BMS COLLEGE OF ENGINEERING, BANGALORE
Autonomous College under VTU
Department: INDUSTRIAL ENGINEERING & MANAGEMENT **Semester: 03**

Subject Code										Subject Title	Credit Hours/Week				Contact hrs/wk	Marks		
											L	T	P	Total credit		CIE	SEE	Total
0	9	M	A	3	I	C	M	A	T	MATHEMATICS III	3	1	0	4	5	50	50	100
0	9	I	E	3	D	C	P	T	1	PRODUCTION TECHNOLOGY-I	4	0	1	5	7	50	50	100
0	9	I	E	3	D	C	S	O	M	STRENGTH OF MATERIALS	3	1	0	4	5	50	50	100
0	9	I	E	3	D	C	M	M	M	MECHANICAL MEASUREMENTS & METROLOGY	3	0	1	4	5	50	50	100
0	9	I	E	3	D	C	F	T	D	FUNDAMENTALS OF THERMODYNAMICS	3	1	0	4	5	50	50	100
0	9	M	I	3	G	C	C	M	D	COMPUTER AIDED MACHINE DRAWING	2	0	2	4	6	50	50	100
Total														**25**	**33**	**300**	**300**	**600**

L – Lecture Hours / week**; T-** Tutorial Lecture Hours **/** week**; P-**Practical Lecture Hours / week**.**
CIE- Continuous Internal Evaluation; **SEE**- Semester End Examination (of 3 Hours duration)'

Chairperson-BOS
MI Cluster

HOD – IEM

BMS COLLEGE OF ENGINEERING, BANGALORE
Autonomous College under VTU
Department: INDUSTRIAL ENGINEERING & MANAGEMENT **Semester: 04**

Subject Code										Subject Title	Credit Hours/Week				Contact hrs/wk	Marks		
											L	T	P	Total credits		CIE	SEE	Total
0	9	I	E	4	D	C	M	A	T	ENGINEERING MATHEMATICS - IV	3	1	0	4	5	50	50	100
0	9	I	E	4	D	C	P	T	2	PRODUCTION TECHNOLOGY-II	3	0	1	4	5	50	50	100
0	9	I	E	4	D	C	T	O	M	THEORY OF MACHINES	3	1	0	4	5	50	50	100
0	9	I	E	4	D	C	M	S	M	MATERIAL SCIENCE & METALLURGY	4	0	1	5	6	50	50	100
0	9	I	E	4	D	C	M	C	D	MACHINE DESIGN	3	1	0	4	5	50	50	100
0	9	I	E	4	D	C	F	M	M	FLUID MECHANICS & MACHINES	3	1	0	4	5	50	50	100
Total														25	31	300	300	600

L – Lecture Hours / week; **T-** Tutorial Lecture Hours / week; **P-**Practical Lecture Hours / week.
CIE- Continuous Internal Evaluation; **SEE-** Semester End Examination (of 3 Hours duration)

Chairperson-BOS
MI Cluster

HOD – IEM

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
III SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	MATHEMATICS III	Sub. Code	09MA3ICMAT
Credits	04	L-T-P	3-1-0

UNIT 1
Fourier Series: Periodic function, Dirichlet's condition, statement of Fourier Theorem, Fourier coefficients, change of interval, Half range Fourier series, Complex Fourier series, Practical Harmonic analysis. **9 Hrs**

UNIT 2
Fourier Transform: Infinite Fourier transform, Fourier Sine and Cosine transform, properties, Inverse transforms, Convolution theorem (statement only), Parseval's identities. **10Hrs**

UNIT 3
Partial Differential Equations: Formation of Partial differential equations–elimination of arbitrary constants, elimination of arbitrary functions Equations of first order- The linear equation $P\,p + Q\,q = R$**,** Lagrange's partial differential equation, Charpits method, Equation of second order , derivation of one-dimensional heat equation, wave equation, various possible solution of these by the method of separation of variables, D'Alemberts solution of wave equation, two dimensional Laplace equation and solutions with various boundary conditions (boundary value problems) **12 Hrs**

UNIT 4
Numerical Methods I: Algebraic and Transcendental Equations: Regula Falsi method, Newton Raphson method, deductions.

Finite Differences: Forward differences, backward differences, Central difference, Shift operator Interpolation: Newton Gregory forward formula, Newton Gregory backward formula. Newton's general interpolation formula, Lagrange's interpolation formula, Inverse interpolation.

Numerical Differentiation: Derivatives using forward and backward formula.

Numerical Integration: Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8th rule, Weddle's rule. **11 Hrs**

UNIT 5
Numerical Methods II: Numerical solution of ordinary differential equations: Taylor's series method, Euler's modified method, Runge-Kutta method, Milne's method and Adam's Bashforth method.

Numerical solution of Partial differential equations: Numerical solution of one-dimensional heat equation –Schmidt's explicit 2-level formula, Bendre Schidmt formula, numerical solution of one dimensional wave equation- explicit 3-level formula, numerical solution of Laplace equation standard 5 point formula. **10 Hrs**

Text Books:
1. Glyn James, Advanced Modern Engineering Mathematics, 3rd ed, Pearson Education.
2. B.V. Ramana, Higher Engineering Mathematics, xxx edition,Tata Mc. Graw Hill.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 8th edition, Wiley Publications.
4. B.S. Grewal, Higher Engineering Mathematics, 37th edition, Khanna Publishers..

Reference Books:
1. Murry R Spiegel, John Schiller, Alu Srinivasan, Probability and Statistics, 2nd edition, Schaum's outlines.
2. S.S. Sastry, Introductory methods in Numerical Analysis, 4th edition, Prentice Hall of India
3. Dennis G Hill, Michael R Cullen, Advanced Engineering Mathematics, 3rd edition, Jones and Barlett Publishers Inc.
4. James Ward Brown and Ruel V Churchill, Complex variables and applications, 7th edn, Mc. Graw Hill

Question Paper Pattern
1. Each unit consists of one full question.
2. Each full question consists of three or four subdivisions with or without internal choice.
3. Five full questions to be answered.

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
III SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	PRODUCTION TECHNOLOGY - I	Sub. Code	09IE3DCPT1
Credits	05	L-T-P	4-0-1

Unit – 1

Theory of Metal Cutting: Single point cutting tool nomenclature, Merchants circle diagram and analysis, Ernst Merchant's solution, shear angle relationship, problems of Merchant's analysis, tool wear and tool failure, tool life, effects of cutting parameters on tool life, tool failure criteria, Taylor's tool life equation, problems on tool life evaluation. **8 Hrs.**

Cutting tool materials: Desired properties, types of cutting tool materials – HSS, carbides coated carbides, ceramics,
Cutting fluids: Desired properties, types and selection. Heat generation in metal cutting, factors affecting heat generation, Heat distribution in tool and W/P, Measurement of tool tip temperature. **6 Hrs.**

Unit-2

Production Lathe: Classification of Lathes, Capstun & Turret lates-Constructional features, tool layout, tool and work holding devices. **4 Hrs.**

Shaping, Slotting and planning machines: Classification, constructional features of shaping m/c, slotting m/c, planning m/c. driving mechanisms of shaping, slotting and planning machines. Operations done on shaping machine, slotting machine and planning machine. **5 Hrs.**

Drilling machines: Classification, constructional features, drilling & related operations, types of drill & drill bit nomenclature, drill materials. Calculation of machining time **3 Hrs.**

Unit – 3

Milling machines: Classification, constructional features, milling cutters nomenclature, milling operations, up milling and down milling concepts. Calculation of machining time. **Indexing:** Simple, compound, differential and angular indexing calculations. Simple numericals on indexing. **10Hrs.**

Broaching machines: Classification, Construction and principle of operations **2 Hrs.**

Unit – 4

Grinding, Laping and Honing machines: Types of abrasives, bonding process, classification, constructional features (cylindrical and surface grinding, centre less grinding), selection of grinding wheel.
Laping and Honing: Principles of operation, construction, applications. **8Hrs.**

Unit – 5

Non-traditional machining processes: Principle, need, equipment, operation and LBM, plasma arc machining, Electro chemical machining, ultrasonic machining, abrasive let machining, water jet machining. **6 Hrs.**

Unit – 6

Preparation of three models on lathe involving: Facing, Plain turning, Taper turning, Step turning, Thread cutting, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning.

Cutting of "V" Groove/ Dovetail / Rectangular groove: Using Shaping Machine, Cutting of Gear Teeth Using Milling Machine.
Demonstration on Grinding Machine.

Text Books:

1. Workshop Technology by Hazara Choudhry, Vol-II, Media Promoters & Publishers Pvt. Ltd. 2004
2. Production Technology by R.K.Jain, Khanna Publications, 2003.
3. Production technology by HMT, Tata MacGraw Hill, 2001.

Reference Books:

1. Manufacturing Science by Amitabha Ghosh and Mallik, affiliated East West Press, 2003.
2. Fundamentals of Metal Machining and Machine Tools by G. Boothroyd, McGraw Hill, 2000.

Scheme of examination :

Five Question to be set with one question from each unit carrying 20 marks each. Any three units will have an internal choice.

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DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
III SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	STRENGTH OF MATERIALS	Sub. Code	09IE3DCSOM
Credits	04	L-T-P	3-1-0

Unit – 1. Simple stress and strain: Introduction, stress, strain, mechanical properties of materials, Linear elasticity, Hooke's Law and Poisson's ratio, Stress-Strain relation – behaviour in Tension for Mild steel and non ferrous metals. Extension / Shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections (circular and rectangular), Principle of super position. Elongation due to self weight for constant cross section, simple shear stress, shear strain, elastic constants and their relations. Volumetric strain. **12 Hrs**

Compound stresses: Introduction, plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr's circle for plane stress. **06 Hrs**

Unit – 2. Bending moment and Shear force in beams: Introduction, Types of beams, loads and reactions, shear forces and bending moments, rate of loading, sign conventions, relationship between shear force and bending moments, shear force and bending moment diagrams for different beams subjected to concentrated loads, uniformly distributed load and couple for different types of beams. **06 Hrs**

Unit -3. Bending and shear stresses in beams: Introduction, theory of simple bending, assumptions in simple bending, relationship between bending stresses , radius of curvature and bending moment, moment carrying capacity of a section, shearing stresses in beams. (composite / fletched beams not included). **08 Hrs**

Deflection of beams: Introduction, differential equation for deflection, equations for deflections, slope and moments, double integration method for cantilever and simply supported beams for point loads, UDL and Couple. **06 Hrs**

Unit - 4. Torsion of circular shafts: Introduction, pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts, power transmitted by solid and hollow circular shafts**.** **06 Hrs**

Unit - 5. Thick and thin cylinders: Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume), Thick cylinders subjected to internal and external pressures (Lame's equation), (compound cylinders not included), No Numerical

Colums and Struts: Introduction: Euler's formula for critical load of columns for different end conditions, limitations of Euler's theory, Rankine's formula. No derivation, No Numerical. **08 Hrs**

Text Books:

1. "Engineering Mechanics of Solids" Egor.P. Popov, Pearson Edu. India, 2nd, Ed 1998.
2. "Mechanics of materials" K.V. Rao, G.C. Raju,Subhash Stores, First Edition,2007

Reference Books:

1. "Mechanics of Solids", Mubeen, Pearson Edu. India, 2002
2. "Strength of Materials", W.A. Nash, Schaum's Outline Series, Fourth Edition-2007
3. "Mechanics of materials", S.I. Units, Ferdinand Beer & Russell Johnstan, TATA McGrawHill-2003.
4. "Strength of Materials", S.S.Bhavikatti, Vikas pub. House – Pvt. Ltd., 2nd Ed., 2006.

Scheme of examination: One question from each unit and choice from unit 1 and 3

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
III SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	MECHANICAL MEASUREMENTS & METROLOGY	Sub. Code	09IE3DCMMM
Credits	04	L-T-P	3-0-1

Unit – 1

Standards of measurement: Definition and Objectives of metrology, Standards of length - International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, Slip gauges, Wringing phenomena, Indian Standards (M-81, M-112), Numerical problems on building of slip gauges. **4 Hrs**

Comparators and Angular measurement: Introduction to Comparator, Characteristics, classification of comparators, mechanical comparators, Sigma Comparators, dial indicator, Optical Comparators -principles, Zeiss ultra optimeter, Electric and Electronic Comparators -principles, LVDT, Pneumatic Comparators, Principles, Solex Comparators.

4 Hrs

Unit – 2

System of limits, Fits, Tolerances and gauging: Definition of tolerance, Specification in assembly, Principle of inter changeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances accumulation of tolerances, definition of fits, types of fits and their designation (IS 919 -1963), geometrical tolerance, positional - tolerances, hole basis system, shaft basis of system, classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges -plain plug gauge, ring . Gauge, snap gauge, limit gauge, gauge materials. **10Hrs**

Unit – 3

Angular measurements: Bevel Protractor, Sine Principle and. use of Sine bars, Sine center.

Principles of Interferometry: Interferometer Principle of interferometery, autocollimator. Optical flats. **4 Hrs**

Screw thread gear measurement : Terminology of screw threads, measurement of major diameter, minor diameter pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, Best size wire. Toolmakers microscope, gear terminology, use of gear tooth Vernier caliper and gear tooth micrometer. **4 Hrs**

Unit – 4

Measurements and Measurement systems:

Definition, Significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hystersis, repeatability, linearity, loading effect, system response-times delay. Errors in Measurements, Classification of Errors. **4 Hrs**

Transducers, Intermediate modifying and terminating devices: Transfer efficiency, Primary and Secondary transducers, electrical, Mechanical, electronic transducers, advantages of each type transducers. Electrical intermediate modifying devices, electronic amplifiers. Terminating devices, Mechanical, Oscillographs, X-Y Plotters. **4 Hrs**

Unit – 5

Measurement of Force,Torque & Pressure: Principle, platform balance, proving ring, Torque measurement, Prony brake, hydraulic dynamometer. Pressure Measurements, Principle, use of elastic members, Bridgeman gauge. **4 Hrs**

Temperature and strain measurement: Resistance thermometers, thermo-couple, law of thermocouple materials used for construction, pyrometer, Optical Pyrometer. Strain Measurements, Strain gauge, gauge factor, methods of strain measurement. **4 Hrs**

Unit – 6 (Laboratory Experiments)

1. Calibration of Pressure Gauge
2. Calibration of Thermocouple
3. Calibration of LVDT
4. Calibration of Load cell
5. Determination of modulus of elasticity of a mild steel specimen using strain gauges.
6. Measurements using Optical Projector / Toolmaker Microscope.
7. Measurements of angle using Sine Center / Sine bar / bevel protractor
8. Measurements of cutting tool forces using
   a) Lathe tool Dynamometer b) Drill tool Dynamometer.
9. Measurements of Screw thread Parameters using two wire or three-wire method.
10. Measurements of Surface roughness. Using Tally surf/mechanical Comparator.
11. Measurements of gear tooth profile using gear tooth vernier /gear tooth micrometer.
12. Calibration of micrometer using slip gauges
13. Measurement on the using Optical Flats

Text Books:

1. "Mechanical measurements" by Beckwith Marangoni and Lienhard, Pearson Education, 6 th Ed., 2006.
2. "Engineering Metrology" by R.K.Jain, Khanna Publishers, 1994.

Reference Books:

1. "Engineering Metrology" by I.C.Gupta, Dhanpat Rai Publications, Delhi
2. Measurements Systems, Applications & Design, by Ernen O Dobeblein, 5^{TH} ed.
3. "Industrial Instrumentation" Alsutko, Jerry. D.Faulk, Thompson Asia Pvt. Ltd.2002. Mechanical Measurements, R.S.Shirohi & H.C.Radhakrishna, 3^{rd} Ed., New Age Intl.Pvt Ltd.,

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
III SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	FUNDAMENTALS OF THERMODYNAMICS	Sub. Code	09IE3DCFTD
Credits	04	L-T-P	3-1-0

UNIT-1

1) Fundamental Concepts & Definitions:

Thermodynamics: Definition and scope. Microscopic and Macroscopic approach Engineering Thermodynamics Definition, some practical applications of engineering thermodynamic. System (closed system) and Control Volume (open system), Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive and extensive properties. Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic processes; Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium- Zeroth law of thermodynamics, Temperature; concepts, scales, measurement. Internal fixed point

2) Work & Heat:

Mechanics definition of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; at part of a system boundary, at whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Shaft work; Electrical work. Other types of work. Heat; definition, units and sign convention, what heat is not. **7 Hrs**

UNIT-2

1) First Law of Thermodynamics:

Joule's experiments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non -cyclic processes, energy, energy as a property, modes of energy. Extension of the First law to control volume; steady state-steady flow energy equation, important applications, analysis of unsteady processes such as filling and evacuation of vessels with and without heat transfer. 6**Hrs**

UNIT-3

1) Second Law of Thermodynamics:

Devices converting heat to work; (a) in a thermodynamic cycle, (b) in a mechanical cycle. Thermal reservoir. Direct heat engine; schematic representation and efficiency. Devices converting work to heat in a thermodynamic cycle; reversed heat engine, schematic representation, coefficients of performance. Kelvin -Planck statement of the Second law of Thermodynamic; PMM I and PMM1I. Clasiu's statement .of Second law of Thermodynamic; Equivalence of the two statements; Reversible and irreversible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Carnot principles. Thermodynamic temperature scale.

2) Entropy:

Clasiu's inequality; statement, proof, application to a reversible cycle. Q_R/T as independent of the path. Entropy; definition, a property, principle of increase of entropy, entropy as a quantitative test for irreversibility, calculation of entropy using T ds relations, entropy as a coordinate. **11 Hrs**

UNIT-4

1) Gas Power Cycles:

Air standard cycles; Carnot, Otto, Diesel, Dual and Stirling cycles, P-v and T-s diagrams, description, efficiencies and mean effective pressures. Comparison of Otto, Diesel and Dual cycle.

2) Gas turbines and Jet Propulsion:

Classification of Gas Turbines, Analysis of open cycle gas turbine cycle. Advantages and Disadvantages of closed cycle. Methods to improve thermal efficiency. 12 **Hrs**

UNIT-5

1) I C Engines:

Testing of two-stroke and four-stroke Sl and CI engines for performance, related numerical problems, heat balance, Morse test. 6 **Hrs**

Text Books:

1. **"Basic and Applied Thermodynamics"** by P .K. Nag, Tata McGraw Hill, 3rd Edi. 2002
2. **"Thermodynamics an engineering approach"**, by Yunus A. Cengel and Michael A. Boles, Tata McGraw hill Publication, 2002

Reference Books:

1. **Engineering Thermodynamics**. by Rajput, Laxmi Publications pvt ltd., 3rd Edition 2007.
2. **Engineering Thermodynamics** by J.B. Jones and G.A. Hawkins, John Wiley and Sons.
3. **Thermo Dynamics** by S.C. Gupta, Pearson Edu. Pvt. Ltd., 1st Edition, 2005.
4. Fundamentals of Thermodynamics by G.J. Van Wylen and R.E. Sonntag, Wiley Eastern
5. I C Engines by V. Ganesan, Tata McGraw Hill, 3rd Edition. 2002
6. I C Engines by M.L. Mathur and R.P. Sharma.

Scheme of Examination: One question from units 1, 2 & 5 and two questions from units 3 & 4

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
III SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	COMPUTER AIDED MACHINE DRAWING	Sub. Code	09MI3GCCMD
Credits	04	L-T-P	2-0-2

Unit – 1 C*hapter 1* - Sections of Solids: Sectioning, Sectional view, Representation of section plane, Hatching, Sectioning of engineering objects when the axis is inclined to one plane of projection & parallel to the other like: Square, Pentagonal, Hexagonal prisms, Square, Pentagonal, Hexagonal pyramids, Cylinder, Cone and Tetrahedron. **8 Hrs.**

***Chapter 2* - 3D Modelling from Orthographic views**: Given the 2 or 3 views of a machine component, Generation of the object in 3D environment using software. **8 Hrs.**

Chapter 3 –Threaded Fasteners: Thread terminology, sectional views of threads. ISO Metric (Internal & External) BSW (Internal & External) square and Acme. Sellers thread, American Standard thread. Etc.

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly), Proportions for square and hexagonal headed bolts & nuts, simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw. **4 Hrs.**

Unit – 2 *Chapter 4* - Joints: Assembly of Socket and Spigot cotter joint, Pin or Knuckle joint, Protected type flanged coupling, Universal coupling. **8 Hrs.**

Unit – 3 *Chapter 5* – Assembly Drawings: Screw jack, Machine vice, Plummer block, Tail stock, Steam stop valve, Ram's bottom safety valve, Petrol engine connecting rod, simple eccentric. **24 Hrs.**

Text books:
1. Machine Drawing" by K.R.Gopalkrishna, 20th Edition, Subhas stores, 2007.
2. "Machine Drawing" by Sri N.D.Bhat & V.M.Panchal, 42nd Edition, Charotar Publishing House,2007.
3. "Machine Drawing" by N. Siddeshwar, P. Kanniah, V.V.S. Sastri,published byTata Mc GrawHill,2006.

Reference Book:
1. "Machine Drawing with Auto CAD". Goutam Pohit & Goutham Ghosh, 1st Indian print Pearson Education, 2005.
2. "Auto CAD 2006, for engineers and designers". Sham Tickoo. Dream tech 2005

Scheme of Examination:
Test 1 – covering the syllabus from Unit 1 (using computer).
Test 2 – covering syllabus from Unit 2 (only manual drafting).

Semester End Exam – Only manual drafting.

One questions from Sections of Solids : 25 marks.
One question from Unit 3 : 75 marks.
TOTAL :**100 marks**

BMS COLLEGE OF ENGINEERING, BANGALORE – 560019
MATHEMATICS DEPARTMENT
SYLLABUS (2011 - 2012)
FOURTH SEMESTER B.E COURSE - (Common to all branches except for BT)

Course Name	Engineering Mathematics-4	Course Code	11MA1ICMAT
Credits	04	L – T - P	3 -1- 0
Contact hours	52 hours (40L+12T)		

UNIT-1

STATISTICS [10 hours]

Curve fitting – Fitting a straight line, fitting of a parabola, fitting of curves of the form $y = a\ b^x$, $y = a\ x^b$, $y = ae^{bx}$; Correlation and regression. **(4L+1T)**

PROBABILITY 1

Probability of an event, axiomatic definition, addition theorem, conditional probability, multiplication theorem, Bayes' theorem. **(4L+1T)**

UNIT-2

PROBABILITY 2 [10 hours]

Probability distributions: Random variables, Discrete probability distributions, continuous probability distributions, Some standard distributions: Binomial distribution, Poission distribution, exponential distribution, normal distribution.

(8L+2T)

UNIT-3

COMPLEX ANALYSIS 1 [10 hours]

Function of a complex variable, Analytic functions, Cauchy-Riemann equations, construction of analytic functions, Cauchy-Reimann equations in Polar form.

Transformations- $w = z^2$, $w = e^z$ and $w = z + \frac{a^2}{z}$ $(z \neq 0)$, Bilinear transformations.

(8L+2T)

UNIT-4

COMPLEX ANALYSIS 2 [12 hours]

Complex integration-Cauchy's theorem, Cauchy's integral formula, Taylor's and Laurent's series, Singular points, poles, residues, the residue theorem. **(5L+2T)**

SERIES SOLUTION OF DIFFERENTIAL EQUATIONS

Series solution-Frobenius method, series solution of Bessel's differential equation leading to Bessel function of first kind, equations reducible to Bessel's differential equation, series solution of Legendre's differential equation leading to Legendre polynomials, Rodrigue's formula.

(4L+1T)

UNIT-5

PROBABILITY 3 **[10 hours]**

Joint Probability distributions: Case of discrete random variables, mathematical expectation, correlation, covariance.

Markov Chain: Probability vectors, stochastic matrices, fixed points, regular stochastic matrices. Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states.

(7L+3T)

Text Books

1. Advanced Engineering Mathematics, Erwin Kreyszig, 8th edition, 2007, Wiley-India
2. Higher Engineering Mathematics, B.S. Grewal, 40th edition, 2007, Khanna Publishers.

Reference Books:

1. Advanced Modern Engineering Mathematics, Glyn James, 3rd edition, 2004, Pearson Education.
2. Higher Engineering Mathematics, B.V. Ramana, 2007, Tata Mc. Graw Hill.
3. Advanced Engineering Mathematics, P. V. O' Neil, 5th Indian reprint, 2009, Cengage learning India Pvt. Ltd.

Question Paper Pattern

1. Each unit consists of one full question.
2. Each full question consists of three or four subdivisions.
3. Five full questions to be answered.
4. Internal Choice in Unit 2 and Unit 4

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
IV SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	PRODUCTION TECHNOLOGY-II	Sub. Code	09IE4DCPT2
Credits	04	L-T-P	3-0-1

Unit – 1.

CASTING PROCESS: Introduction : concepts of manufacturing process, its importance. Classification of manufacturing processes, introduction to casting process & steps involved. Varieties of components produced by Casting process. Advantages & limitations of casting process.

Patterns: Definition, functions, materials used for pattern, various pattern allowances and their importance, classification of patterns.

Binder: Definition, Types of binder used in moulding sand.

Additives: Need, type of additives used. **8 Hrs**

Unit - 2.

Sand Moulding and special moulding process : Types of base sand, requirement of base sand. Types of sand moulds.

Sand moulds: Moulding sand mixture ingredients (base sand, binder & additives) for different sand mixtures. Method used for sand moulding.

Cores: Definition, Need, Types. Method of making cores, Binders used.

Concept of Gating & Risering. Principle involved and types. Fettling and cleaning of castings. Basic steps involved. Casting defects causes, features and remedies.

Moulding machines : Jolt type, squeeze type, Jolt & Squeeze type and Sand slinger.

Special moulding Process : Study of important moulding processes Green sand, Core sand, Dry sand, Sweep mould, CO2 sand, Shell mould, Investment mould & Full mould.

Metal moulds: Gravity die-casting, centrifugal casting, Squeeze Casting, Slush casting, Thixocasting and continuous casting processes. **14Hrs**

Unit - 3.

Melting Furnaces: Classification of furnaces. Constructional features & working principle of Gas fired pit furnace, Resistance furnace, Coreless Induction furnace, Electric Arc Furnace, Cupola furnace.

Inspection methods: Methods used for inspection of casting & welding, visual, magnetic particle, Fluroscent particle, Ultrasonic, Radiagraphy, Eddy Current, Holography methods of inspection. **8 Hrs**

Unit - 4.

WELDING*:* Welding process: Definition, Principles, Classification, Application, Advantages & limitations of welding.

Arc Welding: Principle, Metal Arc welding **(MAW)**, Flux Shielded Metal Arc Welding **(FSMAW)**, Inert Gas Welding **(TIG & MIG)** Submerged Arc Welding **(SAW)** and Atomic Hydrogen Welding processes. **(AHW)**

Gas Welding: Principle, Oxy – Acetylene welding, Reaction in Gas welding, Flame characteristics, Gas torch construction & working. Forward and backward welding.

Special type of welding: Resistance welding - principles, Seam welding, Butt welding, Spot welding and projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding Electron beam welding. **14Hrs**

Unit - 5.

Metallurgical aspect in welding : Structure of welds, Formation of different zones during welding. Heat affected zone **(HAZ).** Parameters affecting **HAZ**. Effect of carbon content on structure and properties of steel. Shrinkage in welds & Residual stresses. Concept of electrodes, Filler rod and fluxes. Welding defects – Detection causes & remedy.

Principles of soldering & brazing: Parameters involved & Mechanism, Different Types of Soldering & Brazing Methods. **10 Hrs**

Unit – 6.

1. Testing of Moulding sand and Core sand Preparation of sand specimens and conduction of the following tests:

1 Compression, Shear and Tensile tests on Universal Sand Testing Machine.
2 Permeability test
3 Core hardness & Mould hardness tests.
4 Grain fineness number test (Seive Analysis test)
5 Clay content test.
6 Moisture content test.
7 Collaspsilibity test.
8 Friability test.

2. Foundry Practice

Use of foundry tools and other equipments.
Preparation of moulds using two moulding boxes using patterns or without patterns. (Split pattern, Match plate pattern and Core boxes).

Preparation of one casting (Aluminum or cast iron-Demonstration only)
Gatting system – bottom gate, top gate, parting gate and step gate.

3. **Welding Process**

Preparation of Welding models using Gas,TIG and MIG welding.
Preparation of Brazing models using Gas flame.
Preparation of Soldering models.

Text Books:

1. "Manufacturing Process-I", Dr.K.Radhakrishna, Sapna Book House, 5th Ed, 2006.
2. "Manufacturing & Technology: Foundry Forming and Welding", P.N.Rao 2nd Ed., Tata McGraw Hill, 2003.

Reference Books:

1. "Manufacturing Technology", Swaroop Kalpakjian, Steuen.R.Sechmid, Pearson Education Asia, 5th Ed. 2006.
2. "Process and Materials of Manufacturing:, Roy A Lindberg, 4th Ed. Pearson Edu. 2006.
3. Workshop Technology, Vol-I, H.K.Hajra Choudhry & A.K.Hajra Choudhry, 12th Edition, MPP Publisher, 2001.

Scheme of examination:

Answer five full questions, Units I, III, V are compulsory, and answer one question each from Unit II & IV.

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
IV SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	THEORY OF MACHINES	Sub. Code	09IE4DCTOM
Credits	04	L-T-P	3-1-0

Unit - 1

INTRODUCTION: DEFINITIONS: Link or element, kinematic pairs, degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, structure, Mobility of Mechanism, Inversion, Machine Gashoff's criteria.
Kinematic Chains And Inversions: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain. **06Hrs**

MECHANISMS: Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Straight line motion mechanisms –Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms –Geneva mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Davis & Ackerman steering gear mechanism. **07Hrs**

Unit – 2

CAMS: Types of cams, Types of followers, Displacement, Velocity and Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-faced follower, Disc cam with oscillating roller follower, Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.
08 Hrs

Unit – 3

BALANCING OF MACHINERY: Static and Dynamic balancing, balancing of single rotating mass in same plane and in different planes. Balancing of several rotating masses in same plane and in different planes. Balancing of reciprocating masses. Inertia effect of crank and connecting rod. **08 Hrs**

Unit - 4

SPUR GEARS: Gear terminology, law of gearing, Characteristics of involute action, Path of contact, Arc of contact, Contact ratio, Interference in involute gears, Methods of avoiding: interference, Back lash, Comparison of involute and cycloidal teet **06 Hrs**

GEAR TRAINS: Simple gear trains, Compound gear trains for large speed reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains. **08 Hrs**

Unit – 5

BELTS, ROPES AND CHAINS: Introduction, Belt and Rope drives, open and crossed belt drives, action of belt on pulleyes, velocity ratio, slip, law of belting, length of belt, Ratio of friction, chains, chain length and analytical, classification of chains. **04Hrs**

GOVERNORS: Types of governors; force analysis of Porter and Hartnell governors. Controlling force, stability, sensitiveness, isochronisms, effort and power. 0**5 Hrs**

Text Books:

1. Rattan S.S, "Theory of Machines" Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 2nd edition -2005.
2. Sadhu Singh, "Theory of Machines," Pearson Education (Singapore) Pvt. Ltd., Indian Branch, New Delhi, 2ND Edi. 2006.
3. Jagadish Lal, 'Theory of Machine', Dhanpat Rai Publications, New Delhi.

Reference books:

1. Shigley. J. V. and Uickers, J.J., "Theory of Machines & Mechanisms" OXFORD University press.2004
2. "Theory of Machines -I", by A.S.Ravindra, Sudha Publications, Revised 5th Edi. 2004.

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
IV SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	MATERIAL SCIENCE & METALLURGY	Sub. Code	09IE4DCMSM
Credits	05	L-T-P	4-0-1

Unit - 1.*Structure of crystalline solids:* Concepts of unit cell, space lattice, Unit cells for cubic structure & HCP structure and their characteristics calculations of radius, Coordination Number and Atomic Packing Factor .Crystal imperfections: point, line, surface defects. Diffusion in solids: Diffusion Mechanism, Fick's laws of diffusion. Plastic deformation by slip & twinning. **8 hrs**

Unit - 2. *Testing of Materials*: Tensile properties, Engineering stress-strain, true stress & strain, Hardness testing (Brinell hardness testing, Vickers, Rockwell hardness stress) **4 hrs**

Types of Fracture: Brittle, Ductile facture, Griffith's criterion.
Creep: The creep curves, creep mechanism and creep tests,
Fatigue – Fatigue cycles, Fatigue test, S.N curves, Fatigue mechanism, Factors affecting fatigue life. **7 hrs**

Unit -3. *Solid solutions and phase diagrams:* Types of solids solutions, Rules of governing the formation of solid solutions and intermediate phases.

Cooling curves, construction of phase diagrams, Phase diagrams of Eutectic systems.
Phase rules: Gibbs phase rule and Lever rule. Interpretation of phase diagrams. **6 hrs**
Iron carbon equilibrium Diagram; Equilibrium phases, Invariant reactions, critical temperatures, Solidification of steels. **5 hrs**

Unit - 4. *Heat treatment of Ferrous and Non-ferrous materials:* TTT diagram, Construction of TTT diagram, TTT diagram for hypo and hyper eutectoid steels cooling curves, Non-equilibrium phases, Effect of alloying elements on steels. **5 hrs**

Heat treatment processes- Annealing, and its types, normalizing, hardening, tempering, surface heat treatment methods. Heat treatment of Non-ferrous materials. Study and Observation of Microstructure of Ferrous and Non-ferrous alloys. **5 hrs**

Unit - 5. *Ferrous, Non-ferrous and advanced materials*.
Ferrous – Types, Composition, Properties and applications of plain carbon steels and cast irons. Designation of steels.
Non-ferrous – Aluminium and its alloys, Magnesium alloys, Copper and its alloys **5 hrs**
Composite Materials – Definition, Classifications, Production methods, properties and applications of MMC and FRP composites. **5 hrs.**

Unit - 6. Tensile, shear and compression tests of metallic and non metallic specimens using a Universal Testing Machine Torsion tests, Bending Test on metallic and nonmetallic specimens. Fatigue Test.
Izod and Charpy tests on M.S. Specimen. Brinell, Rockwell and Vickers's Hardness test.
1. Examination of different engineering materials. Identification of microstructures of plain carbon steel, tool steel, gray C.I,
   SG iron, Brass, Bronze & composites. (Preparation of specimen – demo)
2. Heat treatment: Annealing, normalizing, hardening and tempering of steel. Hardness studies of heat-treated samples (Demo).
3. To study the wear characteristics of one ferrous, and one non-ferrous and composite materials for different parameters.
4. Demo on Non-destructive test experiments like,
   (a). Magnetic crack detection
   (b). Dye penetration testing, to study the defects of Casted and Welded specimens

Text Books:

1. "Materials Science & Engineering-An Introduction", William D.Callister Jr. Wiley India Pvt. Ltd. 6th Edition,2006,New Delhi.
2. "Materials Science & Engineering", V.Raghavan, 5th Edition, Prentice Hall.

Reference Books:

1. "Introduction to Material Science for Engineering", 6th edition James F. Shackel ford. Pearson, Prentice Hall, New Jersy, 2006.
2. "Foundation of Material Science and Engineering", Smith, 3rd Edition McGraw Hill, 1997.
3. Mechanical Mellorgy 3rd Edn., George.E.Dieter, McGraw Hill, 2001.

Scheme of Examination: Each Question from each unit and Internal choice from Unit 3 & 4.

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
IV SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	MACHINE DESIGN	Sub. Code	09IE4DCMCD
Credits	04	L-T-P	3-1-0

UNIT – I:

Design for Static Strength: Design considerations: Codes and Standards, Static strength; Static loads and factor of safety; Theories of failure -Maximum normal stress theory, maximum shear stress theory, Distortion energy theory; Failure of brittle materials, Failure of ductile materials. Stress concentration, Determination of Stress concentration factor. Combined Stress concentration factor. 6 **Hrs**

Design for Fatigue Strength: Introduction, S -N diagram, Low cycle fatigue, High cycle fatigue, and Endurance limit. Modifying factors -size effect, surface effect, Stress concentration effects; Fluctuating stresses, Fatigue strength under fluctuating stresses, Goodman and Soderberg relationship; Stresses due to combined loading, cumulative fatigue damage. **6 Hrs**

UNIT – II:

Joints and Coupling: Design of rigid flange coupling & Bushed pin type flexible coupling. Cotter and Knuckle joints. **6 Hrs**

Design of Shafts: Torsion of shafts, design for strength & rigidity, with steady loading, ASME & BIS codes for design of transmission shafting, shafts under fluctuating loads and combined loads 6 **Hrs**

UNIT- III:

Design of Gears: Introduction to Spur, Helical & Bevel gears. Design of spur gear, stresses in gear tooth, Lewis equation, form factor- dynamic and wear load. **6 Hrs**

UNIT- IV:

Mechanical Joints: Riveted Joints -Types, rivet materials, Failures of Riveted joints, Efficiency, Welded Joints -Types, Strength of butt and fillet welds. 6 **Hrs**

UNIT V:

Lubrication and Bearings: Mechanisms of Lubrication -Viscosity, bearing modulus, coefficient of friction, minimum oil film thickness-Heat Generated, Heat dissipated, bearing materials, lubricants and properties. Examples of journal bearing and thrust bearing design, Ball and Roller Bearings**:** Bearing life, equivalent bearing load, selection of bearings of different types. 6 **Hrs**

TEXTBOOKS:

1. Mechanical Engineering Design -Joseph Edward Shigley, Tata McGraw Hill, New Delhi 1986
2. Machine Design -.VL. Maleev and Hartman, CBS Publishers &Distribution, Delhi, 1983 .

Design Data Hand Books:

1. Design Data Hand Book, K. Mahadevan and Balaveera Reddy, CBS Publication.
2. Design Data Hand Book Vol .l & Vol.2 -Dr. K. Lingaiah, Suma Publications, Bangalore.
3. Design Data Hand Book -Prof. H. a. Patil, Shri Shastri Prakashan, Belgaum.

REFERENCE BOOKS:

1. Machine design -Robert .L. , Norton -Pearson Education Asia, New Delhi, 2001
2. Theory and Problems of Machine Design, Hall, Holowinko, Laughlin, - Schaums Outline Series, 2002
3. Elements of Machine Design -N. C. Pandey and C. S. Shah, 2002 - Chorotar Publishing House
4. Design of Machine Elements -V. B. Bahandri, -Tata McGraw Hill Publishing Co. Ltd., New -Delhi.
5. Machine Component & Design -William Orthwan, Jaico Publishing Co.
6. Fundamentals of Design -Benerad J Hamrock, Bo -Jacobson & Steven R. Schmid.
7. Fundamentals of Machine Design Component -Robert C. Juvinall and Kurt M. Marshek -John & sons
8. Machine Design -R. K. Jain , Khanna Publications, New Delhi.
9. Design of Machine Elements –J B K Das and P L Srinivasa Murthy, -Sapna Book House,Bangalore.

Scheme of Examination: Two questions from units 1 & 2 and one question from units 3, 4 & 5

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
IV SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	FLUID MECHANICS & MACHINES	Sub. Code	09IE4DCFMM
Credits	04	L-T-P	3-1-0

NOTE : Inclusive of Related Derivations and problems

Unit – 1

Introduction to Properties of Fluids : Introduction, Properties of fluids-mass density, weight density, specific volume, specific gravity, viscosity, surface tension, capillarity, vapour pressure compressibility and bulk modulus. Types of Fluids. Fluid pressure at a point, Pascal's law, pressure variation in a static fluid in 2D, Absolute, gauge, atmospheric and vacuum pressures **10Hrs**

Unit – 2

Fluid Statics : Types of Manometers, total pressure and center of pressure for horizontal plane, vertical plane surface and , inclined plane surface submerged in static fluid.

Buoyancy, center of buoyancy, meta center and meta centric height, Stability of floating bodies. **10Hrs**

Unit – 3

Fluid Kinematics and Dynamics : Types of fluid flow, continuity equation in 2D & 3D(Cartesian co-ordinate system only), velocity potential function and stream function.

Forces acting on fluid in motion, Euler's equation of motion, Bernoulli's equation from Euler's equation, Bernoulli's equation for real fluids. **10Hrs**

Unit – 4

Fluid flow measurements: Introduction, Vena-contracta, Jet of water, venturimeter, orifice meter, Pitot tube.

Major &Minor losses-Darcy Equation for loss of head due to friction in pipes, Chezy's equation for loss of head due to friction in pipes, Hagen poiseulle's equation, Bend losses, Change of section losses. **10Hrs**

Unit - 5

TURBINES AND PUMPS: Introduction, classification & problems on turbines & pumps. **12Hrs**

Text Books:

1. Fluid Mechanics by Dr. Bansal.R.K, Lakshmi Publications.
2. Hydraulics, Fluid Mechanics and Fluid Machines, S Ramamrutham, Dhanpat Rai pub co.,

Reference books:

1. Fluid Mechanics ,and Hydraulics Machines by R.K Rajput, S.Chand & Company.
2. A Textbook of Hydraulics Fluid Mechanics & Hydro Machines by Khurmi R.S, S.Chand & Co
3. Fluid Mechanics and Hydraulics, Dr. Jagadishlal: Metropolitan Book Co-Ltd.
4. Fluid Mechanics, Fundamental & applications, by Yunus A, Cenegel, John M,Cimbala, Tata McGraw Hill, 2006.

Note: Two questions to be set from Unit 1 and 3 each and one question from unit 2,4,5.Each question is for twenty marks.

BMS COLLEGE OF ENGINEERING, BANGALORE
Autonomous College under VTU
Department: INDUSTRIAL ENGINEERING & MANAGEMENT **Semester: 05**

Subject Code										Subject Title	Credit Hours/Week				Contact hrs/wk	Marks		
											L	T	P	Total credit		CIE	SEE	Total
1	0	I	E	5	D	C	C	I	M	COMPUTERS IN MANUFACTURING	4	0	1	5	6	50	50	100
1	0	I	E	5	D	C	I	E		INDUSTRIAL ENGINEERING	4	0	1	5	6	50	50	100
1	0	I	E	5	D	C	S	F	E	STATISTICS FOR ENGINEERS	3	1	0	4	5	50	50	100
1	0	I	E	5	D	C	M	A	M	MATERIALS MANAGEMENT	3	0	0	3	3	50	50	100
1	0	I	E	5	D	C	O	P	R	OPERATIONS RESEARCH	3	1	0	4	5	50	50	100
1	0	I	E	5	D	C	M	A	E	MANAGEMENT AND ENTREPRENEURSHIP	3	0	0	3	3	50	50	100
1	0	I	E	5	D	L	M	E	L	MECHANICAL LAB	0	0	3	1	3	50	50	100
TOTAL														25	31	350	350	700

L – Lecture Hours / week; **T**- Tutorial Lecture Hours / week; **P**-Practical Lecture Hours / week.

CIE- Continuous Internal Evaluation; **SEE**- Semester End Examination (of 3 Hours duration)'

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.

INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	Computers in Manufacturing	Subject Code	10IE5DCCIM
Credits	05	L-T-P	4-0-1

Unit – I

1. Introduction: Role of computers in design and manufacturing. Influence of computers in manufacturing environment. Product cycle in conventional and computerized manufacturing environment, Introduction to CAD, Introduction to CAM, Advantages and disadvantages of CAD and CAM. **06Hrs**

2. Hardware in CAD: Basic hardware structure, working principles, usage and types of hardware for CAD -input and output devices, memory, CPU, hardcopy and storage devices. **04 Hrs**

Unit – II

3. Computer Graphics: Software configuration of a graphic system, functions of a graphics package,
Constriction of geometry, wire frame and solid modeling, geometric 2D and 3D homogeneous transformation with simple problems. **06 Hrs**

4. Introduction to Robotics: Introduction, robot configuration, robot motions, Programming the robots, Robot - programming methods, End effectors, work cell control and interlocks Robot sensors, Robot applications. **06 Hrs**

Unit - III

5. Numerical Control of Machine Tools: Fundamenta1 concepts, classification and structure of Numerical Control systems, open and closed loop systems, point to point systems, positioning cum straight cut systems, continuous path systems, coding systems, program mediums - tape format and codes. Interpolators - linear interpolation, circular interpolation. Feed back devices – encoders, inductosyn. **10Hrs**

6. Drives for CNC Machine Tools: Introduction to drives, stepper motors, DC servo drives, AC servo drives, selection criterion for drive system. **04 Hrs**

Unit - IV

7. Introduction to Modern CNC Machine Tools and Manufacturing Systems: Turning tools geometry, milling tooling systems, tool presetting, ATC, work holding. CNC machine tools, Overview of different CNC machining centres, CNC turning centres, High speed machine tools. **06 Hrs**

Unit - V

8. Programming of CNC Machine Tools: Introduction to part programming, coordinate systems, dimensioning, axes and motion nomenclature, structure of a part program, word address format, tool radius and length compensation, subroutines, canned cycles. Programming examples for machining centers, Programming for turning center, Manual part programming. APT programming and examples, **10 Hrs**

Unit – VI

Laboratory Experiments:

1) CNC Turning: Writing and simulation of manual part program using G & M codes for simple parts including turning, taper turning, and shoulder turning and cutting. Use of radius compensation, canned cycles, macros etc. (4 programs)

2) CNC Milling- Writing and simulation of part program for contour milling. Simulation of Turning/Milling operations on a computer using CAM packages. (4 programs)

3) Programming of Robots by lead through and off line methods. Use of robot to pick and place, stacking of objects in increasing or decreasing order. (2 programs)

Text Books:

1) Mechatronics" HMT – Tata Mc Graw Hill publishing company, ISBN 0-07-462127-5

2) Yorem Koren. "Computer Control of Manufacturing Systems" Mc Graw Hill

3) CAD/CAM, Mikell P. Grover, Emory, W. Zimmers Pearson Education Inc., 2003

4) CAD/CAM Principle and Applications, PN Rao, Tata Mc Graw Hill

References:

1 Numerical Control of Machine tool, Yoren Korem. Khanna Publishers. Delhi

2. Principle of interactive Computer Graphics, Newman and Spraoull, TMH

3. CAD/CAM, Ibhrahim Zeid THM

4. Kundra, Rao and Tiwary, "Numerical control and CAM" Tata Mc Graw Hill Publishing Co.,New Dehli.

Scheme for examination: Five questions choosing one each from each unit and Unit 2 and 3 with choice questions

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.
INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	INDUSTRIAL ENGINEERING	Subject Code	10IE5DCIE
Credits	05	L-T-P	4-0-1

UNIT - 1

PRODUCTIVITY: Definition of productivity, individual enterprises, task of management Productivity of materials, land, building, machine and power. Measurement of productivity, factors affecting the productivity, productivity improvement programs, wages and incentives (simple numerical problems). **7 Hrs**

WORK STUDY: Definition, objective and scope of work study. Human factor in work study. Work study and management, work study and supervision, work study and worker. **6 Hrs**

UNIT - 2

INTRODUCTION TO METHOD STUDY: Definition, objective and scope of method study, activity recording and exam aids. Charts to record moments in shop operation – process charts, flow process charts, travel chart and multiple activity charts.(With simple problems) **7 Hrs**

MICRO AND MEMO MOTION STUDY: Charts to record moment at work place – principles of motion economy, classification of moments two handed process chart, SIMO chart, and micro motion study. Development, definition and installation of the improved method, brief concept about synthetic motion studies. **6Hrs**

UNIT - 3

INTRODUCTION TO WORK MEASUREMENT: Definition, objective and benefit of work measurement. Work measurement techniques. Work sampling: need, confidence levels, sample size determinations, random observation, conducting study with the simple problems. **6 Hrs**

UNIT - 4

TIME STUDY: Time Study, Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, recording information. Rating & standard Rating, standard performance, scale of rating, factors of affecting rate of working, allowances and standard time determination. Predetermined motion time study – Method time measurement (MTM) **7 Hrs**

UNIT – 5

Ergonomics: Introduction, areas of study under ergonomics, system approach to ergonomics model, man-machine system. Components of man-machine system and their functions – work capabilities of industrial worker, study of development of stress in human body and their consequences. Computer based ergonomics. **6 Hrs**

DESIGN OF MAN-MACHINE SYSTEM: Fatigue in industrial workers. Quantitative qualitative representation and alphanumeric displays. Controls and their design criteria, control types, relation between controls and displays, layouts of panels and machines. Design of work places, influence of climate on human efficiency. Influence of noise, vibration and light. **7 Hrs**

UNIT - 6

LABORATORY:

1. Recording Techniques**:** Preparing the following charts and diagrams

   (Minimum 3 Charts)

   - Outline process chart
   - Multiple Activity Chart
   - Flow process chart and Flow diagram
   - String diagram,

2. Experiments on the Application of principle of motion economy Two handed process chart
3. Exercises on conducting method study for assembling simple components and office work.
4. Development of Layout plans using SLP technique
5. Experiments on Line balancing.
6. Rating practice using walking simulator
7. Rating practice using pin board assembly
8. Rating practice for dealing a deck of cards
9. Rating practice for marble collection activity
10. Determining the standard time for simple operations using stopwatch time study
11. Exercises on estimating standard time using PMTS.
12. Determination of standard time using PDA device and time study software
13. Experiments on office work measurement through work sampling
14. Measurement of parameters (heart beat rate, calorie consumption) using walking simulator
15. Measurement of parameters (heart beat rate, calorie consumption, revolutions per minute) using ergometer
16. Effect of Noise, Light, and Heat on human efficiency in work environments.

TEXT BOOKS:

1. **ILO, Introduction to work study** - III Revised Edition, 1981
2. **Motion and Time study** - Ralph M Barnes; John Wiley, 8th Edition, 1985.
3. **Engineered work Measurement** - Wledon, ELBS, 1991, Marvin E. Mundel- Motion and Time study, PHI, 1st edition

REFERENCES BOOKS:

1. **Human Factors in Engineering Design -** S Sanders and E J McCormick, 6th Edition, Mc Graw Hill
2. **Work Study and Ergonomics** - S Dalela and Sourabh, – Chand Publishers, 3rd edition.
3. **Industrial Engineering Hand book** Maynard.
4. **Work Study** - Ralph & Barnes.

SCHEME OF EXAMINATION:

Six Questions to be set with one question from each unit carrying 20 marks each. Any three units will have an internal choice.

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.
INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	Statistics For Engineers	Sub Code	10IE5DCSFE
Credits	04	L-T-P	3-1-0

Unit – 1

The Role of Statistics in Engineering (Data Summary and Presentation): Statistical Thinking, Collecting data, Statistical Modeling Frame work, measure of central tendency and variance, Importance of Data summary and Display, Practical problems solving through tools like Tabular and Graphical display, Pie charts, Constructions of Box Plots, S curves, Frequency polygon, Pareto Graph. **7 Hrs**

Unit - 2

Discrete Random Variables and Probability Distributions: Discrete Random variables, Probability distributions and Probability mass functions, Cumulative distribution functions, Mean and Variance of a discrete random variable, discrete uniform distribution, Binominal distribution, Hyper Geometric distribution, Applications.

Continuous Random Variables and Probability Distributions: Continuous random variables, Probability distributions and probability density functions, cumulative distribution functions, Mean and Variance of a continuous random variable, uniform distribution, Normal distribution, Normal approximation to Binominal and Poisson distribution, Applications. Chi-square Disrtributions, Exponential distribution Weibull Distribution (Underlined Distributions - Exposure limited to theoretical concepts). **10 Hrs**

Unit - 3

Estimation Theory: Statistical Inference, Random sampling, Properties of Estimators, Sampling distribution, Sampling distribution of means, variance and proportion, Introduction to confidence intervals. **5Hrs**

Unit - 4

Statistical Inference for a Single Sample and Two Samples: Hypothesis testing, Inference on the mean of a population (variance known and unknown), Inference on the variance of a normal population, Inference on a population proportion.

Statistical Inference for a Single Sample and Two Samples: Testing for Goodness of Fit, Inference for a difference in Means, Variances known, Inference for a difference in means of two normal distributions, Variances unknown, Inference on the Variances of two normal populations, Inference on two population proportions. **10Hrs**

Unit – 5

Simple Linear Regressions and Correlation: Simple Linear Regression, Properties of Least square Estimators and Estimation of variances, Common abuses of regression, Prediction of new observations, Assessing the adequacy of

regression model, Transformations to a straight line, Introduction to multiple regression (will not have problems), Correlation.

Design of Experiments: Strategy of experimentation, completely randomized single - factor experiment, Tests on individual treatment means, the random effects model, the randomized complete block design, one way analysis of variance and two way analysis of variance. (Exposure limited to theoretical concepts **8 Hrs**

- Statistical Software to be utilized extensively wherever possible to solve problems.
- Question Paper: One Question to be set from each unit and Two Questions will be set from the unit 2 & 4.Student will answer any 5 questions selecting at least one from each unit.

Text books:

1. Applied statistics and Probability for Engineers – Douglas C Montgomery, George C Runger, 2nd Edn, John Wiley and Sons, ISBN-0-471-17027-5
2. Statistics for Management - Richard I Levin, David S Rubin, 6th Edn, Prentice Hall India, ISBN-81-203-0893-X

Reference books:

1. Probability and Statistics in Engineering - William W Hines, Douglas C Montgomery, 2nd Edn, John Wiley and Sons
2. Business Statistics for Management and Economics - Daniel, Terrell, 6th Edn, Houghton Mifflin Company, ISBN-0-395-62835-0
3. Probability and Statistics - Walpole & Mayer, MacMillan Publishing Company, 1989.

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.

INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	MATERIALS MANAGEMENT	Subject Code	10IE5DCMAM
Credits	03	L-T-P	2-1-0

UNIT - 1

INTRODUCTION: Dynamics of materials management, Material management at micro-level, Inventories of materials, Total concepts, definition, A brief history of development, An over-view. System approach to material management, The process of management and the materials functions, The materials function, interfaces, An overview of the systems concept, benefits of integrated systems approach. **6 Hrs**

FORECASTING: Forecasting and planning, forecasting methods

OBJECTIVES AND THE MATERIALS ORGANIZATION: Systems Design, Integral control of flow of materials, Objectives of materials management, Organization of materials management, Environmental change, The development of functional organization, **6 Hrs**

MATERIALS PLANNING: Making the materials plan work, the materials cycle and flow control system, Materials budget. **4 Hrs**

UNIT – 2

PURCHASING: Purchasing principles, procedures and Practices, Fundamental objectives of purchasing, Scope, Responsibility and Limitations, Sources of supply and Supplier selection, Purchasing policy and procedures budgets and statistics. **4 Hrs**

PURCHASING IN MATERIALS MANAGEMENT: Systems concept, price determination, price forecasting, Price-cost analysis, The learning curve, Negotiation, Reciprocity, Cost-plus contracts, Hedging, Forward buying, Buying ethics, Principles and standards of purchasing, Make-or-buy, information, Documentation and Purchasing library, Legal aspects of purchasing, Law of Agency, Law of contract, Legal status of buyer, Warranties and conditions, Right of inspection, Right of rejection, Vendor-vendee relations, Vendor development. **7 Hrs**

PURCHASING OF CAPITAL EQUIPMENT, PLANT AND MACHINERY: Responsibility and decision, Purchasing v/s Leasing. **1 Hrs**

INTERNATIONAL BUYING AND IMPORT PURCHASING: Industrial needs, Import procedure and documents, Classification of stores, Categories of importers, Import application, Basis of licensing, Import purchasing procedures, Letter of credit, Income-tax clearance, Registration of licenses & Customs tariff. **5 Hrs**

UNIT 3

INVENTORY MANAGEMENT: Definition of Inventory, The need of inventory and its management, functions of inventory management, Types of inventories, inventory control, Cost elements, Economic Order Quantity, Standard deterministic EOQ models – deterministic models, stochastic models, Max – Min system, Inventories and demand uncertainty. **6 Hrs**

INVENTORY MANAGEMENT: Determining safety stock, Q-system, Effect of quantity discounts, P-system, Optional replenishment system, Demand forecasting, Demand and uncertainty and risk, Store keeping and inventory control, A practical approach, ABC inventory classification, The need for systems approach, Material requirement planning, Basic tool, conclusion. **6Hrs**

UNIT – 4

STORES MANAGEMENT AND OPERATION: Storage system, Stores location and layout. Development of storing, Centralization and Decentralization of stores, Standardization and variety reduction, the system, Merits and demerits of codification, Materials accounting and materials audit. **4 Hrs**

UNIT – 5

MATERIALS MANAGEMENT INFORMATION SYSTEM AND COMPUTER: MIS – Management and MM, Computer systems for MIS and MM. In-process materials and management control. **3 Hrs**

TEXT BOOKS:

1. Materials Management - Gopal Krishnan and Sundaresan,: An Integrated Approach, Prentice Hall
2. Materials Management - Datta, A K, , Procedure, Text and cases, Prentice hall of India Pvt Ltd., New Delhi 2001

REFERENCE BOOK:

1. Purchase Managemnet - Lee Dobler-. 1st Edition

SCHEME OF EXAMINATION:

Five Questions to be set with one question from each unit carrying 20 marks each. Any three units will have an internal choice.

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.
INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	OPERATIONS RESEARCH	Subject Code	10IE5DCOPR
Credits	04	L-T-P	3-1-0

UNIT-I

Introduction: OR definition, scope, phases, limitations, models **02Hrs**

Linear programming: definition, mathematical formulation, standard form, solutions space solution-feasible, basic feasible, infeasible, multiple optimal, redundancy, degeneracy using graphical and simplex methods, Introduction to duality in LPP with simple problems **11 Hrs**

UNIT - II

Transportation problem: formulation of transportation model, basic feasible solution using different methods, optimal solutions, degeneracy in transportation problems, unbalanced transportation problem **07 Hrs**

Assignment problem: formulation, unbalanced assignment problem, travelling salesman problem using Hungarian and little's methods **05 Hrs**

UNIT - III

Queuing theory: Queing system and their characteristics, analysis of markovian queues, M/M/1, M/M/K queuing system **06 Hrs**

UNIT - IV

Project management using network analysis: Network construction, determination of critical path and duration, floats using CPM. PERT-Estimation of project duration, Variance and crashing of projects **06 Hrs**

UNIT - V

Game theory: two persons - zero sum game, games with and without saddle point, graphical solution, dominance property **05 Hrs**

Text books:

1. Taha H A, Operations Research and Introduction, mcmillian

2. Hiller and Liberman, Introduction to Operation Research, mcgraw hill

3. Philips Ravindaran and Soleberg, Principles of Operations Research –Theory and practice, PHI

Reference books:

1. S D Sharma Operations Research, Kedarnath, Ramnath and Co
2. Kanthi swarup and others- Operations Research, Sultan chand and sons
3. J K Sharma,Operations Research Theory and application,Pearson Education Pvt.Ltd.
4. Manmohan and P K Gupta,Problems in operations Research, Sultan chand and sons

Scheme of Examination: Each question from each unit and internal choice from unit III & unit V

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.
INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	MANAGEMENT AND ENTREPRENEURSHIP	Subject Code	10IE5DCMAE
Credits	03	L-T-P	3-0-0

UNIT – I

MANAGEMENT : Introduction – Meaning – nature and characteristics of Management, Scope and Functional areas of management – Management as a science, art of profession – Management and Administration – Roles of Management, Levels of Management, development of Management Thought – Early management approaches – Modern management approaches. **8 Hrs**

UNIT – II

PLANNING : Nature, importance and purpose of planning process – Objectives – Types of plans – Importance of planning – steps in planning and planning premises – Hierarchy of plans.

ORGANISING AND STAFFING : Nature and purpose of organization – Principles of organization – Types of organization – Committees – Centralization Vs Decentralization of authority and responsibility – Span of control. Nature and importance of staffing. **8 Hrs**

UNIT – III

DIRECTING & CONTROLLING : Meaning and nature of Directing – Leadership styles, motivation theories, communication – Meaning and Importance of Coordination. Techniques of Co-ordination. Steps in controlling. **8 Hrs**

UNIT – IV

ENTREPRENEURSHIP : Meaning, evolution of the concept, functions, types. Entrepreneur – an emerging class, Evolution of Entrepreneurship, development of Entrepreneurship; stages in entrepreneurial process; role of entrepreneurs in economic development, Entrepreneurship in India, Entrepreneurship – its barriers.

SMALL SCALE INDUSTRIES : Definition, characteristics; need and rationale; objectives; scope; role of SSI in economic, development advantages of SSI steps to start and SSI – government policy towards SSI, different polities of SSI; government support for SSI during 5 year plans. Impact of Liberalization, Privatization, Globalization on SSI. Effect of WTO/GATT supporting agencies of Government for SSI, meaning, nature of support; objectives; functions; types of help; ancillary industry and tiny industry (definition only). **10 Hrs**

UNIT – V

INSTITUTIONAL SUPPORT : Different schemes; TECKSOK, KIADB, KSSIDC, KSIMC, DIC Single window agency, SISI; NSIC, SIDBI, KSFC.

PREPARATION OF PROJECT : Meaning of project; Project identification; Project selection; project report; need and significance of report; Network analysis; project appraisal, identification of business opportunities; Feasibility study. **8 Hrs**

TEXT BOOKS :

1. Principles of Management – Harold Koontz, Heinz Weihrich, Ramachandra Aryasri, Tata McGraw Hill, 2010.
2. Principles of Management – P.C.Tripathi, P.N.Reddy – Tata McGraw Hill.
3. Dynamics of Entrepreneurial Development & Management – Vasant Desai – Himalaya Publishing House.
4. Entrepreneurship Development – Poornima M. Charantimath – Small Business Enterprises – Pearson Education – 2006 (2 & 4).

REFERENCE BOOKS :

1. Management Fundamentals – Concepts, Application, Skill Development – Roberts Lusier – Thomson –
2. Entrepreneurship Development – S.S.Khanka – S. Chand & Co.
3. Management – Stephen Robbins – Pearson Education/PHI – 17th Edition, 2003.

Scheme : One question from each unit and choice from Unit 4 and 5.

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.
INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	Mechanical Lab	Subject Code	10IE5DLMEL
Credits	01	L-T-P	0-0-3

1. Determination of Flash point and Fire point of lubricating oil using Abel Pensky, Pensky Martin & Cleveland open cup Apparatus
2. Determination of Viscosity of Lubricating oil using Redwood, Saybolt and Torsion Viscometers.
3. Valve Timing Diagram
4. Planimeter
5. Performance Test on Ruston Diesel Engine and Heat Balance Sheet
6. Performance Test on Four Stroke Diesel Engine
7. Performance Test on Twin cylinder Diesel Engine and Morse test
8. Performance Tests on Four Stroke Petrol Engine
9. Performance Tests on Two Stroke Petrol Engine
10. Calibration of Venturimeter
11. Orificemeter
12. Friction losses in flow through Pipes
13. Performance Test on Centrifugal Pump
14. Performance Test on Reciprocating Pump
15. Performance Test on Francis Turbine
16. Performance Test on Pelton Wheel

CIE - 50 MARKS

SEE - 50 MARKS

BMS COLLEGE OF ENGINEERING, BANGALORE
Autonomous College under VTU
Department: INDUSTRIAL ENGINEERING & MANAGEMENT **Semester: 05**

Subject Code										Subject Title	Credit Hours/Week				Contact hrs/wk	Marks		
											L	T	P	Total credit		CIE	SEE	Total
1	0	I	E	5	D	C	C	I	M	COMPUTERS IN MANUFACTURING	4	0	1	5	6	50	50	100
1	0	I	E	5	D	C	I	E		INDUSTRIAL ENGINEERING	4	0	1	5	6	50	50	100
1	0	I	E	5	D	C	S	F	E	STATISTICS FOR ENGINEERS	3	1	0	4	5	50	50	100
1	0	I	E	5	D	C	M	A	M	MATERIALS MANAGEMENT	3	0	0	3	3	50	50	100
1	0	I	E	5	D	C	O	P	R	OPERATIONS RESEARCH	3	1	0	4	5	50	50	100
1	0	I	E	5	D	C	M	A	E	MANAGEMENT AND ENTREPRENEURSHIP	3	0	0	3	3	50	50	100
1	0	I	E	5	D	L	M	E	L	MECHANICAL LAB	0	0	3	1	3	50	50	100
TOTAL														25	31	350	350	700

L – Lecture Hours / week; **T**- Tutorial Lecture Hours / week; **P**-Practical Lecture Hours / week.
CIE- Continuous Internal Evaluation; **SEE**- Semester End Examination (of 3 Hours duration)'

Chairperson-BOS
ME Cluster

HOD – IEM

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.
INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	Computers in Manufacturing	Subject Code	10IE5DCCIM
Credits	05	L-T-P	4-0-1

Unit – I

1. Introduction: Role of computers in design and manufacturing. Influence of computers in manufacturing environment. Product cycle in conventional and computerized manufacturing environment, Introduction to CAD, Introduction to CAM, Advantages and disadvantages of CAD and CAM. **06Hrs**

2. Hardware in CAD: Basic hardware structure, working principles, usage and types of hardware for CAD -input and output devices, memory, CPU, hardcopy and storage devices **04 Hrs**

Unit – II

3. Computer Graphics: Software configuration of a graphic system, functions of a graphics package,
Constriction of geometry, wire frame and solid modeling, geometric 2D and 3D homogeneous transformation with simple problems. **06 Hrs**

4. Introduction to Robotics: Introduction, robot configuration, robot motions, Programming the robots, Robot - programming methods, End effectors, work cell control and interlocks Robot sensors, Robot applications 06**Hrs**

Unit - III

5. Numerical Control of Machine Tools: Fundamenta1 concepts, classification and structure of Numerical Control systems, open and closed loop systems, point to point systems, positioning cum straight cut systems, continuous path systems, coding systems, program mediums - tape format and codes. Interpolators - linear interpolation, circular interpolation. Feed back devices – encoders, inductosyn. **10Hrs**

6. Drives for CNC Machine Tools: Introduction to drives, stepper motors, DC servo drives, AC servo drives, selection criterion for drive system. **04 Hrs**

Unit - IV

7. Introduction to Modern CNC Machine Tools and Manufacturing Systems: Turning tools geometry, milling tooling systems, tool presetting, ATC, work holding. CNC machine tools, Overview of different CNC machining centres, CNC turning centres, High speed machine tools. **06 Hrs**

Unit - V

8. Programming of CNC Machine Tools: Introduction to part programming, coordinate systems, dimensioning, axes and motion nomenclature, structure of a part program, word address format, tool radius and length compensation, subroutines, canned cycles. Programming examples for machining centers, Programming for turning center, Manual part programming. APT programming and examples, **10 Hrs**

Unit – VI

Laboratory Experiments:

1) CNC Turning: Writing and simulation of manual part program using G & M codes for simple parts including turning, taper turning, and shoulder turning and cutting. Use of radius compensation, canned cycles, macros etc. (4 programs)

2) CNC Milling- Writing and simulation of part program for contour milling. Simulation of Turning/Milling operations on a computer using CAM packages. (4 programs)

3) Programming of Robots by lead through and off line methods. Use of robot to pick and place, stacking of objects in increasing or decreasing order. (2 programs)

Text Books:

1) Mechatronics" HMT – Tata Mc Graw Hill publishing company, ISBN 0-07-462127-5
2) Yorem Koren. "Computer Control of Manufacturing Systems" Mc Graw Hill
3) CAD/CAM, Mikell P. Grover, Emory, W. Zimmers Pearson Education Inc., 2003
4) CAD/CAM Principle and Applications, PN Rao, Tata Mc Graw Hill

References:

1 Numerical Control of Machine tool, Yoren Korem. Khanna Publishers. Delhi
2. Principle of interactive Computer Graphics, Newman and Spraoull, TMH
3. CAD/CAM, Ibhrahim Zeid THM
4. Kundra, Rao and Tiwary, "Numerical control and CAM" Tata Mc Graw Hill Publishing Co.,New Dehli.

Scheme for examination: Five questions choosing one each from each unit and Unit 2 and 3 with choice questions

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.
INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	INDUSTRIAL ENGINEERING	Subject Code	10IE5DCIE
Credits	05	L-T-P	4-0-1

UNIT - 1

PRODUCTIVITY: Definition of productivity, individual enterprises, task of management Productivity of materials, land, building, machine and power. Measurement of productivity, factors affecting the productivity, productivity improvement programs, wages and incentives (simple numerical problems). **7 Hrs**

WORK STUDY: Definition, objective and scope of work study. Human factor in work study. Work study and management, work study and supervision, work study and worker **6 Hrs**

UNIT - 2

INTRODUCTION TO METHOD STUDY: Definition, objective and scope of method study, activity recording and exam aids. Charts to record moments in shop operation – process charts, flow process charts, travel chart and multiple activity charts.(With simple problems) **7 Hrs**

MICRO AND MEMO MOTION STUDY: Charts to record moment at work place – principles of motion economy, classification of moments two handed process chart, SIMO chart, and micro motion study. Development, definition and installation of the improved method, brief concept about synthetic motion studies. **6Hrs**

UNIT - 3

INTRODUCTION TO WORK MEASUREMENT: Definition, objective and benefit of work measurement. Work measurement techniques. Work sampling: need, confidence levels, sample size determinations, random observation, conducting study with the simple problems. **6 Hrs**

UNIT - 4

TIME STUDY: Time Study, Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, recording information. Rating & standard Rating, standard performance, scale of rating, factors of affecting rate of working, allowances and standard time determination. Predetermined motion time study – Method time measurement (MTM) **7 Hrs**

UNIT – 5

Ergonomics: Introduction, areas of study under ergonomics, system approach to ergonomics model, man-machine system. Components of man-machine system and their functions – work capabilities of industrial worker, study of development of stress in human body and their consequences. Computer based ergonomics **6 Hrs**

DESIGN OF MAN-MACHINE SYSTEM: Fatigue in industrial workers. Quantitative qualitative representation and alphanumeric displays. Controls and their design criteria, control types, relation between controls and displays, layouts of panels and machines. Design of work places, influence of climate on human efficiency. Influence of noise, vibration and light. **7 Hrs**

UNIT - 6

LABORATORY:

1. Recording Techniques**:** Preparing the following charts and diagrams

(Minimum 3 Charts)

- Outline process chart
- Multiple Activity Chart
- Flow process chart and Flow diagram
- String diagram,

2. Experiments on the Application of principle of motion economy Two handed process chart
3. Exercises on conducting method study for assembling simple components and office work.
4. Development of Layout plans using SLP technique
5. Experiments on Line balancing.
6. Rating practice using walking simulator
7. Rating practice using pin board assembly
8. Rating practice for dealing a deck of cards
9. Rating practice for marble collection activity
10. Determining the standard time for simple operations using stopwatch time study
11. Exercises on estimating standard time using PMTS.
12. Determination of standard time using PDA device and time study software
13. Experiments on office work measurement through work sampling
14. Measurement of parameters (heart beat rate, calorie consumption) using walking simulator
15. Measurement of parameters (heart beat rate, calorie consumption, revolutions per minute) using ergometer
16. Effect of Noise, Light, and Heat on human efficiency in work environments.

TEXT BOOKS:

4. **ILO, Introduction to work study** - III Revised Edition, 1981
5. **Motion and Time study** - Ralph M Barnes; John Wiley, 8th Edition, 1985.
6. **Engineered work Measurement** - Wledon, ELBS, 1991, Marvin E. Mundel- Motion and Time study, PHI, 1st edition

REFERENCES BOOKS:

5. **Human Factors in Engineering Design -** S Sanders and E J McCormick, 6th Edition, Mc Graw Hill
6. **Work Study and Ergonomics** - S Dalela and Sourabh, – Chand Publishers, 3rd edition.
7. **Industrial Engineering Hand book** Maynard.
8. **Work Study** - Ralph & Barnes.

SCHEME OF EXAMINATION:

Six Questions to be set with one question from each unit carrying 20 marks each. Any three units will have an internal choice.

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.
INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	Statistics For Engineers	Sub Code	10IE5DCSFE
Credits	04	L-T-P	3-1-0

Unit – 1

The Role of Statistics in Engineering (Data Summary and Presentation): Statistical Thinking, Collecting data, Statistical Modeling Frame work, measure of central tendency and variance, Importance of Data summary and Display, Practical problems solving through tools like Tabular and Graphical display, Pie charts, Constructions of Box Plots, S curves, Frequency polygon, Pareto Graph. **7 Hrs**

Unit - 2

Discrete Random Variables and Probability Distributions: Discrete Random variables, Probability distributions and Probability mass functions, Cumulative distribution functions, Mean and Variance of a discrete random variable, discrete uniform distribution, Binominal distribution, Hyper Geometric distribution, Applications.

Continuous Random Variables and Probability Distributions: Continuous random variables, Probability distributions and probability density functions, cumulative distribution functions, Mean and Variance of a continuous random variable, uniform distribution, Normal distribution, Normal approximation to Binominal and Poisson distribution, Applications. Chi-square Disrtributions, Exponential distribution Weibull Distribution (Underlined Distributions - Exposure limited to theoretical concepts). **10 Hrs**

Unit - 3

Estimation Theory: Statistical Inference, Random sampling, Properties of Estimators, Sampling distribution, Sampling distribution of means, variance and proportion, Introduction to confidence intervals **5Hrs**

Unit - 4

Statistical Inference for a Single Sample and Two Samples: Hypothesis testing, Inference on the mean of a population (variance known and unknown), Inference on the variance of a normal population, Inference on a population proportion.

Statistical Inference for a Single Sample and Two Samples: Testing for Goodness of Fit, Inference for a difference in Means, Variances known, Inference for a difference in means of two normal distributions, Variances unknown, Inference on the Variances of two normal populations, Inference on two population proportions. **10Hrs**

Unit - 5

Simple Linear Regressions and Correlation: Simple Linear Regression, Properties of Least square Estimators and Estimation of variances, Common abuses of regression, Prediction of new observations, Assessing the adequacy of regression model, Transformations to a straight line, Introduction to multiple regression (will not have problems), Correlation.

Design of Experiments: Strategy of experimentation, completely randomized single - factor experiment, Tests on individual treatment means, the random effects model, the randomized complete block design, one way analysis of variance and two way analysis of variance. (Exposure limited to theoretical concepts **8 Hrs**

- Statistical Software to be utilized extensively wherever possible to solve problems.
- Question Paper: One Question to be set from each unit and Two Questions will be set from the unit 2 & 4.Student will answer any 5 questions selecting at least one from each unit.

Text books:

1. Applied statistics and Probability for Engineers – Douglas C Montgomery, George C Runger, 2nd Edn, John Wiley and Sons, ISBN-0-471-17027-5
2. Statistics for Management - Richard I Levin, David S Rubin, 6th Edn, Prentice Hall India, ISBN-81-203-0893-X

Reference books:

1. Probability and Statistics in Engineering - William W Hines, Douglas C Montgomery, 2nd Edn, John Wiley and Sons
2. Business Statistics for Management and Economics - Daniel, Terrell, 6th Edn, Houghton Mifflin Company, ISBN-0-395- 62835-0
3. Probability and Statistics - Walpole & Mayer, MacMillan Publishing Company, 1989.

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.
INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	MATERIALS MANAGEMENT	Subject Code	10IE5DCMAM
Credits	03	L-T-P	2-1-0

UNIT - 1

INTRODUCTION: Dynamics of materials management, Material management at micro-level, Inventories of materials, Total concepts, definition, A brief history of development, An over-view. System approach to material management, The process of management and the materials functions, The materials function, interfaces, An overview of the systems concept, benefits of integrated systems approach. **6 Hrs**

FORECASTING: Forecasting and planning, forecasting methods

OBJECTIVES AND THE MATERIALS ORGANIZATION: Systems Design, Integral control of flow of materials, Objectives of materials management, Organization of materials management, Environmental change, The development of functional organization **6 Hrs**

MATERIALS PLANNING: Making the materials plan work, the materials cycle and flow control system, Materials budget. **4 Hrs**

UNIT – 2

PURCHASING: Purchasing principles, procedures and Practices, Fundamental objectives of purchasing, Scope, Responsibility and Limitations, Sources of supply and Supplier selection, Purchasing policy and procedures budgets and statistics. **4 Hrs**

PURCHASING IN MATERIALS MANAGEMENT: Systems concept, price determination, price forecasting, Price-cost analysis, The learning curve, Negotiation, Reciprocity, Cost-plus contracts, Hedging, Forward buying, Buying ethics, Principles and standards of purchasing, Make-or-buy, information, Documentation and Purchasing library, Legal aspects of purchasing, Law of Agency, Law of contract, Legal status of buyer, Warranties and conditions, Right of inspection, Right of rejection, Vendor-vendee relations, Vendor development. **7 Hrs**

PURCHASING OF CAPITAL EQUIPMENT, PLANT AND MACHINERY: Responsibility and decision, Purchasing v/s Leasing. **1 Hrs**

INTERNATIONAL BUYING AND IMPORT PURCHASING: Industrial needs, Import procedure and documents, Classification of stores, Categories of importers, Import application, Basis of licensing, Import purchasing procedures, Letter of credit, Income-tax clearance, Registration of licenses & Customs tariff. **5 Hrs**

UNIT 3

INVENTORY MANAGEMENT: Definition of Inventory, The need of inventory and its management, functions of inventory management, Types of inventories, inventory control, Cost elements, Economic Order Quantity, Standard deterministic EOQ models – deterministic models, stochastic models, Max – Min system, Inventories and demand uncertainty. **6 Hrs**

INVENTORY MANAGEMENT: Determining safety stock, Q-system, Effect of quantity discounts, P-system, Optional replenishment system, Demand forecasting, Demand and uncertainty and risk, Store keeping and inventory control, A practical approach, ABC inventory classification, The need for systems approach, Material requirement planning, Basic tool, conclusion. **6Hrs**

UNIT – 4

STORES MANAGEMENT AND OPERATION: Storage system, Stores location and layout. Development of storing, Centralization and Decentralization of stores, Standardization and variety reduction, the system, Merits and demerits of codification, Materials accounting and materials audit.

4 Hrs

UNIT – 5

MATERIALS MANAGEMENT INFORMATION SYSTEM AND COMPUTER: MIS – Management and MM, Computer systems for MIS and MM. In-process materials and management control.

3 Hrs

TEXT BOOKS:

3. Materials Management - Gopal Krishnan and Sundaresan,: An Integrated Approach, Prentice Hall
4. Materials Management - Datta, A K, , Procedure, Text and cases, Prentice hall of India Pvt Ltd., New Delhi 2001

REFERENCE BOOK:

2. Purchase Managemnet - Lee Dobler-. 1st Edition

SCHEME OF EXAMINATION:

Five Questions to be set with one question from each unit carrying 20 marks each. Any three units will have an internal choice.

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.
INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	OPERATIONS RESEARCH	Subject Code	10IE5DCOPR
Credits	04	L-T-P	3-1-0

UNIT-I

Introduction: OR definition, scope, phases, limitations, models **02Hrs**

Linear programming: definition, mathematical formulation, standard form, solutions space solution-feasible, basic feasible, infeasible, multiple optimal, redundancy, degeneracy using graphical and simplex methods, Introduction to duality in LPP with simple problems **11 Hrs**

UNIT - II

Transportation problem: formulation of transportation model, basic feasible solution using different methods, optimal solutions, degeneracy in transportation problems, unbalanced transportation problem 0**7 Hrs**

Assignment problem: formulation, unbalanced assignment problem, travelling salesman problem using Hungarian and little's methods **05 Hrs**

UNIT - III

Queuing theory: Queing system and their characteristics, analysis of markovian queues, M/M/1, M/M/K queuing system **06 Hrs**

UNIT - IV

Project management using network analysis: Network construction, determination of critical path and duration, floats using CPM. PERT-Estimation of project duration, Variance and crashing of projects **06 Hrs**

UNIT - V

Game theory: two persons - zero sum game, games with and without saddle point, graphical solution, dominance property **05 Hrs**

Text books:

1. Taha H A, Operations Research and Introduction, mcmillian
2. Hiller and Liberman, Introduction to Operation Research, mcgraw hill
3. Philips Ravindaran and Soleberg, Principles of Operations Research –Theory and practice, PHI

Reference books:

5. S D Sharma Operations Research, Kedarnath, Ramnath and Co
6. Kanthi swarup and others- Operations Research, Sultan chand and sons
7. J K Sharma,Operations Research Theory and application,Pearson Education Pvt.Ltd.
8. Manmohan and P K Gupta,Problems in operations Research, Sultan chand and sons

Scheme of Examination: Each question from each unit and internal choice from unit III & unit V

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.
INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	MANAGEMENT AND ENTREPRENEURSHIP	Subject Code	10IE5DCMAE
Credits	03	L-T-P	3-0-0

UNIT – I

MANAGEMENT : Introduction – Meaning – nature and characteristics of Management, Scope and Functional areas of management – Management as a science, art of profession – Management and Administration – Roles of Management, Levels of Management, development of Management Thought – Early management approaches – Modern management approaches. **8 Hrs**

UNIT – II

PLANNING : Nature, importance and purpose of planning process – Objectives – Types of plans – Importance of planning – steps in planning and planning premises – Hierarchy of plans.

ORGANISING AND STAFFING : Nature and purpose of organization – Principles of organization – Types of organization – Committees – Centralization Vs Decentralization of authority and responsibility – Span of control. Nature and importance of staffing. **8 Hrs**

UNIT – III

DIRECTING & CONTROLLING : Meaning and nature of Directing – Leadership styles, motivation theories, communication – Meaning and Importance of Coordination. Techniques of Co-ordination. Steps in controlling. **s**

UNIT – IV

ENTREPRENEURSHIP : Meaning, evolution of the concept, functions, types. Entrepreneur – an emerging class, Evolution of Entrepreneurship, development of Entrepreneurship; stages in entrepreneurial process; role of entrepreneurs in economic development, Entrepreneurship in India, Entrepreneurship – its barriers.

SMALL SCALE INDUSTRIES : Definition, characteristics; need and rationale; objectives; scope; role of SSI in economic, development advantages of SSI steps to start and SSI – government policy towards SSI, different polities of SSI; government support for SSI during 5 year plans. Impact of Liberalization, Privatization, Globalization on SSI. Effect of WTO/GATT supporting agencies of Government for SSI, meaning, nature of support; objectives; functions; types of help; ancillary industry and tiny industry (definition only). **10 Hrs**

UNIT – V

INSTITUTIONAL SUPPORT : Different schemes; TECKSOK, KIADB, KSSIDC, KSIMC, DIC Single window agency, SISI; NSIC, SIDBI, KSFC.

PREPARATION OF PROJECT : Meaning of project; Project identification; Project selection; project report; need and significance of report; Network analysis; project appraisal, identification of business opportunities; Feasibility study. **8 Hrs**

TEXT BOOKS :

5. Principles of Management – Harold Koontz, Heinz Weihrich, Ramachandra Aryasri, Tata McGraw Hill, 2010.
6. Principles of Management – P.C.Tripathi, P.N.Reddy – Tata McGraw Hill.
7. Dynamics of Entrepreneurial Development & Management – Vasant Desai – Himalaya Publishing House.
8. Entrepreneurship Development – Poornima M. Charantimath – Small Business Enterprises – Pearson Education – 2006 (2 & 4).

REFERENCE BOOKS :

4. Management Fundamentals – Concepts, Application, Skill Development – Roberts Lusier – Thomson –
5. Entrepreneurship Development – S.S.Khanka – S. Chand & Co.
6. Management – Stephen Robbins – Pearson Education/PHI – 17th Edition, 2003.

Scheme : One question from each unit and choice from Unit 4 and 5.

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.
INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	Mechanical Lab	Subject Code	10IE5DLMEL
Credits	01	L-T-P	0-0-3

17. Determination of Flash point and Fire point of lubricating oil using Abel Pensky, Pensky Martin & Cleveland open cup Apparatus
18. Determination of Viscosity of Lubricating oil using Redwood, Saybolt and Torsion Viscometers.
19. Valve Timing Diagram
20. Planimeter
21. Performance Test on Ruston Diesel Engine and Heat Balance Sheet
22. Performance Test on Four Stroke Diesel Engine
23. Performance Test on Twin cylinder Diesel Engine and Morse test
24. Performance Tests on Four Stroke Petrol Engine
25. Performance Tests on Two Stroke Petrol Engine
26. Calibration of Venturimeter
27. Orificemeter
28. Friction losses in flow through Pipes
29. Performance Test on Centrifugal Pump
30. Performance Test on Reciprocating Pump
31. Performance Test on Francis Turbine
32. Performance Test on Pelton Wheel

CIE - 50 MARKS
SEE - 50 MARKS

BMS COLLEGE OF ENGINEERING, BANGALORE
Autonomous College under VTU 2008-09
Department: INDUSTRIAL ENGINEERING & MANAGEMENT Semester: 06

Subject Code										Subject Title	Credit Hours/Week				Contact hrs/wk	Marks		
											L	T	P	Total credit		CIE	SEE	Total
1	0	I	E	6	D	C	S	M	A	SIMULATION MODELING &ANALYSIS	3	0	1	4	5	50	50	100
1	0	I	E	6	D	C	F	P	D	FACILITIES PLANNING AND DESIGN	3	0	0	3	3	50	50	100
1	0	I	E	6	D	C	E	E		ENGINEERING ECONOMY	3	1	0	4	5	50	50	100
1	0	I	E	6	D	C	Q	A	R	QUALITY ASSURANCE AND RELIABILITY	4	0	1	5	7	50	50	100
										ELECTIVE-I	4	0	0	4	4	50	50	100
										ELECTIVE - II	4	0	0	4	4	50	50	100
1	0	I	E	6	D	L	N	M	L	NUMERICAL METHODS LAB	0	0	3	1	3	50	50	100
TOTAL														**25**	**31**	350	350	700

L – Lecture Hours / week; **T**- Tutorial Lecture Hours / week; **P**-Practical Lecture Hours / week.

CIE- Continuous Internal Evaluation; **SEE**- Semester End Examination (of 3 Hours duration)'

ELECTIVE – I

10IE6DEVE	VALUE ENGINEERING
10IE6DENCM	NON CONVENTIONAL MACHINING
10IE6DESEM	SOFTWARE ENGINEERING AND MANAGEMENT

ELECTIVE - II

10IE6DEPEM	PLANT ENGINEERING & MAINTENANCE

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.

INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	Simulation Modeling and Analysis	Subject Code	10IE6DCSMA
Credits	04	L-T-P	3-0-1

UNIT-I

INTRODUCTION TO SIMULATION: Simulation, advantages, Disadvantages, Areas of application, System environment, components of a system, Model of a system, types of models, steps in a simulation study. **06 hrs**

SIMULATION EXAMPLES: Simulation of Queuing systems, Simulation of Inventory System, Other simulation examples **06 hrs**

UNIT - II

GENERAL PRINCIPLES: Concepts in discrete - events simulation, event scheduling / Timeadvance algorithm, simulation using event scheduling. **06 hrs**

RANDOM NUMBERS: Properties, Generations methods, Tests for Random number- Frequency test, Runs test, Autocorrelation test, Gap test, Poker test **06 hrs**

UNIT -III

RAMDOM VARIATE GENERATION: Inverse Transform Technique- Exponential, Uniform, Weibull, Triangular distributions, Direct transformation for Normal and log normal Distributions, convolution methods- Erlang distribution, Acceptance - Rejection Techniques – Poisson Distribution, Gamma Distribution. **08 hrs**

UNIT - IV

ANALYSIS OF SIMULATION DATA

Input Modelling: Data collection, Identification and distribution with data, parameter estimation, Goodness of fit tests, Selection of input models without data **04 hrs**

Verification and Validation of Model- Model Building, Verification, Calibration and Validation of Simulation Models (only introduction). **02 hrs**

UNIT - V

Output Analysis - Stochastic Nature of output data, Measures of Performance and their estimation **03 hrs**

Simulation Softwares – Introduction, Simulation packages & Languages **01 hrs**

UNIT – VI (Laboratory Exercise)

1. Estimation of Profit using Monte Carlo technique
2. Determination of the value of the given Integral
3. Solving the value of Pi using Monte Carlo method
4. Solving Monte Carlo simulation problems using MS Excel
5. Statistical Analysis of Simulation models (input analysis)
6. Building simulation models for manufacturing operations (Electronic assembly – With Basic templates)
7. Building simulation models for manufacturing operations (Electronic assembly – With Common templates)
8. Building simulation models for manufacturing operations with transporter System
9. Building simulation models for manufacturing operations with Conveyor System
10. Building simulation models for manufacturing operations with layout
11. Building simulation Models for Banking service (Bank teller problem)
12. Building simulation Models for Banking service (Bank lobby problem)
13. Building simulation model for xerox centre model
14. Building simulation Models for Mortgage application problem
15. Statistical Analysis of Simulation models (output analysis)

Suggested Text books :

1. Discrete Event system Simulation - Jerry Banks, John S Carson, II, Berry L Nelson,

2. David M Nicol, III Edition, Pearson Education, Asia.

3. Systems Simulation with Digital Computer - Narsingh Deo; PHI Publication (EEE).

4. Simulation Modelling & Analysis - Averill M Law, W David Kelton; McGraw Hill International Editions - Industrial Engineering series.

5. Gordan. G. "Systems Simulation", Prentice Hall India Ltd, 1991.

Suggested Software Packages

1. Simulation Packages : Arena, Quest, Pro-model
2. MS Excel

Scheme of Examination:

Each question from each unit and internal choice from **unit I** & **unit II**

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.

INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	FACILITY PLANNING AND DESIGN	Subject Code	10IE6DCFPD
Credits	03	L-T-P	3-0-0

UNIT - 1

PLANT LOCATION: Factors influencing plant location, Theories of plant location and location economics. P**lant layout**-Objectives of plant layout, Principles of plant layout, types of plant layout, their merits and demerits

Facilities design function: Objectives, Types of Layout Problems. **7 Hrs**

MATERIAL HANDLING: Objectives and principles of Material handling, Unit load concept, classification of material handling equipment basic systems, different types of material handling equipments. **6Hrs**

UNIT - 2

PLANT DESIGN: Layout procedures: Emmer, Nadler, Muther, Apple James and Reed's approaches, systematic layout planning, activity relationship chart, relationship Diagram, Space relationship diagram to plant layout.

COMPUTERIZED LAYOUT PLANNING: CRAFT, COFAD, PLANET, CORELAP, ALDEP. **7 Hrs**

UNIT - 3

SPACE DETERMINATION AND AREA ALLOCATION: Factors for consideration in space planning, receiving, storage, production, shipping, tool room and tool crib, other auxiliary service actions, Establishing total space requirement, area allocation factors to be considered, expansion, flexibility, aisles column, area allocation procedure, the plot plan. Sequence demand Straight line and non directional methods.

CONSTRUCTION OF THE LAYOUT: Methods of constructing the layout, evaluation of layout, efficiency indices, presenting layout to management. **3 Hrs**

LOCATION MODELS: Single and Multi facility location models, Location allocation problems – quadratic assignment problems. **3Hrs**

UNIT - 4

QUANTITATIVE APPROACHES TO FACILITIES PLANNING: Deterministic models single and multi facility location models, Location allocation problems – quadratic assignment problem, Warehouse layout models, plant location problems. **6Hrs**

UNIT – 5

LAYOUT MODELS: Warehouse Layout Models, Waiting line models, Storage models – simple problems, Evaluation, selection and implementation of facilities plan. **7Hrs**

TEXT BOOKS:

1. **Plant Layout and Material handling -** James M Apple,2nd Edition, John, Wiely and Sons
2. **Facility layout and Location** - Francies,R.L. and White,J.A., Mc Graw Hill 2nd edition

REFERENCE BOOKS:

1. **Practical layout** - Muther Richard, Mc Graw Hill-1955.
2. **Facilities Design** – Sunderesh Heragu, , PWS Publishing Company,

   ISBN-0-534-95183.
3. **Plant Layout Design -** James M Moore, Mac Millon Co.1962 LCCCN61- 5204.

SCHEME OF EXAMINATION:

Five Questions to be set with one question from each unit carrying 20 marks each. 1 & 2 units will have an internal choice.

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.

INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	Engineering Economy	Sub Code	10IE6DCEE
Credits	04	L-T-P	3-1-0

Unit - 1

Introduction: Engineering Decision- Makers, Engineering and Economics, Problem solving and Decision making, Intuition and Analysis, Tactics and Strategy, Decision maze. Practical oriented decision making. **5 Hrs**

Interest and Interest Factors: Interest rate, simple interest Compound interest, Cash- flow diagrams, Exercises and Discussion on time value of money. **6 Hrs**

Unit - 2

Present Worth Comparison: Conditions for present worth comparisons, Basic Present worth comparisons, Present worth equivalence, Net Present worth, Assets with unequal lives, infinite lives, Future worth comparison, Pay – back comparison, Exercises, Discussions and problems. **6 Hrs**

Unit - 3

Equivalent Annual Worth Comparisons: Equivalent Annual Worth Comparison methods, Situations for Equivalent Annual Worth Comparison Consideration of asset life, Comparison of assets with equal and unequal lives, Use of sinking fund method, Annuity contract for guaranteed income, Exercises, Problems. **6Hrs**

Rate of Return Calculations: Rate of return, Minimum acceptable rate of return, IRR, IRR misconceptions, Cost of capital concepts. **3 Hrs**

Depreciation: Causes of Depreciation, Basic methods of computing depreciation charges **3 Hrs**

Unit - 4

Replacement Analysis: Deterioration, obsolescence, inadequacy, Economic life for cycle replacements **3Hrs**

Structural Analysis of Alternatives: Identifying and Defining alternatives, IRR analysis of mutually exclusive alternatives, Capital Budget view point, Rankine criteria. **4Hrs**

Unit - 5

Estimating & Costing: Components of costs such as Direct Material Cost, Direct Labour Cost, Fixed, Over – Heads, Factory

Costs, Administrative – Over Heads, First Cost, Marginal Cost, Selling price, Estimation for simple components

Effects of Inflation: Causes, consequences and control of inflation. After tax actual cash flow comparisons, Lease/ Buy decisions **5Hrs**

- Question Paper: One Question to be set from each unit and Two Questions will be set from the unit 1 & 3.Student will answer any 5 questions selecting at least one from each unit.

TEXT BOOKS:

1. **Engineering Economy** - RIGGS J.L. McGraw Hill, 2002.

2. **Engineering Economy** - PAUL DEGARMO, Macmillan Pub, Co. 2001.

3. **Engineering Economy** - Naidu, Babu and Rajendra –, New Age International Pvt. Ltd. – 2006

4. **Engineering Economics-** R Pannerselvam – PHI Publishing Pvt Ltd- 2008**REFERENCE BOOKS:**

1. **Industrial Engineering and Management** - OP KHANNA, Dhanpat Rai & Sons 2000

2. **Financial Management** - I M PANDEY, Vikas Publishing House 2002.

3. **Engineering Economy -** THUESENH.G. PHI, 2002

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.

INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	QUALITY ASSURANCE AND RELIABILITY	Subject Code	10IE6DCQAR
Credits	05	L-T-P	4-0-1

Unit – 1

INTRODUCTION TO QUALITY: Definition of Quality, Quality function, Dimensions of Quality, Quality Engineering terminology, Brief history of quality methodology, Statistical methods for quality improvement, Quality costs – four categories costs and hidden costs. Brief discussion on sporadic and chronic quality problems, Introduction to Quality function deployment, Robust Design. **8Hrs**

Unit – 2

QUALITY ASSURANCE: Definition and concept of quality assurance, departmental assurance activities. Quality audit concept, audit approach etc. structuring the audit program, planning and performing audit activities, audit reporting, ingredients of a quality program. **6 Hrs**

STATISTICAL PROCESS CONTROL: Introduction to statistical process control – chance and assignable causes variation. Basic principles of control charts, choice of control limits, sample size and sampling frequency, rational subgroups. Analysis of patterns of control charts. Case Studies on application of SPC, Process capability – Basic definition, standardized formula, relation to product tolerance and six sigma concept of process capability, Seven QC tools. **8 Hrs**

Unit – 3

CONTROL CHARTS FOR VARIABLES: Controls charts for X bar and Range, statistical basis of the charts, development and use of X bar and R charts, interpretation of charts. Control charts for X bar and standard deviation (S), development and use of X bar and S chart. Brief discussion on – Pre-control X bar and S control charts with variable sample size, control charts for individual measurements, cesium chart, moving-range charts**.** Gauge R and R and MSA. **8 Hrs**

CONTROL CHARTS FOR ATTRIBUTES: Controls chart for fraction non- conforming (defectives) development and operation of control chart, brief discussion on variable sample size.

Control chart for non-conformities (defects) – development and operation of control chart for constant sample size and variable sample size. Choice between variables and attributes control charts. Guidelines for implementing control charts. **6Hrs**

Unit - 4

SAMPLING INSPECTION: Concept of accepting sampling, economics of inspection, Acceptance plans – single, double and multiple sampling. Operating characteristic curves – construction and use. Determinations of average outgoing quality, average outgoing quality level, average total inspection, producer risk and consumer risk, published sampling plans. **6Hrs**

STATISTICAL THEORY OF TOLERANCES: Application of statistical theory of tolerances to Design of tolerances in random assemblies and application in other areas. **4Hrs**

Unit - 5

RELIABILITY AND LIFE TESTING: Failure models of components, definition of reliability, MTBF, Failure rate, common failure rate curve, types of failure, reliability evaluation in simple cases of exponential failures in series, paralleled and series-parallel device configurations, Redundancy and improvement factors evaluations **6Hrs**

Unit - 6

1. To test the Goodness of fit for the given quality characteristic using Uniform distribution
2. To test the Goodness of fit for the given quality characteristic using Binomial distribution
3. To test the Goodness of fit for the given quality characteristic using Poisson distribution
4. To test the Goodness of fit for the given quality characteristic using Normal distribution
5. Conduction of Repeatability and Reproducibility studies for appraiser and instrument using R&R Software
6. Assessing Process Capability of the given manufacturing process using Normal Probability paper method and process capability indices
7. Assessing Process Capability of the given manufacturing process using Digital Motorized Multifunctional Height Gauge and SQC Display unit
8. Experiments on Application of 7 QC Tools as applied to Manufacturing and Service Operations.
9. Construction of control chart for variable quality characteristic using Digital Motorized Multifunctional Height Gauge

   SQC Display unit

   SQC/SPC software
10. Construction of control chart for attribute quality characteristic
11. Construction of control charts using Systat Software
12. Attribute sampling Plans – Single, Double and Multiple sampling plans.
13. Experiments on correlation and Simple linear regressions
14. Experiments on multiple linear regressions
15. Conduction of Design of Experiments – Full Factorial approach for the given quality characteristic for machining operations.
16. Exercises to demonstrate Taguchi's Orthogonal Array technique through DOE software.

TEXT BOOKS

1. **Introduction to statistical Quality Control -** D C Montgomery 3rd Edition, John Wiley and Sons.

2. **Quality Planning & Analysis** - J M Juran, Frank M Gryna; Tata McGraw Hill, 3rd edition,

REFERENCE BOOKS

1. **Statistical Quality Control** - Grant and Leavenworth, McGraw Hill, 6th Edition

2. **Total Quality Management** – NVR Naidu, KM Babu and G. Rajendra – New Age International Pvt. Ltd – 2006

3. **Total Quality Management** - Kesavan R, I.K. International, New Delhi – 2007

Scheme for examination: Five questions choosing one each from each unit and Unit2 and 3 with choice questions

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.

INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	VALUE ENGINEERING	Subject Code	10IE6DEVE
Credits	04	L-T-P	4-0-0

Unit – 1

INTRODUCTION TO VALUE ANALYSIS: Definition of Value, Value Analysis, Value Engineering, Value management, Value Analysis versus Value Engineering, uses, applications, advantages and limitations of Value analysis. Symptoms to apply value analysis.

TYPE OF VALUES: Reasons for poor value & unnecessary cost of product, Peeling cost Onion concept, unsuspected areas responsible for higher cost, Value Analysis Zone, attractive features of value analysis. **10Hrs**

UNIT - 2

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. **8Hrs**

UNIT – 3

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 and case studies. **7Hrs**

UNIT - 4

Implementation of VE TECHNIQUES: Guidelines for selecting VE projects, Guidelines for formation of VE teams, Application of VE for cost reduction and improving competitiveness – some examples, Relevance of VE for Materials Management. **5Hrs**

UNIT - 5

Introduction of some advanced techniques: FAST diagramming, Life Cycle costing. VE and some new variants – BPR, Product Reengineering, QFD, Benchmarking. Value analysis of Management practice (VAMP): Steps involved in VAMP and some case studies.

Typical Case Studies – Tapping device of transformer, front rings, conveyor rollers, speedometer of a motorcycle, oil pump etc. **10 Hrs**

TEXT BOOKS:

1.Value engineering for COST REDUCTION and PRODUCT IMPROVEMENT – M.S. Vittal, Systems Consultancy Services Edn 1993.

2. Achieving competitive edge through Value Engineering – M.S.Vittal, Systems Consultancy Services Edn 1993.

3. Value Engineering - S.S Iyer,

4. Value Engineering- A Practical approach for Owners, Designers and Contractors – Larry Zimmerman, P.E., Glen Hart, CBS Publishers & Distributors, 1988.

REFERENCE BOOKS:

1.Value Analysis for Better Management – Warren J Ridge American Management Association Edn 1969

2.Elements of Production Planning and Control – Samuel Eilon, Universal Book Corporation. Edn 1981

3.Getting More at Less Cost (The Value Engineering Way) – G.Jagannathan Tata Mcgraw Hill Pub. Comp. Edn 1995

4.Value Engineering – Arther E Mudge McGraw Hill Book Comp. Edn 1981

5.An Introduction to Operational Research – C R Kothari Vikas Pub. House Pvt. Ltd., Edn. 1982.

6.Value Management, Value Engineering and Cost Reduction – Edward D Heller Addison Wesley Publishing Company 1971

Scheme: One question from each unit and choice from unit 1 and unit 5

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.
INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	Non Conventional Machining	Subject Code	10IE6DENCM
Credits	04	L-T-P	4-0-0

UNIT – I

Introduction: History, Classification, Comparison between conventional and nonconventional machining process selection.

Mechanical Process: Ultrasonic machining (USM): Introduction, Equipment, tool materials & tool Size, Abrasive slurry, Cutting tool system design: Magnetostriction assembly, Tool cone (Concentrator), Exponential concentrator of circular cross section & rectangular cross section Hollow cylindrical concentrator. Mechanics of cutting: Theory of Miller & Shaw Effect of parameter: Effect of amplitude of frequency and vibration, Effect of grain diameter, Effect of applied static load, effect of slurry, Tool and work material, USM process Characteristics: Material removal rate, tool wears, Accuracy, surface finish. Applications, advantages & disadvantages of USM. **08 Hrs**

UNIT – II

Abrasive Jet Machining (AJM): Introduction, Equipment, Variables in AJM: Carrier Gas, Type of abrasive, Size of abrasive grain, Velocity of the abrasive jet, Mean No. abrasive particles per unit volume of the carrier gas, Work material, Standoff Distance (SOD), Nozzle design, Shape of cut. Process characteristics – Material removal rate, Nozzle wear, Accuracy & Surface finish. Applications, advantages & disadvantages of AJM. **06 Hrs**

Electrochemical Machining (ECM): Introduction, classification of ECM process, Fundamental principles of ECM, Elements of ECM process: Cathode tool, Anode work piece, source of DC power, Electrolyte, Tool-work gap, Chemistry of the ECM process, ECM process characteristics: Material removal rate, Accuracy, Surface finish. ECM Tooling**:** ECM tooling techniques and examples, Tool & insulation materials, Tool size, Electrolyte flow arrangement, Handling of slug, Economics of ECM, Determination of metal removal rate, evaluation of metal removal rate of an alloy, Applications, Advantages, Limitations of ECM, Electrochemical Turning, Electrochemical Grinding, Electrochemical Honing and Electrochemical Debarring. **10Hrs**

UNIT – III

Chemical Machining (CHM): Introduction, Elements of process, chemical blanking process: Preparation of work piece, Preparation of masters, masking with photo resists, etching for blanking, applications of chemical blanking, chemical milling (Contour machining) :- Process steps : masking, Etching, process characteristics of CHM :Material removal rate, accuracy, surface finish, Hydrogen embrittlement, Advantages & applications of CHM. **08 Hrs**

UNIT – IV

EDM Process: Introduction, machine, dielectric fluid, spark generator, EDM tools (Electrodes): Electrode manufacture, Electrode wear, EDM electrode holders, EDM tool design: Choice of matching operation, electrode materiel selection, machine settings, under sizing and length of electrode, Machining time. Flushing: Pressure flushing, Suction flushing, Side flushing, pulsed flushing synchronized with electrode movement, EDM process characteristic: Metal removal rate, Accuracy, surface finish, Heat affected Zone. Applications: EDM accessories applications, Electrical Discharge Grinding (EDG), Travelling wire EDM. **14 Hrs**

UNIT – V

Plasma Arc Machining (PAM): Introduction, process principle, equipments, non-thermal generation of plasma, selection of gas, Mechanism of Metal removal, PAM process parameters, Process characteristics. Safety precautions, applications, advantages and limitations of PAM. **6Hrs**

TEXT BOOKS:

1. Modern Machining Process by Pandey and Shan, Tata Mc Graw Hill 2009.
2. Production Technology by HMT, Tata McGraw Hill 2001.

REFERENCE BOOKS:

1. New Technology by Bhattacharya, 2000.
2. Unconventional Machining Process by M K Singh, New Age Publications.
3. Thermal Metal Cutting Process by B G Ranganath, I K International Publishing House Pvt Ltd.
4. Fundamentals of Machining and Machine Tools by R K Singal, I K International Publishing House Pvt Ltd.

Scheme of Exam: One Question to be set from each unit and Two Questions to be set from the units 2 & 4. Student has to answer any 5 questions selecting at least one question from each unit.

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.

INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	SOFTWARE ENGINEERING AND MANAGEMENT	Subject Code	10IE6DESEM
Credits	04	L-T-P	4-0-0

UNIT - 1

THE PRODUCT AND THE PROCESS: The product - Evolving role of Software, Characteristics, Components, and Applications. The Process Software process, Models - Linear, sequential, Prototype, RAD, Process Technology, Software Development Life cycle.

SOFTWARE PROJECT MANAGEMENT CONCEPTS: The Management Specification, People, Problem, Process **12 Hrs**

UNIT - 2

SOFTWARE PROJECT PLANNING: Objectives, Scope, Resource, Project estimation, Decomposition Techniques, Empirical Estimation Models. Make-buy decision, Automated estimation tools.

RISK MANAGEMENT: Reactive v/s Proactive Risk Strategies, Software Risks, Risk identification, Risk projection, Monitoring. **13 Hrs**

SOFTWARE PROJECT SCHEDULING AND TRACKING: Basic concepts, defining a task set selection, Defining Scheduling, Project Plan **SOFTWARE QUALITY ASSURANCE:** Quality assurance concept, Cost impact of software defects, Technical review, statistical Quality assurance, software reliability, ISO 9000 Quality standards

7 Hrs

UNIT - 4

SYSTEM ANALYSIS CONCEPT AND PRINCIPLES: Requirement analysis, Principles, software prototyping, specifications, Data Modeling, Functional Modeling and Information Flow, Structured Analysis, Data Dictionary. **8 Hrs**

UNIT - 5

SYSTEM DESIGN CONCEPTS AND PRINCIPLES: Design Process Concept, Modular design,Documentation Design Methods, Data Design, Interface Design, Procedural Design, Design for Real Time Systems, System, Considerations in Real Time systems, Analysis and Simulation of Real Time Systems.

SOFTWARE TESTING: Objectives, Principles, Testability

SOFTWARE QUALITY AND RELIABILITY: Introduction, Software failure modes, software structure and modularity, language, Data reliability, Fault tolerance, software checking and software testing.

OBJECT ORIENTED CONCEPT AND PRINCIPLES: Object Oriented Concepts, Identifying the elements of an object model, Examples. **11 Hrs**

TEXT BOOK:

1. **Software Engineering** – Pressman, Computer Science Series TATA McGraw-Hill Publications, 6th edition

REFERENCE BOOKS:

1. **Software Engineering** - Somerville, Pearson Education, Delhi –2001
2. **Software Engineering** - Shooman, TATA Mc Graw Hill Publications. 6th Edn.

Scheme: One question from each unit and choice from unit 1 and 5

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.
INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	PLANT ENGINEERING AND MAINTENANCE	Subject Code	10IE6DEPEM
Credits	04	L-T-P	4-0-0

Unit-1

Introduction To Maintenance system: Definition, scope, objectives, functions and importance of system. Types of maintenance system. Break down maintenance system, preventive maintenance system and predictive maintenance. Design of maintenance, corrective maintenance, planned maintenance, total productive maintenance, condition monitoring.

Economics in maintenance: Repair, replenishment. Repair complexity. Finding out most optimal preventive maintenance frequency. **12Hrs**

Unit-2

Maintenance of Machinery: causes of machine failure, performance evaluation, complete overhauling of Lathes, Drilling machines, Milling machines, shapers, planers, Boring machines and grinding machines. Maintenance planning and scheduling. Repair order control, manpower requirement. Maintenance job analysis and spare parts control. **10 Hrs**

Computers in Maintenance Management: File data bank, storage of data such as break downs, spare parts, lubricating points and drawings of machine parts. **6 Hrs**

Unit-3

Industrial Safety: Economic importance of accidents, Types of safety organizations. Analysis of accident records, accident investigations, Analysis of accident safety standards for-Mechanical equipment, electrical equipment and systems chemical hazards, material handling, exhaust systems, welding, plant housekeeping-building, aisles passages, floors, tool cribs wash rooms and canteens. **12 Hrs**

Unit-4

Fire prevention and protection: Conditions favoring fire break down, prevention of firing methods, fire protection-classification of fires, fire extinguishing systems, fire alarms, fire fighting equipments. **6 Hrs**

Unit-5

Industrial pollution control: Dust control-Fiber collectors, wet type collectors, electro static precipitators. Noise pollution control-Noise measurement and control. Industrial vibration and its control. **6 Hrs**

Text books:

Maintenance Engineering And Management. - R.C. Mishra and K.Pathak

Safety in Engineering Industry. – N. Srinivasan

Reference books:

Plant engineering hand book-staniar

Maintenance Engineering hand book-Morrow

Reference books :

Hand book of maintenance management-Frank Herbaty

Industrial pollution control hand book-Lund

Industrial maintenance-H P Garg

Hand book of Industrial Engineering and management- Grant lemon and Eugene L Grant

Scheme of exam: One question from each unit and choice from unit 1 and unit 3

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.

INDUSTRIAL ENGINEERING & MANAGEMENT

Subject	Numerical Methods Lab	Sub Code	IE6DCENE
Credits	01	L-T-P	0-0-3

Numerical Methods Lab.

Finding out solutions to various engineering problems by adopting

1. Bisection Method
2. False position Method
3. Newton raphson Method
4. Linear regression Method
5. Gauss elimination Method
6. Gauss seidel Method
7. Crouts Method
8. Trapezoidal Method
9. Simpsons rule $1/3^{rd}$ & $3/8^{th}$ rule
10. Lagrange's interpolation Method
11. Newtons forward interpolation Method
12. Runge kutta (2 Method) 2^{nd} & 4^{th} order Method
13. Eulers Method
14. milne's Predictor & Corrector Method

Scheme of Examination: Student was appear for Examination and will Conduct will Conduct 2 Experiment as suggested by the Examiners.

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.
Autonomous College under VTU 2008-09
INDUSTRIAL ENGINEERING & MANAGEMENT **Semester: 07**

Subject Code	Title	TEACHING HOURS			Credits	Contact Hours/ Week	Marks		Total Marks
		L	T	P			CIE	SEE	
11IE7DCFAC	FINANCIAL ACCOUNTING & MANAGEMENT	3	1	0	4	5	50	50	100
11IE7DCSCM	SUPPLYCHAIN AND LOGISTICS MANAGEMENT	3	0	1	4	5	50	50	100
	ELECTIVE – III	4	0	0	4	4	50	50	100
	ELECTIVE- IV	4	0	0	4	4	50	50	100
	INSTITUTION ELECTIVE – I	4	0	0	4	4	50	50	100
11IE7DCPW1	PROJECT WORK-I	-	-	-	5	5	50	50	100
TOTAL					**25**	**27**	**300**	**300**	**600**

Elective – III

11IE7DEAOR	ADVANCED OPERATIONS RESEARCH
11IE7DERE	RELIABILITY ENGINEERING
11IE7DETM	TECHNOLOGY MANAGEMENT
11IE7DEHAP	HYDRALICS & PNEUMATICS
11IE7DEPM	PROJECT MANAGEMENT

Elective – IV

11IE7DEPOM	PRODUCTION AND OPERATIONS MANAGEMENT
11IE7DEIPC	INDUSTRIAL POLLUTION CONTROL
11IE7DEMM	MARKETING MANAGEMENT
11IE7DEAIM	AUTOMATION IN MANUFACTURING

Institution Elective-I

11IE7IEDBM	DATABASE MANAGEMENT
11IE7IETQM	TOTAL QUALITY MANAGEMENT

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
VII SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	Financial Accounting and Management	Sub. Code	11IE7DCFAC
Credits	04	L-T-P	3-1-0

UNIT - 1

FINANCIAL ACCOUNTING: Introduction to Book keeping: double-entry accounting, journal & ledger posting. **6 Hours**

FINANCIAL STATEMENTS & ANALYSIS: Trial balance, preparation of Trading and Profit & Loss account, and Balance sheet. **10 Hours**

UNIT - 2

RATIO ANALYSIS: Balance sheet ratio's, profit – loss account ratio's, and combined ratio's. **6 Hours**

UNIT - 3

COSTING: Objectives of costing, Elements of costing, methods of costing preparation of cost sheet (job costing) **6 Hours**

Process costing, Marginal costing and absorption costing.

STANDARD COSTING: Material, labour, overhead cost variance. **4 Hours**

UNIT - 4

WORKING CAPITAL MANAGEMENT: Factors influencing working capital requirement, determination of operating cycle and working capital.

6 Hours

UNIT - 5

BUDGETING: Sales budget, production budget, selling and administrative expense budget, , Master budget. **4 Hours**

TEXT BOOKS:

1. **Cost Accounting** - Khan M Y and Jain P K, Tata McGraw-Hill, 4thEdition.
2. **Financial Management -** Prasanna Chandra; Tata McGraw-Hill,4th Edition. 1998.
3. **Management Accounting & Costing -** PRASAD .N.K
4. **Financial Management and Policy -** James. C Vanhorne , Pearson education, 12th edition.

REFERENCE BOOKS:

1. **Elements of Accountancy** - B.S Raman,
2. **Practical Costing** - Ahuja, Pandey, Khanna and Arora, , S. Chand & Co. Ltd 2005
3. **Financial Management & Costing -** KHAN & JAIN, TMH - 2000

Note : Choice from unit 1 & unit 3 , and one question each from the remaining units2, 4 and 5.

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
VII SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	SUPPLY CHAIN & LOGISTICS MANAGEMENT	Sub. Code	11IE7DCSCM
Credits	04	L-T-P	3-0-1

UNIT - 1

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.

5Hours

UNIT - 2

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. **10 Hours**

UNIT - 3

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.

10Hours

UNIT - 4

SOURCING, TRANSPORTATION AND PRICING PRODUCTS: Role of transportation, Factors affecting transportation decisions. Modes of transportation and their performance characteristics. Designing transportation network. Trade-off in transportation design. Tailored transportation, Routing and scheduling in transportation. International transportation. Analytical problems. Role Revenue Management in the supply chain, Revenue management for: Multiple customer segments, perishable assets, seasonal demand, bulk and spot contracts. **5 Hours**

UNIT - 5

COORDINATION AND TECHNOLOGY IN THE SUPPLY CHAIN: Co-ordination in a supply chain: Bullwhip effect. Obstacles to coordination. Managerial levers to achieve co-ordination, Building strategic partnerships. 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 **10Hours**

SUGGESTED TEXT BOOK:

Supply Chain Management – 2001, Strategy, Planning & Operation. Sunil Chopra & Peter Meindl; Pearson Education Asia, ISBN: 81-7808-272-1.

REFERENCE BOOKS:

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

Modelling the Supply Chain -Jeremy F Shapiro, Duxbury;, 2002, Thomson Learning, ISBN 0-534-37363

Designing & Managing the Supply Chain -David Simchi Levi, Philip Kaminsky & Edith Simchi Levi;; Mc Graw Hill

Scheme of Exam: One question from each unit and choice from unit 1 unit 3

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
VII SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	Advanced Operations Research	Subject Code	11IE7DEAOR
Credits	04	L-T-P	4-0-0

UNIT – I

ADVANCED LINEAR PROGRAMMING: Two phase simplex techniques, Revised simplex techniques. Sensitivity analysis **10 Hours**

UNIT – II

INTEGER PROGRAMMING: . Gomore's Alongorithm and Branch & Board Technique, Solution of Alignment & Travelling salesman Problem **06 Hours**

GOAL PROGRAMMING: Introduction and simple Problem formulation. **06 Hours**

UNIT – III

NON-LINEAR PROGRAMMING: Introduction, Lagrange and Kuhn – Tucker conditions for constrained problems **06 Hours**

QUEING THEORY: M/Ek/1, M/D/1, M/M/C and M/G/1 **06 Hours**

UNIT - IV

DYNAMIC PROGRAMMING: Characteristics and DP model, Computational procedure

(no problem solving, only formulation) **04 Hours**

ADVANCED CPM TECHNIQUES: Advanced CPM Techniques: Resource leveling network techniques, scheduling activities to level the demands on key resources, time cost of trade off aspects in network techniques. Determination of least cost schedule. **04 Hours**

UNIT - V

MARKOV CHAINS: Discrete Stochastic Process, Markovian process, Stationary Markov chains, Markov diagrams, Ergodic and Absorbing Markov chains, Steady State probabilities, stochastic matrix, transition m, matrix and their applications. **04 Hours**

Suggested Texts books:

1. Taha H A, Operation Research, Macmillan
2. Ravindra, Phillips and Solberg, Operations Research ,Wiley International
3. Hiller Leiberman – Operation Research – Holdenday / CBS Publishers 1994 Edn.

References books:

1. Sesieni Yaspan and Freidan – Operation Research ,Wiley International
2. Ackoff Arnoff – Introduction to OR – Wiley International

3. H.M.Wagner – Principles of OR – Prentice Hall .ISBN –0-87692-162-4

Scheme of Examination:

Each question from each unit and internal choice from unit **I** & **unit III**

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
VII SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	Reliability Engineering	Subject Code	11IE7DERE
Credits	04	L-T-P	4-0-0

Unit - 1

INTRODUCTION: Concepts, terms, and definitions of reliability and related performance measure, Terminology in reliability, Failure rate, MTBF, Life test, importance of reliability, definition, meaning of adequate performance, reliability-engineering Programme and its scope, Typical applications.

RELIABILITY MANAGEMENT: Reliability goals & policies, economics of reliability, reliability data Collection. **8 Hours**

Unit - 2

COMPONENT LIFE: Failure distribution function, reliability function and hazard rate function, interrelationships, MTTF, MTBF, bath tub curve (Mortality curve), conditional reliability function, constant and time dependant failure models.

PRACTICAL FAILURE PATTERNS: Failure behaviour of mechanical, electrical, electronic parts, common failure distribute. **8 Hours**

COMBINATORIAL RELIABILITY (RELIABILITY OF SYSTEMS): Reliability analysis of systems: (Success-Failure models only) Analysis of Series, parallel, series parallel and parallel series configurations. R out of n configurations, redundancy improvement factor, stand by systems. **8 Hours**

TECHNIQUES FOR COMPLEX SYSTEMS RELIABILITY EVALUATION: Inspection methods, event space methods, path tracing methods, decomposition methods, cut set methods, tie set methods. **4 Hours**

Unit - 3

DESIGN FOR RELIABILITY: System effectiveness measures and life cycle cost analysis, reliability allocation, methods for reliability in design, failure analysis, systems safety and fault tree analysis, multistate model. Failure mode effect and criticality analysis. **6 Hours**

MARKOV MODELS FOR SYSTEM RELIABILITY: Reliability analysis of state dependent systems, Markov analysis, stand by system analysis. **6 Hours**

Unit - 4

MAINTENABILITY AND AVAILABILITY: Analysis of Down time, Repair Time distributions, maintainability, Maintenance increment, Design for maintainability. Availability analysis, Different forms of availability, system availability analysis, mission availability, Availability of stand by system.

6 Hours

Unit - 5

ANALYSIS FAILURE DATA: Types of life testing, data collection, Empirical methods, Estimation of Static life, types of life testing: development of confidence intervals, acceptance test procedures for life estimation using exponential, weibull and Gamma distribution models, Sequential life tests and acceptance criteria.

APPLICATION AND CASE STUDIES: Case example involving redundancy, burning tests, preventive maintenance analysis, Repairable system analysis, Software reliability. **6 Hours**

TEXT BOOKS:

1. **Concepts of Reliability Engineering -**L. S. Srinath, - Affiliated East West Press Pvt. Ltd 2nd ed.
2. **Reliability Engineering -** Dr. Balaguru Swamy – Tata McGraw Hilll, Fourth Edition 2003
3. **An introduction to Reliability and Maintainability -** Charles E Ebeling –TMH, Edition 2000.ISBN 0-07-042138-2

REFERENCES BOOKS:

1. **Reliability Hand Book** – Ireson and Grant -1995
2. **Mathematical Theory of Reliability and Mathematics** – Barlow and Proschan, 1st edition.
3. **Probability Reliability & Engineering approach**-Shooman-1976.
4. **Practical Reliability Engineering –** Patrick D.T.O – John Wiley and Sons – 2002.
5. **Introduction to Reliability Engineering** – E E Lewis – John Wiley & Sons, 2nd edition.

Scheme for examination: Five questions choosing one each from each unit and Unit 2 and 3 with choice questions

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
VII SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	Technology Management	**Subject Code**	**11IE7DETM**
Credits	**04**	**L-T-P**	**4-0-0**

UNIT-1

The Concept of Technology: Introduction, The nature of knowledge, Aspects of classification, Concept and Meaning of technology, The character of a specific technology, Scope of technology, Examples of classification of technology, Scale of technology information, Levels of technology, Technology portfolios, Technology as an environment.

The Nature of Technological Change: Introduction, Meaning of technological change, Concept of invention, Nature of innovation, Emergence of new technologies, Life cycle of a technology, Motivation for technological change, Nature of technological progress, Nature of mature technology, Nature of diffusion, Technological convergence.

10Hrs

UNIT-2

The Economics of Technology: Introduction, Meaning of technological economics, Examples of technological economics, Scope of technological economics, Engineering economics, Production economics, Concept of economy of scale, Concept of optimum size, Technology as a commodity, Technology at the macro-economic level.

Corporate Technology Strategy: Introduction, The business mission, Where is the business? Concept of business strategy, Capability for strategic planning, Corporate technology strategy, Competitive technology, Focus of strategy, Technological alliances, Realization of strategy, Technology crisis.

10Hrs

UNIT-3

Analysis for Technology Strategy: Introduction, Technology assessment, Technology forecasting, Main techniques of technology forecasting, Technology forecasting system, Yield of technology forecasting. **8 Hrs**

UNIT-4

The Realization of New Technology: Introduction, Concept of R&D, R&D policy, Stimuli for innovation, Sources of innovation, Intelligence function of R&D, Management of R&D, R&D team, Effectiveness of R&D, Marketing aspects of R&D, Finance for R&D, Design, Development, Manufacture and Marketing, Reduction of development lead time, Patterns for new technology development, Remaining a going concern.

The Adoption of New Manufacturing Technology: Introduction, Manufacturing strategy, Introduction of new technology, Challenges of factory automation, Stages of factory automation, Manufacturing cells, FMS, CIM, CAD/CAM, Intelligent manufacturing systems, Operation of new technology, Change management, People and technology at work, Work structures.

8 Hrs

UNIT-5

1. **Technology- An Instrument of Competition**: Introduction, Securing competitive advantage, Technological competition analysis, Technological leadership, Adoption of new technology, Marketing a new technology product, Retention of competitive advantage.

8 **Hrs**

Text book:

Paul Lowe, The Management of Technology: Perceptions and Opportunities, **Chapman and Hall**, London, 1995.

Reference Books:

1. *Frederick Betz*, Strategic Management of Technology, **McGraw-Hill Inc**, 1993.
2. *Rastogi, P.N*., Management of Technology and Innovation: Competing Through Technological Excellence, **Sage Publications**, 1995

Scheme: One question from each unit and Unit 1 and 2 will have internal choice

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
VII SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	**Hydraulics & Pneumatics**	**Sub. Code**	**11IE7DE HAP**
Credits	**04**	**L-T-P**	**4-0-0**

UNIT - 1

INTRODUCTION TO HYDRAULIC POWER: Pascal's law and problems on Pascal's Law, continuity equations. Structure of Hydraulic Control System. The Source of Hydraulic Power: Pumps Pumping theory, pump classification, gear pumps, vane pumps, piston pumps, pump performance, pump selection. **8 Hours**

UNIT - 2

HYDRAULIC ACTUATORS AND MOTORS: Linear Hydraulic Actuators [cylinders], Mechanics of Hydraulic Cylinder loading, Hydraulic Rotary Actuators, Gear motors, vane motors, piston motors, Hydraulic motor theoretical torque, power and flow rate, hydraulic motor performance

8 Hours

UNIT - 3

CONTROL COMPONENTS IN HYDRAULIC SYSTEMS: Directional Control Valves – Symbolic representation, Constructional features, pressure control valves – direct and pilot operated types, flow control valves. **8 Hours**

UNIT - 4

HYDRAULIC CIRCUIT DESIGN AND ANALYSIS: Control of single and double – acting Hydraulic Cylinder, regenerative circuit, pump unloading circuit, Double pump Hydraulic system, Counter Balance Valve application, Hydraulic cylinder sequencing circuits. Locked cylinder using pilot check valve, cylinder synchronizing circuits, speed control of hydraulic cylinder, speed control of hydraulic motors, accumulators and accumulator circuits.

9 Hours

MAINTENANCE OF HYDRAULIC SYSTEMS: Hydraulic oils; Desirable properties, general type of fluids, Sealing devices, reservoir system, filters and strainers, problem caused by gases in hydraulic fluids, wear of moving parts due to solid particle contamination, temperature control, trouble shooting. **6 Hours**

UNIT - 5

INTRODUCTION TO PNEUMATIC CONTROL: Compressed air: Production of compressed air – compressors, preparation of compressed air- Driers, Filters, Regulators, Lubricators, Distribution of compressed air- Piping layout. Characteristics of compressed air. Structure of Pneumatic control system. Pneumatic Actuators: Linear cylinders – Types, conventional type of cylinder working, end position cushioning, seals, mounting arrangements applications. Rod–less cylinders, types, working advantages. Rotary cylinder types construction and application. Design parameters, selection. **7 Hours**

ELECTRO-PNUEMATICS: Design and constructional aspects, poppet valves, slide valves spool valve, suspended seat type slide valve. Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, use of memory valve. Flow control valves and speed control of cylinders supply air throttling and exhaust air throttling use of quick exhaust valve.

6 Hours

TEXT BOOKS:

1. **Fluid Power with applications,** Anthony Esposito, Fifth edition pearson education, Inc. 2000.
2. **Pneumatics and Hydraulics,** Andrew Parr. Jaico Publishing Co. 2000.

REFERENCE BOOKS:
1. **Oil Hydraulic Systems - Principles and Maintenance,** S.R. Majumdar, Tata Mc Graw Hill publishing company Ltd. 2001.
2. **Pneumatic Systems,** S.R. Majumdar, Tata Mc Graw Hill publishing Co., 1995.
3. **Industrial Hydraulics,** Pippenger, Hicks, McGraw Hill, New York

Scheme of Examination:
Answer Five full questions selecting one from each unit.
To set one question each from Unit 1, 2 & 3 and two questions each from Units 4 & 5.

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DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
VII SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	PROJECT MANAGEMENT	Subject Code	11IE7DEPM
Credits	04	L-T-P	4-0-0

Unit I
Concepts of Project Management: Concept of a Project, Categories of projects, Phases of project life cycle, Roles and responsibilities of project leader, tools and techniques for project management. **8Hours**

Unit II
Project Planning and Estimating: Feasibility report, phased Planning, Project planning steps, Objectives and goals of the project, preparation of cost estimation, evaluation of the project profitability. **8 Hours**

Unit III
Organizing and Staffing The Project Team: Skills and abilities required of project manager, Authorities and responsibilities of project manager, Project organization and types, accountability in project execution, controls, tendering and selection of contractors. **8 Hours**

Unit IV
Tools & Techniques of Project Management: Bar (GANTT) chart, bar chart for combined activities, logic diagrams and networks, Project evaluation and review Technique (PE'RT) and Critical path method (CPM) Planning.
10 Hours

Unit V
Performance Measures in Project Management: Performance indicators, Performance improvement for the CM & DM companies for better project management, Project management and environment.
8Hours

Text Books:

1.Chaudhry S., Project Management.

2. Project Management a System approach to Planning Scheduling & Controlling, Harold Kerzner, CBS Publishers and Distributors.Reference Books:

1. Project Management - Beningston Lawrence-McGraw Hill-1970.

2. PERT & CPM - L.S. Srinath, Affiliated East West Press Pvl. Ltd.

3. A Management Guide to PERT and CPM, WEIST & LEVY, Eastern Economy of PHI

4. Project Management with PERT and CPM, Moder Josep and Phillips cerel R., 2nd edition, New York VAN Nostrand, Reinhold- 1976

5. Project Planning analysis selection implementation & review - Prasanna chandra, ISBNO-07-462049-5. .

6. Project planning, Scheduling & control, James P. Lewis, Meo Publishing company.

7. Bhavesh M Patel, Project Management, Vikas Publishing House ISBN 81-259-0777-7 2002.

8. Jack Gido, James P Clements, Successful Project management, Vikas Publishing House, ISBN 981-243-137-3

Scheme of Examination: Answer one question from each unit. Choice is to be given in **Unit 3** and **Unit 4**.

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DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
VII SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	PRODUCTIONS AND OPERATIONS MANAGEMENT	Subject Code	11IE7DEPOM
Credits	04	L-T-P	4-0-0

UNIT – I

OPERATIONS MANAGEMENT CONCEPTS: Introduction, Historical development, Thetrend: Information and Non-manufacturing systems, Operations management, Factors affecting productivity, International dimensions of productivity, The environment of operations,Production systems decisions- a look ahead. **06Hours**

OPERATIONS DECISION MAKING: Introduction, Management as a science, Characteristicsof decisions, Framework for decision making, Decision methodology, Decision support systems,Economic models, Statistical models. **04 Hours**

SYSTEM DESIGN AND CAPACITY: Introduction, Manufacturing and service systems, Design and systems capacity, Capacity planning.
04Hours

UNIT – II
FORECASTING DEMAND: Forecasting objectives and uses, Forecasting variables, Opinion and Judgmental methods, Time series methods, Exponential smoothing, Regression and Correlation methods, Application and control of forecasts. **08Hours**
AGGREGATE PLANNING AND MASTER SCHEDULING: Introduction- planning and

scheduling, Objectives of aggregate planning, Aggregate planning methods, Master scheduling objectives, Master scheduling methods. **06 Hours**

UNIT – III
MATERIAL AND CAPACITY REQUIREMENTS PLANNING: Overview: MRP and

CRP, MRP: Underlying concepts, System parameters, MRP logic, System refinements, Capacity management, CRP activities. **06Hours**

SCHEDULING AND CONTROLLING PRODUCTION ACTIVITIES: Introduction, PAC, Objectives and Data requirements, Scheduling strategy and guide lines **06 Hours**

UNIT – IV

SINGLE MACHINE SCHEDULING: Concept, measures of performance, SPT rule,Weighted SPT rule, EDD rule, Minimizing the number of tardy jobs.

FLOW –SHOP SCHEDULING: Introduction, Johnson's rule for 'n' jobs on 2 and 3 Machines, CDS heuristic.

JOB-SHOP SHEDULING: Types of schedules, Heuristic procedure, scheduling 2 jobs on 'm'Machines. **06Hours**

UNIT – V

LEAN SYSTEMS: Characteristics of Just-in-Time operations, Pull method of materials flow, Consistently high quality, small lot sizes, Uniform workstation loads, Standardized components and work methods, close supplier Ties, Flexible workforce, Line flows, Automated production,Prevention maintenance, continuous improvement **06Hours**

TEXT BOOKS:

1. Monks, J.G., Operations Management, McGraw-Hill International Editions, 1987.

2. Pannerselvam. R., Production and Operations Management, PHI.

3. Productions & operations management by Adam & Ebert.

REFERENCE BOOKS:

1. Buffa, Modern Production/Operations Management, Wiely Eastern Ltd.

2. Chary, S.N., Production and Operations Management, Tata-McGraw Hill.

3. Operations management by James Dilworth.

4. Lee J Karjewski and Larry P Ritzman, Operations Management – strategy and Analysis, 6th

Scheme of Examination:

Each question from each unit and internal choice from unit III & IV.

BMS College of Engineering, Bangalore – 560 019.
Department of Industrial Engineering and Management

Subject	Industrial Pollution Control	Sub-Code	11IE7DEIPC
Credits	04	L-T-P	4 – 0 – 0

Part One: Pollution and its measurements

Unit I

Introduction : Man and Environment, types of pollution, pollution control aspects **04 Hrs**.

Industrial pollution emissions and Indian standards – industrial emissions – liquids, gases and solids – legislations, water quality management in India, Air (prevention and control of pollution) Act, 1981. **06 Hrs**.

Analysis of Pollutants – Introduction, industrial waste water analysis – industrial gaseous effluents, and analysis - particle size distribution. **04 Hrs**

Part Two: **Pollution control for specific pollutants**

Unit II

Treatment Liquid effluents - Removal of BOD , Chromium, Mercury, Ammonia/urea, Phenolic effluents – sources, measurements, removal systems.

06 Hrs.

Unit III

Treatment of particulate matter – particle dynamics, stopping distance. Separation of particulate matter from effluent gases, methods of separation – cyclone separators, aerodynamic separation, fabric filters, liquid scrubbers, electrostatic precipitators.

08 Hrs.

Treatment of Gaseous effluents – Removal of - Sulphur Dioxide, Oxides of Nitrogen, organic vapour from effluent gases - Analysis, Harmful effects, ISI standards, Control Measures. **06 Hrs**

Part Three : PC is selected process in industries

Unit IV

General considerations of Pollution Control in Chemical industries, Fertilizer Industries, Petrochemical Refineries, Pulp and Paper Industries, Process Industries(Tanning, Alcohol, Sugar, Electroplating and Metal Finishing), Treating – E-wastes, Radioactive wastes.

06 Hrs.

Unit V

Case studies and details of Industrial disasters and their impact on Human Habitation – Bhopal gas tragedy, nuclear disasters - Chernobyl, US, Fukushima Daichi, Heavy Metal Contamination. **06 Hrs**.

Introduction to Pollution Prevention – Definition, Drivers of Pollution Prevention, Path to Pollution Prevention, Program Elements, Incentives for Pollution Prevention, Structured Pollution Prevention Program – Case Studies.

06 Hrs.

Text Books :

1. Pollution Control in Process Industries, S.P.Mahajan, IIT, Bombay, Tata-McGraw Hill Publishing Co., New Delhi, 1985.
2. Pollution Prevention – Methodology, Technologies & Practice, Kenneth L.Mulholland, James A.Dyer, American Institute of Chemical Engineers, New York, 1999.

Reference Books :

3. Industrial Pollution and Management, Arvind Kumar, APH Publishing Corp., New Delhi, 2004.
4. Environmental Planning – Machinery and Management, V.S.Mahajan, Deep & Deep Publishing, 1991
5. Industrial Air Pollution Engineering, Edited by Vincent Cavaseno & Staff of Chemical Engg., McGraw Hill Publishing Co., New York, 1980.

Scheme of examination : Five questions to be set with one question from each unit carrying 20 marks each. Unit 3 and Unit 5 will have an internal choice.

BMS College of Engineering, Bangalore – 560 019.
Department of Industrial Engineering and Management

Subject	Marketing Management	Sub-Code	11IE7DEMM
Credits	04	L-T-P	4 – 0 – 0

UNIT I

1. Market, Marketing and Marketing Management: Introduction: Historical development marketing management, tasks and philosophies, modern marketing concepts, importance of marketing in the India Socio – economic system.
03Hrs

2. Marketing System: Company marketing system – levels in marketing environment of a company, marketing process, marketing mix, marketing strategy. **02 hrs**

3. Consumer Markets and Buying Behavior: Classification of consumer products, participants in the consumer buying decision, factors influencing consumer buying behavior, characteristics influencing consumer behaviour, major stages in buying process.
05Hrs

UNIT II

4. Marketing Information Systems and Research: Components of marketing information system – benefits and uses marketing research system, marketing research procedure, measurement of market demand. **03 hrs**

5. 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 behaviour, characteristics of industrial market demand. Determinants of industrial market demand Buying power of Industrial users, buying motives of Industrials users, the industrial buying process, buying patterns of industrial users.
08Hrs

UNIT III

6. Products Planning and Development: The concept of a product, features of a product, classification of products, product policies – product planning and development, product line, product mix – factors influencing change in product mix, product mix strategies, meaning of "New – product; major stages in new – product development product life cycle.
07Hrs

7. Branding, Labeling and Packaging: Branding Reasons for branding, functions of branding features of types of brands, kinds of brand name.
Labeling: Types, functions advantages and disadvantages
Packaging: Meaning, growth of packaging, function of packaging, kinds of packaging.
05Hrs

UNIT IV

8. Pricing: Importance of Price, pricing objectives, factors affecting pricing decisions, procedure for price determination, kinds of pricing, pricing strategies and decisions.
05Hrs

9. Distribution: Marketing channels – functions, types of channels of distribution number of channel levels.
Physical distribution – importance, total systems concept, strategy, use of physical distribution
04Hrs

UNIT V

10. 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.
05Hrs

11. Personal Selling: Objectives of personal selling, establishing the Sales force objectives, sales – force strategy, sales force structure and size salesmanship, qualities of good salesman, types of salesman, major steps in effective selling.
05Hrs

Text Books:

1. Philip Koteler "Principles of Marketing", Prentice – Hall.
2. Philip Koteler "Marketing Management", Prentice – Hall.

Reference Books:

1. Wiliam J Stannon, "Fundamentals of Marketing", McGraw Hill
2. R.S.N. Pillia and Mrs. Bagavathi "Marketing" S. Chand & Co. Ltd
3. S.A Sherlaker, "Marketing Management"

Scheme of Examination :

Five questions to be set with one question from each unit carrying 20 marks each. 1 and 3 units will have an internal choice.

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
VII SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	AUTOMATION IN MANUFACTURE	Sub. Code	11IE7DE AIM
Credits	04	L-T-P	4-0-0

UNIT - 1

Introduction: Introduction to automation, **d**efinition, types of automation, reasons for automating, arguments for and against automation. **6 Hrs**

Productivity concepts and mathematical models :

Introduction, manufacturing lead-time, components of operating time, production rate, plant capacity, utilization and availability, work-in-process, automation strategies. (problems)

6 Hrs

UNIT - 2

High volume production system:

Introduction, analysis of automated flow lines, assembly lines and line balancing of assembly systems. (problems on line balancing only).

12Hrs

UNIT - 3

Computerised manufacturing planning systems:

Introduction, computer aided process planning, retrieval and generative type of process planning, benefits of computer aided process planning.

4 Hrs

Automated material handling and storage system:

Introduction, types of material handling systems, automated conveyor system, automated guided vehicle system. **4 Hrs**

UNIT – 4

Computer networks for manufacturing:

Introduction, hierarchy of computers in manufacturing, local area networks, manufacturing automation control. **6 Hrs**

Automated Inspection and testing:

Introduction, inspection and testing, automated inspection principles and methods, off-line and on line inspection, contact and non-contact inspection techniques, coordinate measuring machines, machine vision.

8 Hrs

UNIT - 5

The future automated factory:

Introduction, trends in manufacturing, the future automated factory, the social impact of automated systems. **6 Hrs**

Text books:

1. **Automation, Production Systems and Computer Integrated Manufacturing** - Mikell P. Groover, PHI, New Delhi – 2003.
2. **Computer control of manufacturing systems. - Yorem coren**

Reference books:

1. **CAD/CAM**, Mikell P. Groover and Emory W.Zimmers, PHI, New Delhi - 1994.
2. **Numerical Control and Computer aided Manufacture**, Pressman and Williams PHI – 1991
3. **An Introduction to Automated Process Planning System** - Tiess Chieu Chang and Richard A Wysk PHI – 2002

Scheme of examination:

Answer five full questions choosing one from each unit.
To set one question each from units 2, 3 & 5, and two questions each from units 1 & 4.

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
VII SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	DATA BASE MANAGEMENT SYSTEM	Sub Code	11IE7IEDBM
Credits	04	L-T-P	4-0-0

UNIT - 1

DATABASES AND DATABASE USERS: Introduction, characteristics of data base approach, intended use of a DBMS, advantages and implication of database approach.

DATABASE SYSTEMS CONCEPTS AND ARCHITECTURE: Data models, Schemas and instances' DBMS architecture and data independence, database languages and interfaces, database system environment, classification of data base management Systems **6Hours**

DATA MODELING: High level conceptual data models for database design. Entity types, entity. Sets, attributes, and keys. Relationships, relationship types, roles, and Structural constraints. Weak entity types. ER Diagrams **6 Hours**

UNIT - 2

RECORD STORAGE AND PRIMARY FILE ORGANIZATIONS: Secondary storage devices, buffering of blocks, placing fi1l records on disk, operations on files, heap files an sorted files, hashing techniques. **4 Hours**

UNIT – 4

INDEX STRUCTURE OF FILES:

Single-level and multilevel ordered indexes, dynamic multi level indexes using B-trees and B+trees. **2 Hours**

UNIT - 3

RELATIONAL DATA MODE ANQ RELATIONAL ALGEBRA: Brief' discussion on Codd rules, relational model concepts, constraints, and schemas. Update operation on relations, basic and additional relational algebra operations, and queries in relational algebra.

Structured Query Language (SQL): Data definition etc. in SQL2. Basic and complex queries in SQL. Insert, delete, update statements, and views in SQL, embedded SQL. **10 Hours**

UNIT - 4

DATABASE DESIGN: Design guidelines for relational schemes, functional Dependencies, normalization -1st, 2nd, 3'd, 4 , and 5th normal forms. Database design process, factors influencing physic I database design guidelines, and guidelines for relational systems. **6Hours**

UNIT - 5

SYSTEM IMPLEMENTATION: System catalog for RDBMSs, transaction processing and system concepts, properties of transactions, brief discussion on concurrency, control and recovery techniques, database security and authorization. I **4 Hours**

BRIEF DISCUSSION ON: Distributed databases, objected oriented databases, next generation databases, and interfacing with other technologies. **2 Hours**

- Question Paper: One Question to be set from each unit and Two Questions will be set from the unit 1 & 3.Student will answer any 5 questions selecting at least one from each unit.

TEXTBOOKS: I

1. Fundamentals of database systems"-Ramez Elmasri and Shamkanth B. Navathe, , 6th Edi ion, Addison Wesley Publishing Company.

2. "Database Management System", -Raghu Ramakrishnan and

Johanne's Gehrke, 3'd Edition, TATA McGraw Hill, and ISBN 0-071231511 I

REFERENCE BOOKS:

1. Modern Data base management: Mc Lfadden, hoffer, Prescott

2. Database Management Design Gary W. Hansen and James V. Hanesn, "and" 2n Edition, PHI Pv . Ltd

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
VII SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	Total Quality Management	Subject Code	11IE7IETQM
Credits	04	L-T-P	4-0-0

Unit – 1

OVERVIEW OF TOTAL QUALITY MANAGEMENT: History of TQM. Axioms of TQM, contributions of Quality Gurus – Deming's approach, Juran's quality trilogy, Crosby and quality treatment, Imai's Kaizen, Ishikawa's companywide quality control, and Fegenbaum's theory of TQC. **6 Hours**

Unit – 2

EVOLUTION OF QUALITY CONCEPTS AND METHODS: Quality concepts. Development of four fitnesses, evolution of methodology, evolution of company integration, quality of conformance versus quality of design from deviations to weaknesses to opportunities. Future fitness's, four revolutions in management thinking, and four levels of practice. 8 **Hours**

FOUR REVOLUTIONS IN MANAGEMENT THINKING: Customer focus, Continuous Improvement, Total participation and Societal Networking. FOCUS ON CUSTOMERS: Change in work concept marketing and customers. **4 Hours**

CONTINUOUS IMPROVEMENT: Improvement as problem solving process; Management by process, WV model of continuous improvement, process control, process control and process improvement, process versus creativity. Reactive Improvement; Identifying the problem, standard steps and tools, seven steps case study, seven QC tools. **6 Hours**

Unit – 3

PROACTIVE IMPROVEMENT: Management diagnosis of seven steps of reactive improvement. General guidelines for management diagnosis of a QI story, discussion on case study for diagnosis of the seven steps. Proactive Improvement; Introduction to proactive improvement, standard steps for proactive improvement, semantics, example-customer visitation, Applying proactive improvement to develop new products- three stages and nine steps. **8 Hours**

Unit - 4

TOTAL PARTICIPATION: Teamwork skill. Dual function of work, teams and teamwork, principles for activating teamwork, creativity in team processes, Initiation strategies, CEO involvement Example strategies for TQM introduction. Infrastructure for mobilization. Goal setting (Vision/ Mission), organization setting, training and E education, promotional activities, diffusion of success stories, awards and incentives monitoring and diagnosis, phase-in, orientation phase, alignment phase, evolution of the parallel organization. **10Hours**

Unit – 5

SOCIETAL NETWORKING: Networking and societal diffusion – regional and nationwide networking, infrastructure for networking openness with real cases, change agents, Center for quality Management case study, dynamics of a societal learning system. TQM as learning system, keeping pace with the need for skill, a TQM model for skill development, summary of skill development. **10 Hours**

TEXT BOOKS:

1. **A New American TQM Four Practical Revolutions in Management** - Shoji Shiba, Alan Graham and David Walden, Productivity Press, Portland (USA) , 1993
2. **Management for Total Quality** -N Logothetis - Prentice Hall of India, New Delhi, 1994.

Scheme for examination: Five questions choosing one each from each unit and Unit 2 and 3 with choice questions

B.M.S.COLLEGE OF ENGINEERING, BANGALORE – 560 019.
Autonomous College under VTU 2008-09
INDUSTRIAL ENGINEERING & MANAGEMENT

Semester: 08

Subject Code	Title	TEACHING HOURS			Credits	Contact Hours/Week	Marks		Total Marks
		L	T	P			CIE	SEE	
	ELECTIVE – V	4	0	0	4	4	50	50	100
	INSTITUTION ELECTIVE – II	4	0	0	4	4	50	50	100
11IE8DCPW2	PROJECT WORK-II				13	13	200	200	400
11IE8DCSEM	SEMINAR				2	2	50		50
11IE8DCPT	PROJECT WORK TOUR			2	2		50		50
TOTAL					**25**	**23**	**400**	**300**	**700**

ELECTIVE – V

11IE8DEJIT	JUST IN TIME MANUFACTURING
11IE8DEMIS	MANAGEMENT INFORMATION SYSTEM
11IE8DEAI	ARTIFICIAL INTELLIGENCE & EXPERT SYSTEM
11IEDEIEX	INDUSTRIAL EXPERIMENTATION

INSTITUTION ELECTIVE - II

11IE8IEERP	ENTERPRISE RESOURCE PLANNING
11IE8IEHRM	HUMAN RESOURCE MANAGEMENT

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19

DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT

VIII SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	JUST IN TIME MANUFACTURING	Sub Code	11IE8DEJIT
Credits	04	L-T-P	4-0-0

UNIT 1

JIT - INTRODUCTION: Speed of JIT movement, the new production system research association of Japan, some definitions of JIT, core Japanese practices of JIT, creating continuous manufacture, enabling JIT to occur, basic element of JIT, benefits of JIT. **5 Hours**

UNIT - 2

MODERN PRODUCTION SYSTEM: Key feature of Toyota's production system, basic framework of Toyota production system. KANBAN SYSTEM – other types of kanban's, kanban rules, adapting to fluctuations in demand through kanban, whirligig, determining the number of kanban's in Toyota production system, detailed kanban system example, supplier kanban and the sequence schedule for use by suppliers. **6Hours**

PRODUCTION SMOOTHING IN TOYOTA PRODUCTION SYSTEM: production planning, production smoothing, adaptability to demand fluctuations, sequencing method for the mixed model assembly line to realize smoothed production, Criticism of Toyota production system by the communist party of Japan. EDP system for support of the Toyota Production system. Shortening lead time in Toyota Production system – reducing the setup time. Automation in Toyota production system, some comparisons with other manufacturers. **4 Hours**

UNIT - 3

GLOBAL IMPLEMENTATION OF JIT: JIT in automotive industry, JIT in electronics, computer, telecommunication and instrumentation, JIT in process type industry, JIT in seasonal demand industry, other manufacturing industries, JIT in service and administrative operations, conclusion.

JIT IMPLIMENTATION SURVEYS: JIT implementation in US manufacturing firms-analysis of survey results, just in time manufacturing industries, just in time production in West Germany, just in time production in Hong Kong electronics industry, conclusion. **8 Hours**

UNIT - 4

DESIGN, DEVELOPMENT AND MANAGEMENT OF JIT MANUFACTURING SYSTEMS: plant configurations and flow analysis for JIT manufacturing, comparison of JIT's "demand pull" system with conventional "push type" planning and control systems, quality management system for JIT, product design for JIT human resource management in JIT, flexible workforce system at Toyota, creation and maintenance of teams for JIT, union organization and conduct of industrial relations in JIT, interface of JIT with advanced manufacturing technology, assessing performance in JIT manufacturing systems, product costing information systems in JIT manufacturing, an example of overhead allocation in JIT, potential for developing countries, potential for small manufacturing **7 Hours**

FRAMEWORK FOR IMPLEMENTATION OF JIT: Implementation risk, risks Due to inappropriate understanding of JIT, risks due to technical, operational and people problems, risks associated with kanban system, some important activities to be performed during implementation, steps in implementation, a project work to approach to implementation, conclusion. **4 Hours**

UNIT - 5

SUPPLY MANAGEMENT FOR JIT: JIT purchasing-the Japanese way, some studies in JIT purchasing, experience of implementation organizations, surveys

of JIT purchasing, buyer-seller relationship in JIT purchasing, Quality certification of suppliers in JIT purchasing, some problems in implementation of JIT purchasing, reduction freight costs in JIT purchasing, monitoring supplier performance for JIT purchasing, audit in JIT purchasing, implementation of JIT to international sourcing, frequency of shipments, inventory policy, supplier reaction capability, quality, communication sole sourcing, delivery performance and supplier flexibility, conclusion**.** **6 Hours**

- Question Paper: One Question to be set from each unit and Two Questions will be set from the unit 2 & 4.Student will answer any 5 questions selecting at least one from each unit.

TEXT BOOKS:

1. Just In Time Manufacturing - M.G. Korgaonker,", Macmillan India Ltd.- 1992,

2.Japanese Manufacturing Techniques - Richard J. Schonberger," The Free Press – Macmillan Pub.

Co., Inc. New York - 1988.

B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT
VIII SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	Management Information System	Sub. Code	11IE8DEMIS
Credits	04	L-T-P	4-0-0

UNIT - 1

FUNDAMENTALS OF INFORMATION SYSTEMS: Information systems in business, fundamentals of information systems solving business problems with information systems. **6 Hours**

UNIT - 2

INFORMATION SYSTEMS FOR BUSINESS OPERATIONS: Business information systems, Transaction processing systems, management information systems and decision support systems.Artificial intelligence technologies in business, information system for strategic applications and issues in information technology.

8 Hours

SSUES IN MANAGING INFORMATION TECHNOLOGY: Managing information resources and technologies global information technology, management, planning and implementing change, integrating business change with IT, security and ethical challenges in managing IT, social challenges of information technology. **8 Hours**

UNIT - 3

INTRODUCTION TO E-BUSINESS: E-commerce frame work, Media convergence, Consumer applications, Organization applications. **6 Hours**

E-BUSINESS MODEL: Architectural frame work for E-commerce, Application services and transaction Models – B2C Transactions, B2B Transactions, Intra-Organizational Transactions. **6 Hours**

E-BUSINESS MODEL: WWW Architecture: Client server structure of the web, e-Commerce architecture, Technology behind the web. **6 Hours**

UNIT - 4

CONSUMER-ORIENTED E-COMMERCE: Consumer oriented Application: Finance and Home Banking, Home shopping, Home Entertainment, Mercantile Process Models, Consumers perspective, Merchants perspective.

6 Hours

UNIT - 5

ELECTRONICS DATA INTERCHANGE (EDI): EDI Concepts,Applications in business – components of international trade, Customs Financial EDI, Electronic fund transfer, Manufacturing using EDI, Digital Signatures and EDI.

6 Hours

TEXT BOOKS:

1. **Management Information systems**- managing information technology in the internet worked enterprise- jams. A O'Brien – Tata McGraw Hill publishing company limited, 2002.
2.Frontiers of E-Commerce – Ravi Kalakota and Andrew B. Whinston Pearson Education

REFERENCE BOOKS:

1. **Management Information systems**- S. Sadogopan.PHI 1998Edn.ISBN 81-203-1180-9
2. **Information systems for modern management** - G.R. Murdick PHI, 2nd Edition.

Note : Choice from unit 2 & unit 3 , and one question each from the remaining units 1 , 4 and 5.

BMS College of Engineering, Bangalore – 560 019.
Department of Industrial Engineering and Management
VIII SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	Artificial Intelligence & Expert Systems	Sub-Code	11IE8DEAI
Credits	04	L-T-P	4 – 0 – 0

Unit I

Artificial intelligence : Introduction, definition, underlying, assumptions, importance of AI, AI and related fields. State space representations, defining a problem, production systems and its characteristics, search and control strategies – introduction preliminary concepts, examples of search problems. **06 hrs**.

Uniformed or preliminary concepts : Examples of search problems. Uniformed or blind search, informed search, OR graphs, heuristic search techniques – generate and test, hill climbing, best first search, problem reduction, constraint satisfaction, means ends analysis. **08 hrs**.

Unit II

Knowledge representation issues : Representations and mapping, approaches, issues in KR, types of knowledge – procedural Vs declarative, logic programming, forward Vs backward reasoning, matching, non-monotonic reasoning, and its logic. **06 hrs**.

Use of Predicate logic : Representing simple facts, Instance and Is a relationships, syntax and semantics for propositional logic, FOPL and properties of wffs, conversion to causal form, resolution, natural deduction. **06 hrs**.

Unit III

Statistical and Probabilistic reasoning : Symbolic reasoning under uncertainty, probability and Baye's theorem, certainty factors and rule based systems, Bayesian networks, Demster – Shafer theory, fuzzy logic. **08 hrs**.

Unit IV

Expert systems : Introduction, structure and uses, representing and using domain knowledge, expert system shells, pattern recognition, introduction to recognition and classification process, learning classification patterns, recognizing and understanding speech. **06 hrs**.

Unit V

Introduction to knowledge acquisition : Types of learning, general learning model and performance measures..

Typical expert systems : MYCIN variants of MYCIN, PROSPECTOR, DENDRAL, PUFF. **08 Hrs**

Introduction to machine learning : Perceptrons, checker playing examples, learning automata, genetic algorithm, intelligent editors. **04 hrs**.

Text Books :

1. Artificial Intelligence and Expert systems – Elaine Rich and Kevin Knight, M/H, 1983.
2. Introduction to Artificial Intelligence and Expert systems – Dan W. Patterson, PHI, New Delhi, 1999.
3. Artificial Intelligence in business, science and industry – Wendry B, Ranch, Vl. II application, PHI, 1985.

Reference Books :

1. A guide to expert systems – Waterman, D.A, Addison-Wesley Inc., 1986.
2. Building expert systems – Hayes, Roth, Waterman, D.A (ed), AW, 1983.
3. Designing expert systems – Weis, S.M. and Kulliknowske, London, Champion Hull, 1984.

Scheme of Examination :

Five questions to be set with one question from each unit carrying 20 marks each. 1 and 2 units will have an internal choice.

BMS College of Engineering, Bangalore – 560 019.
Department of Industrial Engineering and Management
VIII SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	Industrial Experimentation	Subject Code	11IE8DEIEX
Credits	04	L-T-P	4-0-0

UNIT – 1

INTRODUCTION: History of quality engineering: Japan versus U.S. track records. Taguchi Approach to Quality: Definition of quality, Loss function, Off-line and On-line quality control, Taguchi's quality philosophy. **6 Hours**

BASIC DESIGNS: Completely Randomised Design, Randomised Block Design, Latin Square Designs, one way analysis of variance and two way analysis of variance. **8Hours**

UNIT – 2

FACTORIAL EXPERIMENTATION - TWO LEVELS: Full Factorial Designs: Experimentation as a learning process. Traditional scientific experiments, Two-factor design,Four-factor design, replicating experiments, Factor interactions. Fractional factorial designs based on eight-run experiments. **10Hours**

UNIT – 3

CONSTRUCTING ORTHOGONAL ARRAYS: Counting degrees of freedom, selecting a standard orthogonal array, dummy level technique and compound factor method, Linear graphs and interaction assignment, Modification of linear graphs, column merging method, branching design, Strategy for constructing an orthogonal array, Comparison with the classical statistical experiment design. **8 Hours**

UNIT – 4

STEPS IN ROBUST DESIGN: Case study discussion, Noise factors and testing conditions, Quality characteristics and objective functions, Control factors and their levels, Matrix experiment and data analysis plan, Conducting the matrix experiment, data analysis, verification experiment and future plan. **6 Hours**

SIGNAL-TO-NOISE RATIO FOR STATIC PROBLEMS: Evaluation of sensitivity to noise, S/N ratios for Smaller-the-better, Larger-the-better, Nominal-the-best and Asymmetric Cases. **4 Hours**

Unit - 5

SIGNAL-TO-NOISE RATIO FOR DYNAMIC PROBLEMS: S/N ratios for Continuous-continuous, continuous-digital, digital-continuous, digital- digital cases. Introduction to Taguchi Inner and Outer Arrays. **4 Hours**

SHAININ TECHNIQUE: Introduction, salient features, case studies in sequential DOE tools to solve chronic problems. **6 Hours**

TEXTBOOKS:

1. **Quality Engineering Using Robust Design -** Madhav S. Phadke, Prentice Hall PTR, Englewood Cliffs, New Jersey 07632.
2. **Design of Experiments -** D.C. Montgomery, John Wiley and Sons, 2002.
3. **World Class Quality** – using DOE to make it happen, Keki R. Bhote, American Management Association publications, 2nd Ed. 2000

REFERENCE BOOK:

1. **Designing for Quality** - Robert H. Lochner and Joseph E. Matar, - an Introduction Best of Taguchi and Western Methods or Statistical Experimental Design", Chapman and Hall Madras, 2nd edition.

Scheme for examination: Five questions choosing one each from each unit and Unit 1 and 2 with choice questions

BMS College of Engineering, Bangalore – 560 019.
Department of Industrial Engineering and Management
VIII SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	ENTERPRISE RESOURCE PLANNING	Sub Code	11IE8IEERP
Credits	04	L-T-P	4-0-0

UNIT - 1

INTRODUCTION TO ERP: Introduction, Evolution of ERP, What is ERP?, Reasons for the growth of the ERP market, The advantages of ERP, Why do Man ERP Implementations Fail? Why are ERP packages Being used Now?

ENTERPRISE – AN OVERVIEW: Introduction, Integrated Management Information, Business modeling, Integrated Data Model.

6 Hours

UNIT - 2

ERP AND RELATED TECHNOLOGIES: Introduction, Business Process Reengineering, Management Information System, Decision Support System, Executive Information Systems, Data Warehousing, Data Mining, On-line Analytical Processing, Supply Chain Management.

6 Hours

ERP- MANUFACTURING PERSPECTIVE: Introduction, ERP. CAD/CAM, Materials Requirements Planning, Bill of Material, Closed Loop MRP. Manufacturing Resource Planning, Distribution Requirements Planning. **6 Hours**

UNIT - 3

KANBAN: JIT and Kanban, Product Data Management, Benefits of PDM, Make-to-order, and Make-to Stock, Assemble to order, Engineer to order, Configure-to order.

ERP MODULES: Introduction, Finance, Plant Maintenance, Quality Management, Materials Management. **6 Hours**

UNIT - 4

BENEFITS OF ERP: Introduction, Reduction of Lead time, On-time shipment, Reduction in Cycle Time, Improved Resource Utilisation, Better Customer Satisfaction, Improved Suppler Performance, Increased Flexibility, Reduced Quality Costs, Improved Information Accuracy and Decision – making capability. **6 Hours**

UNIT - 5

ERP Implementation Life Cycle: Pre-evaluations Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Reengineering, Configuration, Implementation of Team Training, Testing, Going Live, End user Training, Post implementation

VENDOR, CONSULTANTS AND USERS: Introduction, In-house implementation – Pros and Cons, Vendors, Consultants, End-users.

FUTURE DIRECTION IN ERP: Introductions, New Markets, New Channels, Faster Implementation Methodologies, Business models and BAPIs, Convergence on Windows NT, Application Platforms, New business segments, web enabling, market snapshot

ERP- Case studies **10 Hours**

- Question Paper: One Question to be set from each unit and Two Questions will be set from the unit 2 & 5. Student will answer any 5 questions selecting at least one from each unit.

TEXT BOOKS:

1. **Enterprise Resource Planning -**Alexis Leon, , 1999, Tata Mc Graw Hill Publishing Company Ltd.,
2. **Enterprise Resource Planning Concept and Practice -**Vinod Kumar Garg and Venkitakrishnan, 2nd Edition, Prentice-Hall India.

1. Personnel / Human resource Management – Decenoz and robbins PHI, 2002
2. Management of Human Resources – CB Mamoria – Himalaya Publication House, 2003
3. Industrial Acts by Jain, 2004

SCHEME OF EXAMINATION: Five Questions to be set with one question from each unit carrying 20 marks each. Any three units will have an internal choice.

VIII SEMESTER: MECHANICAL ENGINEERING CLUSTER

Subject	HUMAN RESOURCE MANAGEMENT	Subject Code	11IE8IEHRM
Credits	04	L-T-P	4-0-0

UNIT - 1

INTRODUCTION: Evolution of HRM, Objectives, Functions and Policies. **6 Hours**

HUMAN RESOURCE PLANNING: Uses and benefits, Man Power Inventory, Man Power Forecasting, Methods of Man Power Forecasting, job Description, Job Specification. **7 Hours**

UNIT - 2

RECRUITMENT: Sources of Man power, Advertisement, Short Listing of Candidates calling Candidates for selection Process. **6 Hours**

SELECTION: Selection procedure – Written Test, Group Discussion. Interview – Different methods, advantages and Limitations, Psychological testing – Advantages and limitations, Induction procedure, transfers, promotion exit interview, (Tutorial on written test, Group Discussion, Interviews). **7 Hours**

UNIT - 3

TRAINING AND DEVELOPMENT: Identification of Training needs, Training Evaluation, Training Budget, Executive Development – Different Approaches, Non-executive development – Different methods. **7 Hours**

PERFORMANCE APPRAISAL: Components (all round performance appraisal), Methods. Advantages and limitations of different methods, Personal Counseling based on Annual Confidential Reports. **7 Hours**

UNIT - 4

COUNSELLING AND HUMAN RESOURCE ACCOUNTING: Characteristics, Need, Function, Types, Suggestions for personnel development, communication function, communication process, effective communication. Human resource records, Advantages of HR accounting, Various methods of accounting. **6 Hours**

UNIT - 5

INDUSTRIAL RELATIONS: Indian trade union act, standing orders act, Indian factories act,

INDUSTRIAL DISPUTES AND SETTLEMENT: Indian Industrial Disputes act, Industrial disputes settlement machinery. Works committee, Board of Conciliation, Voluntary Arbitration, Compulsory arbitration, Court of inquiry, Industrial tribunal, Adjudication.

6 Hours

TEXT BOOKS:

1. Human Resources Management – Dr. K Ashwathappa, Tata McGraw Hill, Edition 1999
2. Management of Organisations Behaviour – Hersey and Blanchard – Prentice Hall of India Edn – 1998
3. Industrial Relations – Arun Monappa – TMH, ISBN – 0-07-451710-8

REFERENCES BOOKS:

4. Personnel / Human resource Management – Decenoz and robbins PHI, 2002
5. Management of Human Resources – CB Mamoria – Himalaya Publication House, 2003
6. Industrial Acts by Jain, 2004

SCHEME OF EXAMINATION: Five Questions to be set with one question from each unit carrying 20 marks each. A