, secondary and working standards.

2. Static and Dynamic Characteristics of Instruments - Range and span, accuracy and precision, calibration, hysteresis and dead zone, sensitivity and linearity, threshold and resolution; speed of response, lag, fidelity and dynamic error, dead time and dead zone. Zero, first and second order systems and their response to step, ramp and sinusoidal input signals.

3. Errors in Measurement - Sources of errors, systematic and random errors; statistical analysis of test-data, probable error and probability tables, ejection of test data; curve fitting, error propagation; Design and planning of experiments and report writing.

4. Metrology - Line, end and wavelength standards; linear measurements - vernier scale and micrometer, vernier height gauge and depth guage; comparators - their types, relative merits and limitations; Angular measurements - sine bar, clinometer, angle guage; concept and measurement of straightness and flatness by interferometry; surface roughness - specifications and measurement by Talysurf, Measurement of major diameter, minor diameter, effective diameter, pitch, angle and form of threads for internal and external threads; measurement of tooth thickness, pitch and checking of profile for spur gears.

5. Functional Elements - Review of electro-mechanical sensors and transducers - variable resistance, inductance and capacitive pick ups, photo cells and piezo-electric transducers and application of these elements for measurement of position / displacement, speed / velocity / acceleration, force and liquid level. Resistance strain guages, guage factor, bonded and unbonded guages, surface preparation and bonding technique signal conditioning and bridge circuits, temperature compensation, application of strain guages for direct, bending and torsional loads. Introduction to amplifying, transmitting and terminating devices.

6. Pressure and Flow Measurement - Bourdon tube, diaphragm and bellows, vacuum measurement - Mcleod guage, thermal conductivity guage and ionisation guage; Dead weight guage tester. Electromagnetic flux meters, ultra-sonic flow meters and hot wire anemometer: flow visualisation techniques.

7. Temperature Measurement - Thermal expansion methods - bimetallic thermometers, liquid-in-glass thermeter and filled-in-system thermometers; thermo-electric sensors - common thermo couples, reference junction considerations, special materials and configurations; metal resistance thermometers and thermistors; optical and total radiation pyrometers; calibration standards.

8. Speed, Force, Torque and Shaft Power Measurement - Mechanical tachometers, vibration reed tachometer and stroboscope; proving ring, hydraulic and pneumatic load cells, torque on rotating shafts; Absorption, transmission and driving dynamo meters.

BOOKS RECOMMENDED::

1. Measurement System : Application and Design by Doebelin E.O; McGraw Hill Publishing Company.
2. Experimental Methods for Engineers by Holman JP; McGraw Hill Publication Company.
3. Mechanical Measurement and Control by Kumar DS; Metropolitan Book Co Pvt. Ltd., New Delhi.
4. Engineering Metrology by Jain RK
5. Automatic Control systems by Kuo BC; Prentice Hall

ME-317 MECHANICAL MEASUREMENT AND METROLOGY LAB

1. Measurement with the help of vernier caliper and micrometer
2. Measurement of an angle with the help of sine bar
3. Measurement of surface roughness
4. Measurement of gear elements using profile projector
5. Three wire method to determine effective diameter of external threads
6. Measurement of thread element by Tool makers microscope
7. Calibration of a pressure guage with the help of a dead weight guage tester
8. Use of stroboscope for measurement of speed of shaft
9. Use of pilot tube to plot velocity profile of a fluid through a circular duct
10. Preparation of a thermocouple, its calibration and application for temperature measurement

IE 310 MATERIAL MANAGEMENT

Integrated approach to materials management: Introduction, materials productivity and role of materials management techniques in improved materials productivity. Cost reduction and value improvement, value analysis for right choice and rationalization of materials**.**

Material Planning & Budgeting: Need for material planning, Factors affecting material planning, Techniques of material planning; Material classification, codification and standardization; Material budgeting - meaning and need, techniques of material budgeting.

Purchasing function: Objectives, purchase requisitions, types of specification, centralized versus decentralized purchasing, timing of purchases. Purchasing research, identification of right sources of supplies. Make or buy decisions, vender selection and vender rating. Negotiations, purchase price analysis and price determination. Purchasing organization, procedures, forms, records and reports. Purchasing as a dynamic profession, transition to supply management, Reverse auctioning

Inventory management: Inventory concepts, reasons for holding inventory, types of inventory, inventory reduction tactics. Inventory turnover ratio. Selective Inventory management: ABC, VED, and FSN analysis etc., identifying critical items with selective inventory management.

Operating policies: continuous review system, periodic review system, comparative advantages and disadvantages of continuous and periodic review systems, hybrid systems. Inventory management across the organization.

Optimizing Inventory: Assumptions for Wilson's lot size model, inventory costs, hidden costs, composition of costs, estimation of inventory related costs, lead time, stock out point, number of time periods, calculating Economic Order Quantity (EOQ), sensitivity analysis of EOQ model.

Special inventory models: Finite replenishment rate model, lot size models with planned backlogging, generalized model with uniform replenishment rate, inventory model with lost sales, quantity discount model, one period decisions. Determination of safety stock, service level and uncertainty in demand. Information systems for inventory management.

Stores management: Introduction, stores functions, stores organization, stores systems and procedures, stores accounting and verification systems, stores address systems, stores location and layout, store equipment.

Discussion on modern materials management techniques like JIT, SMED, DBR & MRP

BOOKS RECOMMENDED::

1. Arnold and Chapman "*Introduction to Materials Management*", Pearson Education Asia, Fourth Edition, (2001)
2. Narsimhan, Mcleavey & Billington, "*Production Planning & Inventory Control*", Prentice Hall of India, Second Edition (2003)
3. Dobler Donald W., Burt David N., "*Purchasing and Supply Management*", Tata McGraw Hill, Sixth Edition (2001)
4. Menon K S, "*Purchasing and Inventory Control*", Wheeler Publishing New Delhi, Third Edition (1997)
5. Krajewski L J and Ritzman L P, "*Operations Management*", Pearson Education Asia, Sixth Edition (2004)

IE 320 OPERATIONS RESEARCH

Introduction : Origin of OR and its role in solving industrial problems : General approach for solving OR problems. Classification of mathematical models : various decision making environments.

Deterministic Models : Formulation of deterministic linear mathematical models : Graphical and simplex techniques for solution of linear programming problems, Big M method and two phase method, Introduction to duality theory and sensitivity analysis : transportation, assignment and sequencing models; Goal Programming. Dynamic programming.

Simulation: Concept general approach and application. Use of Monte-Carlo simulation technique to queuing and inventory problems.

Queuing theory: Types of queuing situation, Queuing models with Poisson's input and exponential service, their application to simple situations.

Network models : Shortest route and traveling sales - man problems, PERT & CPM introduction, analysis of time bound project situations, construction of networks, identification of critical path, slack and float, crashing of network for cost reduction, resource leveling and smoothening.

BOOKS RECOMMENDED::

1. Principles of Operations Research HM Wagner, Prentice Hall.

2. Operations Research PK Gupta and DS Hira, S. Chand & Co.

3. Introduction to Operation Research Taha

4. Introduction to Operation Research F.S. Hiller and G.I. Libermann, Holden Ray.

IE 304 WORK STUDY AND ERGONOMICS

Productivity: Definition, reasons for low productivity, methods to improve productivity, work-study and productivity

Human factor in work-study: Relationship of work-study man with management, supervisor & workers, qualities of a work-study man.

Method-study: Definition, objectives, step-by-step procedure, questioning techniques, charts and diagrams for recording data. Like outline process charts, flow process charts, multiple activity charts, two handed process chart, string diagram, travel chart, cycle graph, Chrono-cycle graph, therbligs, micro motion study and film analysis, Simo chart, principles of motion economy. Development and installation of new method.

Work–Measurement: Definition, various techniques of work-measurement work-sampling, stopwatch time study & its procedure, Job selection, Equipment and forms used for time study, rating, methods of rating, allowances and their types, standard time, numerical problems, predetermined –time standards and standard data techniques.

Incentive: Meaning, objectives of an incentive plan, various types of incentive plans.

Ergonomics: Introduction, history of development, man-machine system and its components. Introduction to structure of the body- features of the human body, stress and strain, metabolism, measure of physiological functions- workload and energy consumption, biomechanics, types of movements of body members, strength and endurance, speed of movements. NIOSH lifting equation, Lifting Index, Maximum acceptable Weights and Forces, Distal upper extremities risk factors, Strain Index, RULA, REBA, and Office Ergonomics. Applied anthropometry - types, use, principles in application, design of work surfaces and seat design. Visual displays for static information, visual displays of dynamic information, auditory, tactual and olfactory displays and controls. Effect of vibration, noise, temperature and illumination on performance.

BOOKS RECOMMENDED:

1. Barnes Ralph M., “Motion & Time study: Design and Measurement of Work”, Wiley Text Books, 2001.
2. Marvin E, Mundel & David L, “Motion & Time Study: Improving Productivity”, Pearson Education, 2000.
3. Benjamin E Niebel and Freivalds Andris, “Methods Standards & Work Design”, Mc Graw Hill, 1997.
4. International Labour organization, “Work-study”, Oxford and IBH publishing company Pvt Ltd., N.Delhi, 2001.
5. Sanders Mark S and McCormick Ernert J, “Human Factors in Engineering and Design”, McGraw-Hill Inc., 1993.

IE 314 WORK STUDY AND ERGONOMICS LABORATORY

1. Method to improve the assembly and dis-assembly of a Bolt, a nut and three washers
2. Methods Improvement – Assembling pins on cardboard
3. Rating Practice –Walking on level grounds and dividing a pack of cards into four equal piles.
4. Rating Practice – Films and analysis.
5. Work sampling exercises
6. Stop watch time study on drilling machine, lathe machine and CNC machine
7. Calibration of an individual using Tread Mill as a loading-device.
8. Measurement of anthropometrics data and analysis of data.
9. To measure the respiratory parameter of an individual.
10. To measure the ambience noise and to check the noise dose of an individual in industrial noisy environment using sound level meter and noise dosimeter.

IE 308 SIMULATION, MODELING & ANALYSIS

Introduction: Basic concepts of systems, Elements of systems, event driven models, simulation as a decision making tool, types of simulation, system modeling, types of modeling

Statistical models in Simulation: Review of terminology and concepts, useful statistical models, discrete distributions, continuous distributions, poisson process, empirical distributions.

Random Numbers: properties of random numbers, pseudo random numbers, techniques for generating random numbers, test for random numbers, techniques for random variate generation.

Analysis of simulation data: data collection, distribution fitting, parametric estimation, goodness of fit tests, verification and validation of simulation models

Markov processes: probabilistic systems, discrete time markov processes, random walks, simulating as a poisson process, continuous time markov processes

Recent advances and case studies/mini project: Development of simulation models using simulation languages studied for systems like queuing systems production, inventory, maintenance, material handling and replacement systems-Investment analysis and network.

BOOKS RECOMMENDED:

1. Gray Beal, Wajne J and Pooch U W, "*Simulation Principles & Methods*", Winthrop Publishing Incorporate.
2. Severance Frank, "System Modelling and Simulation", John Wiley and Hall, 2001.
3. System Simulation with Digital Computer: Deo Narsingh PHI
4. System Simulation: Gordon, PHI
5. Analog Computation : Jackson A.S. Mcgraw hill
6. Computer Simulation Techniques : Naylor T.H. et. al. John wiley
7. Modern Production Management: Buffa Wiley

IE 318 SIMULATION, MODELING & ANALYSIS LAB

1. Laboratory work based on course IE 308
2. Generation of Pseudo random number and analysis with the use of software.
3. Generation of random variate of various teoreticl distributions.
4. Development of simulation models for various industrial systems.
5. Validation and synthesis of data using simulation software.

IE 322 INDUSTRIAL AUTOMATION AND ROBOTICS

1. **Introduction** : Concept and scope of automation: Socio economic consideration: Low cost automation.

2. **Fluid Power Control** : Fluid power control elements and standard graphical symbols. Construction and performance of fluid power generators; Hydraulic and pneumatic cylinders - construction, design and mounting; Hydraulic and pneumatic valves for pressure, flow and direction control: Servo valves and simple servo systems with mechanical feedback, governing differential equation and its solution for step position input; Basic hydraulic and pneumatic circuits.

3. **Pneumatic Logic Circuits** : Design of pneumatic logic circuits for a given time displacement diagram or sequence of operations.

4. **Fluidics** : Boolean algebra; Truth tables; Conda effect; Fluidic elements – their construction working and performance characteristics: Elementary fluidic circuits.

5. **Transfer Devices and Feeders** : their Classification : Construction details and application of transfer devices and feeders(vibratory bowl feeder, reciprocating tube and centrifugal hopper feeder).

6. **Electrical and Electronic Controls** : Introduction to electrical and electronic controls such as electromagnetic controllers - transducers and sensors, microprocessors, programmable logic controllers (PLC); Integration of mechanical systems with electrical, electronic and computer systems.

7. **Robotics;** Introduction, classification based on geometry, devices, control and path movement, End effectors - types and applications: Sensors - types and applications. Concept of Robotic/Machine vision, Teach pendent.

8. **Industrial Applications** of Robots for material transfer, machine loading /

unloading, welding, assembly and spray painting operations.

BOOKS RECOMMENDED:

1. Fluid Power with applications by Anthony Esposito
2. Pneumatic Control by SR Majumdar
3. Robotics and Flexible Automation by SR Deb

IE 324 INDUSTRIAL AUTOMATION AND ROBOTICS LAB

6. Design and assembly of hydraulic / pneumatic circuit.
7. Study of power steering mechanism using cut piece model
8. Study of reciprocating movement of double acting cylinder using pneumatic direction control valves
9. Use of direction control valve and pressure control valves clamping devices for jig and fixture
10. Study of robotic arm and its configuration
11. Study the robotic end effectors
12. Study of different types of hydraulic and pneumatic valves

IE 404 MAINTENANCE & RELIABILITY ENGINEERING

Concept of reliability, objectives, applications, area of use, use of reliability in industry. The reliability functions, mean time between failures, hazard rate function, bath tub curve, conditional reliability, probability density function, failure rate, failure density, hazard rate, uncertainty measures.

Constant and time dependant failure models: Exponential, webull, normal and lognormal distributions

Reliability of systems, Series and parallel-connected systems, Concept of redundancy, objectives, applications, redundant standby systems, system structure functions, minimal cuts and minimal paths, common mode failures, three state devices.

Determination of reliability (state dependant systems), Markov analysis, load sharing system, standby systems, degraded systems.

Failure Analysis: Introduction to failure mode and effect analysis, FMEA and FMECA, criticality analysis, Fault tree diagram, event tree.

Availability: concept and definitions, availability model, system availability.

Introduction: Objectives and policies of maintenance, maintainability terms and definitions, maintainability organization functions and tasks.

Types of maintenance: breakdown, predictive, replacement, on-line, off-line, preventive maintenance, reconditioning and correction maintenance, Preventive maintenances v/s. repair, Development of preventive maintenance schedule, top down bottom up approach, production maintenance integration.

Maintenance manpower planning, spare parts management, computerized maintenance system, condition based monitoring, on-line v/s off-line maintenance systems, maintenance devices, budgeting and cost control. Introduction to TPM and RCM

BOOKS RECOMMENDED:

1. Clifton R H, “Principles of Planned Maintenance”, McGraw Hill, New York, 2001.
2. Ebling CE, “An introduction to Reliability and .Maintainability Engineering” Tata Mc Graw Hill, Delhi, 2004.
3. Srinath L S “Reliability Engineering”, Affiliated East-West Press Limited, New Delhi, 2002.
4. Dhillon B S, “Engineering Maintainability”, Prentice Hall of India, New Delhi,2000.
5. Wireman Terry, “Preventive Maintenance”, Reston Publishing Company, Reston Virginia,1998.

IE 416 SUPPLY CHAIN MANAGEMENT

Building A Strategic Frame Work to Analyse Supply Chains: Supply chain stages and decision phases process view of a supply chain. Supply chain flows. Examples of supply chains. Competitive and supply chain strategies. Achieving strategic fit. Expanding strategic scope. Drivers of supply chain performance. Framework for structuring drivers – Inventory, Transportation, Facilities, Information. Obstacles to achieving fit. Case discussions.

Designing The Supply Chain Network: Distribution Networking – Role, Design. Supply Chain Network (SCN) – Role, Factors, Framework for Design Decisions.

Facility Location and Network Design: Models for facility location and capacity allocation. Impact of uncertainty on SCN – discounted cash flow analysis, evaluating network design decisions using decision using decision trees. Analytical problems.

Planning and Managing Inventories in A Supply Chain: Review of inventory concepts. Trade promotions, Managing multi-echelon cycle inventory, safety inventory determination. Impact of supply uncertainty aggregation and replenishment policies on safety inventory. Optimum level of product availability; importance factors. Managerial levers to improve supply chain profitability.

Sourcing, Transportation and Pricing Products: Role of sourcing, supplier – scoring & assessment, selection and contracts. Design collaboration. Role of transportation, Factors affecting transportation decisions. Modes of transportation and their performance characteristics.

Coordination And Technology In The Supply Chain: The role of IT supply Chain, The Supply Chain IT framework, CRM, Internal SCM, SRM. The role of E-business in a supply chain, The E-business framework, E-business in practice. Case discussion.

Emerging Concepts: Reverse Logistics; Reasons, Activities, Role. RFID Systems; Components, applications, implementation. Lean supply chains, Implementation of Six Sigma in Supply Chains.

BOOKS RECOMMENDED:

1. Supply Chain Management – 2001, Strategy, Planning & Operation. Sunil Chopra & Peter Meindl; Pearson Education Asia, ISBN: 81-7808-272-1.
2. Supply Chain Redesign – Transforming Supply Chains into Integrated Value Systems - Robert B Handfield, Ernest L Nichols, Jr., 2002, Pearson Education Inc, ISBN: 81-297-0113-8
3. Modelling the Supply Chain -Jeremy F Shapiro, Duxbury;, 2002, Thomson Learning, ISBN 0-534-37363
4. Designing & Managing the Supply Chain -David Simchi Levi, Philip Kaminsky & Edith Simchi Levi;; Mc Graw Hill
5. Going Backwards Reverse Logistics Trends and Practices -Dr. Dale S. Rogers,Dr. Ronald S. Tibben-Lembke,University of Nevada, Reno, Center for Logistics Management.

IE 408 MARKETING & FINANCIAL MANAGEMENT

Introduction: Historical development of marketing management, Definition of Marketing, Core marketing concepts, Marketing Management philosophies, Micro and Macro Environment, importance of marketing in the India Socio – economic system.

Consumer Markets and Buying Behavior: Characteristics affecting Consumer behavior, Types of buying decisions, buying decision process, Classification of consumer products, Market Segmentation.

Marketing of Industrial Goods: Nature and importance of the Industrial market, classification of industrial products, participants in the industrial buying process, major factors influencing industrial buying behavior,

Pricing: Importance of Price, pricing objectives, factors affecting pricing decisions, procedure for price determination, kinds of pricing, pricing strategies and decisions.

Distribution: Marketing channels – functions, types of channels of distribution, number of channel levels. Personal Selling

Advertising and Sales Promotion: Objectives of advertisement function of advertising, classification of advertisement copy, advertisement media – kinds of media, advantages of advertising. Objectives of sales promotion, advantages sales promotion.

Introduction to Financial Management, Goals, Forms of Business.

Working capital management: importance, objectives, inventory management, techniques, planning and control of inventory, receivables management, credit policy, cash management.

Capital budgeting: Purpose, principles in estimating costs and benefits of investments,

Appraisal criteria-payback period, ARR, NPV, Benefit –Cost ratio, IRR. Risk analysis in capital budgeting. Cost of capital.

Sources of finance: Long term-equity capital-debenture capital-term loans, deferred credit-government subsidies -leasing and hire purchase, Short term financing-accruals trade credit-short term bank finance public deposit-commercial paper.

BOOKS RECOMMENDED:

1. Principles of Marketing - Philip Kotler , Prentice – Hall. 11th Edn.
2. Marketing Management - Philip Kotler , Prentice – Hall. 12th Edn.
3. Marketing Management Text & Cases - Rajagopal, Vikas Publishing House, ISBN 81-259-0773-4
4. Financial Management Theory and Practice – Prasannachandra – TMH
5. Financial Management – Van Horne – Pearson Education
6. Financial Management – Khan & Jain – TMH

IE 351 TOTAL QUALITY MANAGEMENT

Quality and Total Quality Management; Excellence im manufacturing/service, factors of excellence, relevance of TQM.

Concept and definition of quality; total quality control (TQC) and Total Quality Management (TQM), salient features of TQC and TQM. Total Quality Management Models, benefits of TQM.

Just-in-time (JIT): Definition: Elements, benefits, equipment layout for JIT system, Kanban system MRP (Material Requirement planning) vs JIT system, Waste elimination, workers involvement through JIT: JIT cause and effect chain, JIT implementation.

Customer: Satisfaction, data collection and complaint, redressal mechanism.

Planning Process: Policy development and implementation; plan formulation and implementation.

Process Management: Factors affecting process management, Quality function development (QFD), and quality assurance system.

Total Employees Involvement (TEI): Empowering employees: team building; quality circles; reward and Recognition; education and training, Suggestion schemes.

Problems solving Defining problem; Problem identification and solving process; QC tools.

Benchmarking definition, concept, process and types of benchmarking.

Quality Systems: Concept of quality system standards: relevance and origin of ISO 9000; Benefits; Elements of ISO 9001, ISO 9002, ISO 9003.

Advanced techniques of TQM: Design of experiments: failure mode effect analysis: Taguchi methods

BOOKS RECOMMENDED:

1. Total Quality Management by sunder Raju, Tata Mcgraw Hill
2. TQM for engineers by M.Zairi, Aditya Books
3. Total Quality Management Handbook by J.L. Hradeskym MCGraw Hill
4. ISO 9000 quality System by Dalela and Saurabh, standard Publishers

IE 353 NETWORKS AND PROJECT MANAGEMENT

Concepts of Project Management: Concepts of a Project, Categories of projects, Phases of project life cycle, Roles and responsibility of project leader, tools and techniques for project management.

Project Planning and Estimating: Feasibility report, phased planning, Project planning steps, Objective and goals of the project, preparation of cost estimation, evaluation of the project profitability.

Organizing and Staffing The Project Team: Skills / abilities required for project manager, Authorities and responsibilities of project manager, Project organization and types accountability in project execution, controls, tendering and selection of contractors.

Project Scheduling: Project implementation scheduling, effective time management, different scheduling techniques, resources allocation method.

Tools & Techniques of Project Management: Bar (GANTT) chart, bar chart for combined activities, logic diagrams and networks, Project evaluation and review Techniques (PERT) Planning, Computerized project management

Co-Ordination and Control: Project direction communication in a project, MIS project co-ordination, project control requirement for better control of project or role of MIS in project control, performance, control, schedule control, cost Control

Performance Measures in Project Management: Performance indicators, Performance improvement for the CM & DM companies for better project management, project management and environment.

Case Studies on Project Management: Case studies covering project planning, scheduling, use of tools & techniques, performance measurement.

BOOKS RECOMMENDED:

1. Project Management a System approach to Planning Scheduling & Controlling - Harold Kerzner, CBS Publishers and Distributors. 2002.
2. Project Execution Plan: Plan for project Execution interaction 2001 - Chaudhry S.
3. Project Management – Beningston Lawrence McGraw Hill 1970.
4. A Management Guide to PERT and CPM, WEIST & LeVY Eastern Economy of PH 2002.
5. PERT & CPM.-L.S.Srinnath, Affiliated East West Press Pvt. Ltd. 2002.
6. Project Management with PERT and CPM- Moder Joseph and Philips cerel R., 2nd edition, New York VAN Norstrand, Reinhold - 1976.
7. Project planning analysis selection implementation & review prasanna chandra, ISBNO-07-462049-5 2002.
8. Performing and Controlling Project,-Angus, Planning, 3rd End, Person Education, ISBN:812970020.2001
9. Project planning scheduling & control, james P.Lawis, Meo Publishing company 2001.
10. Project Management -Bhavesh M.Patel, Vikas Publishing House, ISBN 81-259-0777-7 2002.

IE 355 TECHNOLOGY MANAGEMENT

Introduction to technology management: Concept and meaning of technology, Evolution and growth of technology, role and significance of management of technology, Impact of technology on society and business, Forms of technology: process technology and product technology.

Competitive advantages through new technologies: product development – from scientific breakthrough to marketable product – Role of Government in Technology Development. Linkage between technology, development and competition, Managing research and development (R&D), Managing Intellectual Property.

Technological Forecasting: Exploratory: Intuitive, Extrapolation, Growth Curves, Technology Monitoring, Normative: Relevance Tree, Morphological Analysis, Mission Flow Diagram

Technology Assessment: Technology Choice, Technological Leadership and Follower ship, Technology Acquisition. Meaning of Innovation and creativity, innovation management

Technology strategy: concept, types, key principles, framework for formulating technology strategy, Technology forecasting: techniques and application.

Technology diffusion and absorption: Rate of Diffusion; Innovation Time and Innovation Cost, Speed of Diffusion. Project management in adoption and implementation of new technologies.

Technology Transfer Management: Technology transfer-process; outsourcing strategic issues; joint ventures, technology sourcing.

Human Aspects in Technology Management: Integration of People and Technology, Organizational and Psychological Factors, Organizational Structure.

Social Issues in Technology Management: Technological Change and Industrial Relations, Technology Assessment and Environmental Impact Analysis.

BOOKS RECOMMENDED::

1. Strategic Technology Management - Betz. F. - McGraw-Hill.
2. Management of Technology - Tarek Khalli -, McGraw-Hill.
3. Strategic Management of Technological Innovation - Schilling - McGraw-Hill, 2nd ed.
4. Managing Technology and Innovation for Competitive Advantage - V K Narayanan - Pearson Education Asia
5. Strategic Management of Technology & Innovation - Burgelman, R.A., M.A. Madique, and S.C. Wheelwright -. Irwin.
6. Handbook Of Technology Management - Gaynor - Mcgraw Hill
7. Managing New Technology Development - Souder, W.C. and C.M. Crawford -
8. McGraw-Hill.
9. Managing Technological Innovation - Twiss, B. -. Pitman.
10. Bringing New technology To Market - Kathleen R Allen - Prentice Hall India
11. Management of New Technologies For Global Competitiveness —- Christian N Madu - Jaico Publishing House

IE 357 VALUE ENGINEERING

Introduction to Value Analysis: Definition of Value, Value Analysis, Value Engineering, Value management, Value Analysis versus Value Engineering, Value Analysis versus Traditional cost reduction techniques, uses, Applications, advantages and limitations of Value analysis. Symptoms to apply value analysis, Coaching of Champion concept.

Type of Values: Reasons for unnecessary cost of product, Peeling cost Onion concept, unsuspected areas responsible for higher cost, Value Analysis Zone, attractive features of value analysis. Meaning of Value, types of value & their effect in cost reduction. Value analysis procedure by simulation. Detailed case studies of simple products.

Functional Cost and Its Evaluation: Meaning of Function and Functional cost, Rules for functional definition, Types of functions, primary and secondary functions using verb and Noun, Function evaluation process, Methods of function evaluation. Evaluation of function by comparison, Evaluation of Interacting functions, Evaluation of function from available data, matrix technique, MISS technique, Numerical evaluation of functional relationships and case studies.

Problem Setting & Solving System: Steps in problem setting system, Identification, Separation and Grouping of functions. Various steps in problem solving, Case studies.

Value Engineering Job Plan: Meaning and Importance of Value Engineering Job plan. Phases of job plan proposed by different value engineering experts, Information phase, Analysis phase, Creative phase, Judgement phase, Development planning phase, and case studies. Cost reduction programs, criteria for cost reduction program, Value analysis change proposal.

Value Engineering Techniques: Result Accelerators or New Value Engineering Techniques, Listing, Role of techniques in Value Engineering, Details with Case examples for each of the Techniques.

Advanced Value Analysis Techniques: Functional analysis system technique and case studies, Value analysis of Management practice (VAMP), steps involved in VAMP, application of VAMP to Government, University, College, Hospitals, School Problems etc., (service type problems).

Application of Value Analysis: Application of Value analysis in the field of Accounting, Appearance Design, Cost reduction, Engineering, manufacturing, Management, Purchasing, Quality Control, Sales, marketing, Material Management Etc., Comparison of approach of Value analysis & other management techniques.

BOOKS RECOMMENDED:

1. Value engineering for COST REDUCTION and PRODUCT IMPROVEMENT – M.S. Vittal, Systems Consultancy Services Edn 1993
2. Value Management, Value Engineering and Cost Reduction – Edward D Heller Addison Wesley Publishing Company 1971
3. Value Analysis for Better Management – Warren J Ridge American Management Association Edn 1969
4. Elements of Production Planning and Control – Samuel Eilon, Universal Book Corporation. Edn 1981
5. Getting More at Less Cost (The Value Engineering Way) – G.Jagannathan Tata Mcgraw Hill Pub. Comp. Edn 1995
6. Value Engineering – Arther E Mudge McGraw Hill Book Comp. Edn 1981
7. An Introduction to Operational Research – C R Kothari Vikas Pub. House Pvt. Ltd., Edn. 1982.

IE 359 KNOWLEDGE MANAGEMENT

Knowledge Management – An Insight: Knowledge Management – Evolution, why now, Limitation of Existing initiatives, value of knowledge, Minimize effort duplication, sharing of best practices, enhanced innovation, imperatives, Organizational knowledge management – The need, key benefits, key benefits parameters, Organizational benefits, core implementation areas, organizational performance, implementation responsibilities, core groups involved, organization barriers, key elements, Organizational knowledge management.

Essentials of Knowledge Management: Introduction, What is Knowledge? – Data, Information and Knowledge, Wisdom, basic Types of Knowledge, Organizational Knowledge management – types, Capital, classification, Knowledge life cycle, Sources, processes, Knowledge Conversion – Organizational knowledge progression, Organizational knowledge management – technology enablers, organizational intellectual / human capital organizational meta knowledge.

Knowledge Management Techniques, Systems And Tools: Introduction, Organizational Knowledge creation – Knowledge networks, Organizational knowledge mapping techniques, core implementation issues, usage, Organizational knowledge spiral, Organizational Knowledge / capture – Implementation methodology, Knowledge Acquisition Tools, Organizational Knowledge indexing, processing, Document Management System, Database Management Systems Data warehouse, Knowledge Analysis – Data mining, On-line analytical processing, Organizational knowledge dissemination.

Organization Knowledge Management Architecture: Introduction, Developing a KM Framework, Implementation Phases, Architectural Components, KM Systems Requirements, Tools, KM Systems Components – Implementation Strategies – Awakening phase, Actionable phase, Implementation phase, maintenance and measurement phase, Organizational Organic capabilities architecture – business, Information, Data, Systems, Computer, Layered Knowledge. Organizational knowledge management architecture – key considerations, Organizational knowledge Repositories – structure, Life cycle, Organizational knowledge refineries, KM applications – Integrative application Interactive application, knowledge processing applicants management, composite application, organizational KM context.

BOOKS RECOMMENDED:

1. Knowledge Management -Sudhir Warier, Vikas Publishing House, ISBN: 81-259-1363-7.
2. Management Toolkit: Practical Techniques for Building a Knowledge Management System, Prentice Hall, 1999
3. An investigation of Knowledge Management characteristics- Joshi K exington, KY, 1998
4. Hand book on Knowledge Management -C W Holsapple, Springer, 2003 Porter M
5. Competitive Advantage, Free Press, 1985

IE 361 EMERGING TRENDS IN MANUFACTURING TECHNOLOGY

Introduction: classification of modern machining methods, consideration in process selection. Mechanical process, ultrasonic machining, element of U.S.M., acoustic head & its design, tool feed mechanism, abrasive feed mechanism of cutting, effect of parameter on material removal rate and surface finish, economic consideration, application and limitations, recent development; abrasive jet marching, variable affecting material removal rate, application advantages and limitation; water jet machining, jet cutting equipment process details and practical applications.

Electro-chemical process:
Electro-chemical machining: elements of process, electrolytes & their properties, chemistry of process, metal removal rate. Thermal aspect, temperature rise & pressure-flow rate, tool design, accuracy & surface finish, advantages, application & limitations of the process, electrochemical grinding deburring & honing. Chemical machining: Elements of process, resists & echants, advantages & applications.

Thermal process: Electrical discharge machining, mechanism of metal removal, EDM equipment, generators & feed control devices, dielectric fluid, selection of electrode material, accuracy and surface finish, application & future trends. Plasma Arc Machining, mechanism of metal removal, PAM parameters, types of torches, accuracy and surface finish, economics and application of plasma jets, plasma arc spraying. Electro beam machining: generation and control of electron beam, theory of electron beam, process capability and limitations.

Laser beam machining: principles of working, thermal aspect, material removal, cutting speed and accuracy, advantages & limitations.

Emerging Trends in welding processes: Explosive welding, Cladding etc. Under water welding, Metallising, Plasma arc welding / cutting etc.

Emerging Trends in Forming processes: Principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro-Discharge forming, water hammer forming, explosive compaction etc.

BOOKS RECOMMENDED:
1. Shan H S, "*Modern Machining Processes*", Tata McGraw Hill Publishing Co., 2002.
2. Ghosh Amitabh, "*Manufacturing Processes*", Tata McGraw Hill Publishing Co., 2001.
3. Kalpakjian Serope, "*Manufacturing Engineering and Technology*", Addison Wesley Longman Publishers, 2000.
4. Rao P N, "*Manufacturing Technology*", Tata McGraw Hill Publilishing Company, 2000.
5. Mishra P K,"*Non Conventional Machining*", Narosa Publishers, 2001.
6. Singh K K "Unconventional Manufacturing Processes" Dhanpat Rai & Company, New Delhi 2007

IE 352 SMART MATERIALS AND NANO TECHNOLOGY

Introduction to Smart materials: Materials for both actuation and sensing: Piezoelectric Materials, Magnetostrictive Materials, Materials for actuation: Shape Memory alloys Magnetic shape memory material, Electro/Magneto rheological fluids; Materials for sensing: Optical fibre; Composite smart materials and micromodelling related issues; Intelligent system with integrated sensors & actuators; Self-sensing actuators; Placement of Smart Actuators/Sensors - Vibration damping.

Introduction to Nanotechnology: Characteristic scale for quantum phenomena, nanoparticles, nano-clusters, nanotubes, nanowires and nanodots. Drexler-Smalley debate - realistic projections. Electronic structure: quantum wells quantum dots, quantum wires. Nano clusters, clusters of rare gases, clusters of alkali metals.

Processing of Nano Materials: Si processing methods: Cleaning /etching, oxidation-oxides, Gettering, doping, epitaxy. Top-down techniques: Photolithography, other optical lithography's (EUV, X-ray, LIL), particle beam lithography's (e-beam, FIB, shadow mask evaporation), probe lithography's. Molecular-beam epitaxy, chemical beam epitaxy, metal-organic CVD (MOCVD). Bottom-up techniques: self-assembly, self-assembled monolayer, directed assembly, layer-by-layer assembly.

BOOKS RECOMMENDED:

1. Michelle Addington , Daniel L. Schodek "Smart Materials and Technologies in Architecture" John Wiley, 2008
2. Vijay K. Varadan, Ahsan Hariz, Olaf Reinhold "Smart Materials, Structures, & Integrated Systems", Springer, 1997
3. Bhushan, Bharat , "Handbook of Nano Technology" Springer, 2007
4. Di Ventra, Massimiliano; Evoy, Stephane; Heflin, James R. "Introduction to Nanoscale Science and Technology", Wiley, 2006
5. Mark J. Schulz , Ajit D. Kelkar , "Nanoengineering of Structural, Functional and Smart Materials" CRC Press, 2005

IE 354 ADVANCED INDUSTRIAL INSPECTION AND NON DESTRUCTIVE TESTING

Radiography: Principle of radiography, types of radiography, equipments for neutron radiography, x-ray radiography, equipments for x-ray radiography, advantages and applications of fluoroscopy and photo fluoroscopy

Electromagnetic methods: Principle of electromagnetic testing, mathematical analysis, flaw detection in conductors, various types' of instruments used and advantages of various electromagnetic methods for crack detection etc.

Ultrasonic methods: Principle of ultrasonic testing, generation of ultrasonic waves, equipment details for ultrasonic checking, methods of wave propagation, methods of flaw detection, various methods of ultrasonic testing, advantages of ultrasonic methods for flaw detection and crack location

Holography: Principle of holography, method of holographic recording, method of holographic reconstruction, advantages of this technique and applications of holographic methods for non-destructive testing.

Liquid penetrant testing: Principle of liquid penetrates testing, types of dyes and penetrants used in this testing technique and application of liquids for detecting sub-surface defects.

Magnetic particle testing: Principles of magnetic particle testing, details of equipments used and methods of crack detection by magnetic particle testing Hardness testing: Brinnel hardness testing, Rockwell hardness tests, shore hardness testing, Vicker hardness testing and theory behind various hardness testing methods.

BOOKS RECOMMENDED:

1. Malhotra, "Handbook on Non-destructive Testing of Concrete", Publisher: CRC Press, 2002.
2. Mix, Paul E, "Introduction To Nondestructive Testing: A Training Guide", John Wiley and Sons Ltd, 1999.
3. Blitz and Jack, "Electrical and Magnetic Methods of Nondestructive Testing", Institute of Physics Publishing, 2001.
4. Achenbach, J D, "Evaluation of Materials and Structures by Quantitative Ultrasonics", Springer-Verlag Vienna, 2001.
5. Henrique L M, "Non Destructive Testing and Evaluation for Manufacturing and Construction", Hemisphere Publishers, New York, 2001.

IE 356 AUTOMOBILE ENGINEERING

Introduction

Basic structure, general layout and type of automotive vehicles, Frameless and unitary construction; position of power unit.

Power Unit

Power requirements - motion resistance and power loss, tractive effort and vehicle performance curves; selection of power unit and engine performance characteristics; pollution due to vehicle emission and exhaust emission control system.

Fuel Supply System

Air cleaner and fuel pumps; Air fuel requirements and carburation; Modifications in a simple carburettor to meet different starting, running, idling and accelerating consitions; constructional details of carburetors and fuel injection systems used in Indian make vehicles. Diesel fuel system - cleaning, injection pump, injector and nozzles.

Lubrication and Cooling Systems

Necessity of lubrication; Desirable properties of lubricants; various types of lubricants and oil additives; different systems of lubrication - oil filters, oil pumps and oil pressure indicator; crank case ventilation and dilution. Purpose of cooling, air and water cooling systems; radiator, thermostat, pump and fan.

Chassis and Suspension

Loads on the frame, considerations of strength and stiffness, engine mounting, conventional and independent suspension systems; shock absorbs and stablizers; wheels and tyres.

Transmission system

Basic requirements and standard transmission systems; constructional features of automobile clutch, gear box, differential, front and rear axles; overdrives, propeller shaft, universal joint and torque tube drive; Rear wheel vs front wheel drive, principle of automatic transmission

Steering System

Requirement and steering geometry; castor action, camber and king pin angle, toe-in of front wheels, steering linkages and steering gears; wheel alignment; power steering.

Braking System

General braking requirements; Mechanical, hydraulic, vacuum power and servo brakes; Weight transfer during braking and stopping distances

Electric System

Conventional (coil and magneto) and transistorized ignition systems; Charging, capacity ratings and battery testing; starter motor and drive arrangements : voltage and current regulation

Maintenance

Preventive maintenance, trouble shooting and rectification in different systems; engine turning and servicing

BOOKS RECOMMENDED:

1. Automotive mechanics by Crouse WH; McGraw Hill Publishing Co
2. Automotive Mechanics by Heitner J; East West Press
3. Automobile Engineering Vol I and II by Kirpal Singh, Standard Publisher

IE 358 VIBRATION AND NOISE CONTROL

Vibration concepts: Vibration of SDOF free, forced, damped and undamped vibration analysis. Energy based method of analysis: Lagrange's Equation and Hamilton's principal. Lumped parameter and distributed parameter modeling of mechanical vibratory systems.

Applications of numerical procedures to determine natural frequencies and mode shapes.

Finite Element Method for dynamic analysis. Distributed parameter models of rods, bars and beams.

Experimental and theoretical routes to vibration engineering. Introduction to Modal testing, Vibration Testing. Spatial, Modal and Response models of vibrating systems.

Design of vibration isolators. Auxiliary mass systems including tuned & untuned dampers for vibration control. Signal processing for noise and vibration.

Acoustics Concepts: Wave approach to sound, wave equation in two and three dimensions. Noise measurement and instrumentation standards. Sound pressure, power and intensity. Noise radiation from vibrating bodies. Various source models. Various types of sound fields. Sound Absorption and transmission. Some case studies

BOOKS RECOMMENDED:

1. Mechanical Vibrations (2nd Edition) H Benaroya, Marcel Dekker, New York, 2004
2. Mechanical Vibration, (4th Edition) S S Rao, Pearson Education, Delhi, 2004.
3. Theory and Practice of Mechanical Vibration, (2nd Edition) J S Rao and K Gupta, New Age International Publishers, New Delhi, 1999.
4. Advanced Theory of Vibration, J S Rao, Wiley Eastern Ltd. New Delhi, 1992
2. Inman D.J., "*Engineering Vibration*" 2nd Edition, Prentice Hall, 2001, ISBN 013726142X
3. Vibration: Fundamentals and Practice, (2nd Edition) de Silva, CRC Taylor & Francis, FLUSA, 2007.
4. Fundamentals of Acoustics (4th Edition), Kinsler, Frey, Coppens & Sanders, John Wiley & Sons Inc, Delhi, 2000.

IE 360 JIGS FIXTURES AND TOOL DESIGN

Principles of jigs and fixture design: construction method and material used, the basic principles of location, locating methods and devices, radial or angular location, V-location, bush location, the basic principles of clamping, clamping devices, materials for locating and clamping elements. Drilling jigs, types, chip formation in drilling, general considerations in the design of drill jigs, drill bushings, methods of construction, drill jigs and modern manufacturing. Fixtures and economics, types of fixtures, milling fixtures, special vice jaws, design principles for milling fixtures, lathe fixtures, grinding fixtures, broaching fixtures, assembly fixtures, indexing jigs and fixtures, indexing devices, automatic clamping devices.

Tool materials and their properties: heat treatment of tools, basic requirements of a cutting tool, single point cutting tool, nomenclature, inserts, milling cutters, drills, types of drills, reamers, taps, carbide tools. Press operations: types of power presses, press selection, cutting action in punch and die operations, die clearance, cutting forces, methods of reducing cutting forces, minimum diameter of piercing, blanking die design, piercing die design, bending dies, drawing dies.

Forging dies: open & closed die forgings, Principles of die design for forging operations, die material and processes of manufacture of dies, die maintenance, die block dimensions, Selection of forging equipments, die inserts, stock size for closed and open die forging.

BOOKS RECOMMENDED:

1. Grant Hiram E, “Jigs & Fixtures”, Tata McGraw Hill Publishing Company, 1994.
2. Curtis Mark A, “Tool Design for Manufacturing”, John Wiley & Sons, 1996.
3. Donaldson Cyril, “Tool Design”, Tata McGraw Hill Publishing Company Limited, 1997.
4. Sharma P C, “Production Engineering”, S Chand & Company,1997.
5. Kalpakjian S, “Manufacturing Engineering & Technology”, Addison Wesley Longman, Pvt.Ltd., Low Price Edition, 2000.

IE 362 INDUSTRIAL INSTRUMENTATION AND CONTROL

Basic Concepts of Instrumentation: Accuracy and precision of measurement, types of error, statistical analysis of error, electrical standards, IEEE standards. Types of noises i.e. White noise, grey noise and colored noise.

Use of analysis tools of MATLAB, DFT, FFT, IFFT, Linear and Circular co-relation tools etc.

Windowing: Black Man Herris, Flat Top, Hamming, hanning, Co-efficicent windows. Use of windows to reduce leakage

Filters: Design of the analog filters like Butterworth, Bessel, Chebyshev, designing FIR/IIR filters.

Signal Processing: Auto/cross – correlation, discrete Fourier transform, convolution, power spectrum, inverse transforms, and signal amplification

Basic Sensors and Transducers: LVDT: Principle and applications, Signal conditioning of the signal measured by LVDT. Strain gauges: Principle and applications, Signal conditioning of the signal measured by strain gauges. Optical fiber based sensors: Principles of optical fiber technology, types of light emitters and absorbers etc.

Signal Measurement: Digital and analog data acquition, Types and architecture of data actuation cards. Interfacing: Methods of interfacing transducers to measurement system. Multiplexing: Meaning of multiplexing and types of multiplexing methods.

Basic Concepts of Control: Discrete and Continuous time control. Laplace and z- transform. Time domain control theories like Pole placement; Frequency domain control theories like Lead and Lag compensators.

BOOKS RECOMMENDED:

1. D S Kumar, "*Mechanical Measurement*", Metropolitan Books Company Ltd, 1998.
2. Haykin, "*Modern Filters*", Macmillan Publishers, 1989.
3. Ambardar, "*Analog and Digital Signal Processing*" Cole Publishing Company, 2001.
4. "*Measurement and Automation*" Manuals from National Instruments, 2002.
5. Lynn P A, "*Introduction to Digital Signal Processing*", John Wiley and sons, 1998.
6. Zhou K and Doyle j, "Robust and Optimal Control" Prentice Hall Publishers, 1998.

CE-216 ENVIRONMENTAL SCIENCE

The Multidisciplinary nature of environmental studies: Definition, scope and importance Need for public awareness.

Natural Resources : Renewable and non-renewable resources :Natural resources and associated problems.

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
b) Water resources : Use and over-Utilization of surface and ground water, floods, drought, conflicts and water, dams-benefits and problems.
c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.
f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

· Role of an individual in conservation of natural resources.
· Equitable use of resources for sustainable lifestyles.

Ecosystems:

· Concept of an ecosystem.
· Structure and function of an ecosystem.
· Producers, consumers and decomposers.
· Energy flow in the ecosystem.
· Ecological succession.
· Food chains, food webs and ecological pyramids.
· Introduction, types, characteristic features, structure and function of the following ecosystem :-
    a. Forest ecosystem
    b. Grassland ecosystem
    c. Desert ecosystem
    d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its conservation:

· Introduction – Definition : genetic, species and ecosystem diversity.
· Biogeographical classification of India
· Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values
· Biodiversity at global, National and local levels.
· India as a mega-diversity nation
· Hot-spots of biodiversity.
· Threats to biodiversity : habitat loass, poaching of wildlife, man-wildlife conflicts.
· Endangered and endemic species of India
· Conservation of biodiversity : In-situ conservation of biodiversity.

Environmental Pollution:

Definition

· Causes, effects and control measures of :-
    a. Air pollution
    b. Water pollution
    c. Soil pollution
    d. Marine pollution
    e. Noise pollution

f. Thermal pollution
g. Nuclear hazards

· Solid waste Management : Causes, effects and control measures of urban and industrial wastes.
· Role of an individual in prevention of pollution.
· Pollution case studies.
· Disaster management : floods, earthquake, cyclone and landslides.

Social Issues and the Environment:
· From Unsustainable to Sustainable development
· Urban problems related to energy
· Water conservation, rain water harvesting, watershed management
· Resettlement and rahabilitation of people ; its problems and concerns. Case studies.
· Environmental ethics : Issues and possible solutions.
· Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
· Wasteland reclamation.
· Consumerism and waste products.
· Environment Protection Act.
· Air (Preventation and Control of Pollution) Act.
· Water (Prevention and control of Pollution) Act
· Wildlife Protection Act
· Forest Conservation Act
· Issues involved in enforcement of environmental legislation.
· Public awareness.

Human Population and the Environment:
· Population growth, variation among nations.
· Population explosion – Family Welfare Programme.
· Environment and human health.
· Human Rights.
· Value Education.
· HIV / AIDS
· Women and Child Welfare.
· Role of Information Technology in Environment and human health.
· Case Studies.

Unit 8 : Field work
· Visit to a local area to document environmental and river forest grassland hill mountain.
· Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
· Study of common plants, insects, birds.
· Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours)

IE 451 STRATEGIC MANAGEMENT

Strategic Management Introduction: Definition- Levels of strategy- Roles of Strategist- Strategic Management Process benefits and limitations. Mission-Objectives -Social responsibilities.

Strategy Formulation: Strategic Thinking, SWOT analysis- Techniques for environmental analysis- TOWS matrix, Balanced Score Card, Steps in strategy implementation -formulation of SBU strategy.

Strategy Formulation: Leadership implementation communicating the strategy- Annual and Functional objectives- Development of Policies- Organisational Implementation- Evaluation and control. reward system.

Strategy And Structure: Strategy- Structure relationship. Organizational restructuring and Transformation, Principles of Organization.

Strategy Evaluation and Control: Strategic control- Premise and Implementation control strategic Surveillance special alert control- Operational control- Steps in Operational Control, Types of Operational control.

Portfolio Strategy: Business portfolio analysis- BGC matrix, GE multi matrix, an evaluation of Portfolio models - factors influencing portfolio strategy.

Competitive Analysis and Strategies: Structural analysis of industries threat of entry rivalry among existing competitors, threat of substitutes; Bargaining power of suppliers; structural analysis and competitive strategy -competitor analysis value chain.
Business Growth: Reasons, Risks and indicators of Business growth- Mergers and acquisitions. Management of M& A, determination of strategic purpose; screening, evaluation and choice, pitfalls in M&A, Defence strategies.

Globalization: Meaning and Dimensions, Globalization of Indian business, Barriers to change, Implementation of marketing and change.

BOOKS RECOMMENDED:

1. 1.Strategic Management - Francis Cherunilam, Himalya Publishers,
2. 2.Business Policy and Strategic Management - Azhar Kazmi, 2nd Edn, Tata McGraw Hill
3. Business Policy and Strategic Management -P Subba Rao, Himalya Publishers 1st Edition
4. Corporate Strategic Management -R.M.Srivastava, Pragati Prakashan , Meerut 1st Edition
5. Strategic Management – Robert A Pitts and David Lei, Vikas Publishing House 1st Edition
6. Business Environment for Strategic Management - K.Aswantappa, Himalaya Publishers 1st Edition

IE 452 LEAN MANAGEMENT

Introduction to lean management

Historical perspective: Origin of Toyota Production System - Toyota's engineering innovation; Overview of lean management: Definition - Objectives - Difference between mass and lean manufacturing - Benefits of Lean; Key concepts of lean management: Just-in-time – Jidoka; Overview of various Lean tools & supportive strategies; Lean system & lean tools interlink: The "TPS House" diagram; 14 Principles of Toyota Way

Waste elimination

Value added and Non-value added activities: Value-added activities - Non-value activities - Required non-value-added activities - Test for value added activities; Three M's: MUDA - MURI - MURA; Seven wastes: Overproduction - Waiting - Transportation and conveyance -Unnecessary inventory - Over processing or incorrect processing -Unnecessary/excess movement - Product defects

Preparing enterprise for lean

5S: S1 Seiri - S2 Seiton - S3 Seiso - S4 Seiketsu - S4 Shitsuke - Keys to successful implementation of 5S - Benefits of 5S; Visual Management: Use of indicators, signals and controls - Takt board; Team building: Definition - Types of teams- Ingredients of effective teams; Problem solving, the Toyota Way: Every problem is an improvement opportunity -Toyota's tactics for maximizing performance

Creating Lean processes across the enterprise

Continuous improvement cycle - Smaller and smaller batch sizes; Creating initial process stability; Continuous flow & pull system: Batch & queue system vs. Pull system - Creating one piece flow - Difficulties in shifting to continuous flow; Kanban: Rules - Size - Techniques - Squares - Containers - Cards; Establishing standard processes & procedures: Standardization as a basis for continuous improvement and Quality - Difference between standardized work and work-standards - Pre-requisites of standardized work - Standardization as an enabler; Takt time (Pace of manufacturing): Benefits of Takt time - Limitation of Takt time; Heijunka (Leveling work load): Leveling by volume - Leveling by product

Applying lean philosophy across organization

Jidoka (Stopping the line to build in quality) - Autonomation; Building a culture of "line stop" to fix problem: Organization structure at Toyota -Andon (Line Stop Alarm Light) - Changing the culture - The problem-resolution cycle; Minimizing line stop time; Making technology fit with people and lean processes; Developing exceptional people & partners; Lean implementation strategy & tactics: Process improvement approach - Value stream mapping approach - Hot projects approach - Plant wide lean tools approach; Enterprise wide lean tools approach - Applying lean to the extended enterprise; Leading the change: Role of top management - Role of middle management - Role of bottom management - Environments for change - Time frame for Lean

RECOMMENDED BOOKS:

1. Liker, Jeffrey K. and Meier, David P. (2007); The *Toyota Way Fieldbook;* Tata McGraw-Hill
2. Liker, Jeffrey K. (2004); *The Toyota Way,* Tata McGraw-Hill.
3. Womack, James P. and Roos, Daniel T. (2003); Lean *Thinking;* Simon and Schuster, New York.
4. Womack, James P. and Roos, Daniel T. (2005); *Lean Solutions;* Simon and Schuster, New York.
5. Liker, Jeffrey K. (1997); *Becoming Lean: Inside Stories of U.S. Manufacturers;* Productivity Inc., Portland.

IE 453 INDUSTRIAL SAFETY AND ENVIRONMENT

Meaning & need for safety. Relationship of safety with plant design, equipment design and work environment, Industrial accidents, their nature, types and causes. Assessment of accident costs; prevention of accidents. Industrial hazards, Hazard identification techniques, Accident investigation, reporting and analysis.

Planning for safety: Definition, purpose, nature, scope and procedure. Range of planning, variety of plans. Policy formulation and implementation of safety policies.

Safety measures in a manufacturing organization, safety and economics, safety and productivity. Employees participation in safety. Safety standards and legislation

Meaning of environment and need for environmental control factors in industry. Effect of temperature, Illumination, humidity noise and vibrations on human body and mind. Measurement and mitigation of physical and mental "fatigue" Basics of environment design for improved efficiency and accuracy at work.

Ventilation and heat Control Purpose of ventilation. Physiology of heat re gulation. Thermal environment and its measurement. Thermal comfort. Indices of heat stress. Thermal limits for comfort, efficiency and freedom from health risk. Natural ventilation. Mechanical ventilation. Air conditioning Process ventilation. Control of heat exposures: control at source, insulation, and local exhaust ventilation. Control of radiant heat, dilution ventilation. Local relief.

Industrial Lighting: Purpose of lighting, benefits of good illumination. Phenomenon of lighting and safety. Lighting and the work. Sources and types of artificial lighting. Principles of good illumination. Recommended optimum standards of illumination. Design of lighting installation. Maintenance standards relating to lighting and colour.

Noise & Vibrations: Continuous and impulse noise. The effect of noise on man. Noise measurement and evaluation of noise. Noise isolation. Noise absorption techniques. Silencers vibrations: Effect, measurement and control measures.

Environment Standards: Introduction to ISO 14000; Environment standards for representative industries.

BOOKS RECOMMENDED:

1. Ventilation by Joselin, Edward Arnold

2. Noise Reduction by Beranek, Mcgraw Hill

3. Modern Safety and health Technology by DC Reamer; R. Wiley

4. Industrial Accident Prevention by Heinrich, HW; McGraw Hill

5. The process of Hazard Control by Firenze, RJ; Kendale

IE 454 ORGANISATIONAL BEHAVIOUR

Organizational Behaviour –Definition of OB, contributing discipline to OB. Challenges and Opportunities for OB.
Foundations of Individual behaviour-biographical characteristics, ability, and learning.
Values, Attitudes and Job Satisfaction Personality and Emotions Perception
Motivation – Concept, Theories of Maslow, Herzberg, McCelland, Porter & Lawler Model, Application of Motivation concept, Foundations of Group Behaviour-Group formation, development and structure, group processes, Group Decision-Making techniques, work teams.
Interpersonal Skills-Transactional Analysis, Life Positions, Johari Window.
Leadership: Concept, theories, Styles and their application Power and Politics in organization Conflict Management, Stress Management, Crisis Management, Organisational Change & Development, Innovation, Creating learning organization,
Emotional Intelligence –Concept Organisational Culture, Cross-Cultural Behaviour Organisational Effectiveness

Recommended Books

1. Robbins Organisation Behaviour Pearson Education Asia
2. Luthans Organisation Behaviour Tata McGraw Hill
3. Udai Pareek Understanding Organisation Behaviour Oxford Publishing House

IE 455 OPERATION RESEARCH-II

The simplex algorithm, post optimality analysis, duality in l.p., dual simplex method, revised simplex method.

Transportation algorithm and optimality, assignment model, Hungarian method. decision making under certainty, risk and uncertainty, game theory, two-person zero-sum game, mixed strategy.

Elements of queuing model, single channel infinite population model, finite queue length, pure birth and death model, multi channel queuing model.

Goal programming, problem formulation, the weighting method, primitive method.

Integer programming, problem formulation, branch-and-bound algorithm, zero-one implicit enumeration algorithm.

Non-linear programming, direct search method, gradient method.

Evolutionary algorithms, introduction to genetic algorithms, Binary coded GAs for constrained optimization, introduction to real coded GAs. Introduction to simulated annealing, ant colonies, particle swarm optimization.

BOOKS RECOMMENDED:

1. Taha, H.A., Operations Research - An Introduction, Sixth Edition, Prentice Hall of India Private Limited, N. Delhi, 2004.
2. Hillier, F.S., Operations Research, First Indian Edition, CBS Publishers and Distributors, Delhi, 1994.
3. Wagner H.M., Principles of Operations Research, Second Edition, Prentice Hall of India Private Limited, New Delhi, 2003.
4. Deb K, Optimization for Engineering Design, Prentice Hall of India Pvt. Ltd., 2005.
5. Gupta P.K., and Hira, D.S., Operations Research, Third Edition, S. Chand and Company Ltd., New Delhi, 2005.

IE 456 ADVANCED INDUSTRIAL PSYCHOLOGY

Introduction: Nature, Scope, and Problems & Objectives.
Individual Differences and their Evaluation, Role of Heredity, Environment, Types of Individual Differences.
Psychological tests in industries, their Utility, Reliability and Validly
Attitudes: Meaning, Characteristics, Factors that Influence Development of Attitudes, Implication for organization.
Industrial Morale : Meaning, Characteristics, Factors that Influence Morale, Measures of Improving Morale.
Monotony: Fatigue and Stress: Meaning, Impact, Causative Factors. Motivation: Meaning, Types, Applications in industry - MBO, Job design.
Work Environment: The Arousal Hypothesis - Noise, Illumination, Color, Vibration, Miscellaneous Factors.

Recommended Books

1. M.L. Blum & J.C. Naylor - Industrial Psychology - Its Theoretical & Social Foundations - CBS
2. Ghosh & Ghorpade Industrial Psychology Himalaya

IE 461 SOFT COMPUTING

Fuzzy Set Theory: Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Set-theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy If-Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models – Input Space Partitioning and Fuzzy Modeling.

Optimization: Derivative-based Optimization – Descent Methods – The Method of Steepest Descent – Classical Newton's Method – Step Size Determination – Derivative-free Optimization – Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.

Neural Networks: Supervised Learning Neural Networks – Perceptrons - Adaline – Backpropagation Mutilayer Perceptrons – Radial Basis Function Networks – Unsupervised Learning Neural Networks – Competitive Learning Networks – Kohonen Self-Organizing Networks – Learning Vector Quantization – Hebbian Learning.

Neuro Fuzzy Modeling: Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

Applications Of Computational Intelligence: Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.

RECOMMENDED BOOKS

1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 200
2. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997.
3. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.
4. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.
5. R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence - PC Tools", AP Professional, Boston, 1996.

IE 462 MANAGEMENT INFORMATION SYSTEM

Information and Decision Making: Concept of information; data versus information, characteristics of information, classification of information, cost and value of information, Use of information in the decision making process, information requirements for decision making, types of decisions, decision making process, decision making models role of information system, decision support systems, expert systems.

Management Information Systems (MIS) Concept, Characteristics and importance of management information systems, types of information systems role of computers in management information systems, hierarchy of data processing systems, operating elements of MIS, information needs of MIS, storage and retrieval of data processing, functions of information systems, management reports. Analysis and design cycle for MIS.

Various approaches to system analysis and design. Strategic and project Planning for MIS, analysis and design, matching mission, objectives and plans of MIS with business plans, project planning for MIS, Conceptual system design, Detailed system design, Implementation, Evaluation and Maintenance of MIS.

Computer Networks and Data Communication Computer network : Local Area networks; characteristics topologies network structures, switching networks, OSI standards for multi vendor network. I.A.N standards, application of networks, Data Communication concepts, types and modes of transmission, hardware requirements, communication controllers, Data Communication software, data communication protocol

Data Base Management Systems: Introduction, data base designing, relationa l data base management system. Introduction to computerized data base management system.

BOOKS RECOMMENDED:

1. Information systems for Modern Management by Mudrick, Ross and Clagget Prentice Hall.
2. Management Information systems by Davis and Olson McGraw Hill
3. Information systems for management by Lucas McGraw Hill

IE 463 DESIGN OF EXPERIMENTS

INTRODUCTION

Strategy of experimentation, Some typical applications of experimental design, Basic principles, Guidelines for designing experiments, A brief history of statistical design, Using statistical design in experimentation.

SIMPLE COMPARATIVE EXPERIMENTS

Introduction, Basic statistical concepts, Sampling and sampling Distribution, Inferences about the Differences in means, randomized designs, Inferences about the Differences in means, Paired comparison Designs, Inferences about the Variances of Normal Distributions.

FITTING REGRESSION MODELS

Introduction, Linear regression models, Estimate of parameters in linear regression models, Hypothesis testing in multiple regression, Confidence intervals in multiple regression, Prediction of new response observations, Regression model diagnostics, testing for lack of fit

TAGUCHI METHOD OF DESIGN OF EXPERIMENTS

Concept design, Parameter design, Tolerance design, Quality loss function, Signal-to- Noise ratio, Orthogonal array experiments, Analysis of Mean(ANOM), Quality characteristics, Selection and testing of noise factors, Selection of control factors, Parameter optimization experiment, Parameter design case study.

ANALYSIS OF VARIANCE (ANOVA)

Introduction, Example of ANOVA process, Degrees of freedom, Error variance and pooling, Error variance and application, Error variance and utilizing empty columns, the F-test.

BOOKS RECOMMENDED:

1. Design and Analysis of Experiments, Douglas C Montgomery, John Wiley
2. Statistical Design and Analysis of Experiments, John P.W.M., Macmillan,
3. Introduction to Linear Regression Analysis, Montgomery D.C., Runger G. C.,
4. Response Surface Methodology: Process Ang Product Optimisation Using Designed Experiments, Myres R.H., Montgomery D. C., Wiley, New York
5. Introduction to Quality Engineering, Taguchi, G., Asian Productivity Organisation, UNIPUB, White Plains, New York
6. System of Experimental Design: Engineering Methods to Optimize Quality and Minimize Cost, Taguchi, G. UNIPUB, White Plains, New York
7. Statistical Analysis for Engineers And Scientists, J. Wesley Barnes, McGraw Hill Inc.

IE 464 MANAGEMENT AND ENTREPRENEURSHIP

MANAGEMENT: Introduction- meaning nature & characteristic of management, scope & functional areas of management. Management as a science, art or profession, management and Administration, Role of management, levels of management, Development of management thought – early management approaches – modern management and approaches

PLANNING: Nature, Importance and purpose of planning process, objectives, types of plans (meaning only), decision – making, importance of planning, steps in planning and planning premises, Hierarchy of plans

ORGANIZING AND STAFFING: Nature and purpose of organization, principles of organization, Types of organization – Departmentation – committees – centralization v/s decentralization of authority and responsibility, span of control- MBO and MBE (meaning only), nature and importance of staffing, process of selection and recruitment (in brief)

DIRECTING & CONTROLLING: Meaning and nature of directing, leadership styles, motivation theories, communication- meaning and importance, co-ordination, meaning and importance, techniques of co- ordination, Meaning and steps in controlling, essentials of a sound control system, methods of establishing control (in brief)

ENTREPRENEUR: Meaning of entrepreneur, evaluation of the concept, function of an entrepreneur types of entrepreneur, evolution of entrepreneurship, development of entrepreneurship, stages in entrepreneurial 6 process, role of entrepreneurs in economic development entrepreneurship in India, entrepreneurship - its barriers

SMALL SCALE INDUSTRY: Definition, characteristics, need and rationale, objectives, scope, role of SSI in economic development, advantages of SSI, steps to start an SSI – Govt policy towards SSI, different policies of SSI, Govt support for SSI during 5 year plans. Impact of liberalization, privatization, globalization on SSI, effect of WTO/ GATT, supporting agencies of Govt for SSI, meaning; nature of support, objectives, and functions, types of help, ancillary industry and tiny industry (Definition only)

INSTITUTIONAL SUPPORT: Different Schemes, DIC single window Agency SISI, NSIC, SIDBI, PFC

PREPARATION OF PROJECT-Meaning of Project; Project Identification Project Selection Project Report, Need and significance of Report, Contents, Formulation Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report, Project Appraisal, Identification of Business Opportunities. Market Feasibility Study, Technical Feasibility study, Financial Feasibility Study & Social Feasibility study.

BOOKS RECOMMENDED:

1. Principles of Management - PC Tripati, P N Reddy,–THM Hill,
2. Dynamics of Entrepreneurial Development & Management - Vasant Desai Himalaya Publishing House –
3. Entrepreneurship Development – small Business Enterprises Poornima M Charanthmath Pearson Education – 2005
4. Management Fundamentals - Robert Lusier,– Concepts, Application, Skill Development" Thomson
5. Entrepreneurship Development - S S Khanka S Chand & Co
6. Management - Stephan Robbins Pearson Education/PHI 17th Edition 2003.

IE 465 DESIGN FOR MANUFACTURING AND ASSEMBLY

DFMN Approach and Process: Methodologies and tools, design axioms, design for assembly and evaluation, minimum part assessment taquchi method, robustness assessment, manufacturing process rules, designer's tool kit, Computer Aided group process rules, designer's tool kit, Computer Aided group Technology, failure mode effective analysis, Value Analysis. Design for minimum number of parts, development of modular design, minimising part variations, design of parts to be multi-functional, multi-use, ease of fabrication, Poka Yoka principles.

Geometric Analysis: Process capability, feature tolerance, geometric tolerance, surface finish, review of relationship between attainable tolerence grades and difference machining processes. Analysis of tapers, screw threads, applying probability to tolerences. Form Design of Castings And Weldments: Redesign of castings based on parting lineconsiderations, minimising core requirements, redesigning cast members using weldments, use of
welding symbols.

Mechanical Assembly: Selective assembly, deciding the number of groups, control of axial play, examples, grouped datum systems - different types, geometric analysis and applications-design features to facilitate automated assembly.

True Position Theory: Virtual size concept, floating and fixed fasterners, projected tolerance zone, assembly with gasket, zero true position tolerance, functional gauges, paper layout gauging, examples. Operation sequence for typical shaft type of components. Prepration of process drawings for different operations, tolerence worksheets and centrality analysis, examples. Automatic assembly Transfer systems: Automatic Feeding and orienting –vibratory feeders, automatic feeding and orienting mechanical feeders, Feed tracks, parts placement mechanisms Performance and Economics of Assembly

Design for manual Assembly: Product design for high speed automatic assembly and robot assembly, printer circuit board assembly. Feasibility study for assembly automation.

BOOKS RECOMMENDED:

1. Biren Prasad, "*Concurrent Engineering Fundamentals - VOL II*", Prentice Hall, 1997.
2. Ulrich Karl.T, Eppinger Stephen D, "*Product design and development*", McGraw Hill, 1994.
3. Carter Donald E., "*Concurrent Engineering*", Addision Wesley, 1992.
4. Bralla James G., "*Hand Book of Product Design for Manufacturing*", McGraw Hill, 1986.
5. Beitz Paul, "*Engineering Design*", Springer Verlag, 1992.

IE 466 FINITE ELEMENT ANALYSIS

1**. Basic concepts:** Variational and Residual methods-Introduction - Different approaches in Finite Element Method - Direct Stiffness approach, simple examples Variational approach, Elements of variational calculus – Euler's-Lagrange equation, Rayliegh Ritz method , Weighted Residual methods, Point Collation method, Sub domain Collation method, Galerkins method - Steps involved in FEM.

2**.Elements and Interpolation Functions:** Elements and coordinate system –Interpolation Polynomials - Linear elements Shape function - Analysis of simply supported beam - Element and Global matrices - Two dimensional elements, triangular and rectangular elements - Local and Natural Co-ordinate systems.

3. **Finite Element Solution of Field Problems:** Field problems – Finite element formation of field problems - Classification of partial differential equations - Quasiharmonic equation - Steady state problems - Eigen value problems - Propogation problems - Examples, Torsional problem – Fluid flow and Heat transfer problems - Acoustic vibrations – Application in manufacturing problems – metal cutting and metal forming.

4. **Finite Element Solution of Structural Problems:** Solid mechanic problems – Finite element formulation of solid mechanic problems - Axial force member - element matrices for axial force members - Truss element analysis of pinned truss - Two dimensional elasticity problems.

5**. Higher Order Elements and Numerical Methods:** Numerical method and computer implementation –Numerical method in FEM and Computer implimentation. Evaluation of shape functions - One dimensional & triangular elements, Quadrilateral elements, Isoparametric elements - Numerical Integration, Gauss Legendre quadrature - Solution of finite element equations -Cholesky decomposition, Skyline storage - Computer implementation- Use of FEM software.

Recommended Books

1. Larry J Segerlind ," Applied Finite Element Analysis", John Wiley, 1984
2. Bathe, K.J., "Finite Element Procedures", Prentice Hall, 1994.
3. Huebner,K.H. and Thornton, E.A., "The Finite Element Method for Engineers", John Wiley, 1982.
4. Reddy,J.N., "Introduction to Finite Element Method", McGraw Hill, 1993
5. Zienkiewich . O.C., and Taylor . R.L., "The Finite Element Method", McGraw Hill,1991.
6. S.S.Rao, "Finite element method ", 1995.