Jagannath University, Jaipur

Mechanical Engineering

Newly Introduced Subjects 2016-20

BTME301: ADVANCE ENGINEERING MATHEMATICS-I

Credit 3 **Max. Marks: 100(IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3Hours**

UNIT 1 Numerical Methods – 1

Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Gauss's forward and backward interpolation formulae. Stirling's Formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae. Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.

UNIT 2 Numerical Methods – 2:

Numerical solution of ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge- Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Solution of polynomial and transcendental equations-Bisection method, Newton-Raphson method and Regula-Falsi method.

UNIT 3 Laplace Transform:

Definition and existence of Laplace transform, Properties of Laplace Transform and formulae, Unit Step function, Dirac Delta function, Heaviside function, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace transforms method.

UNIT 4 Fourier Transform:

Fourier Complex, Sine and Cosine transform, properties and formulae, inverse Fourier transforms, Convolution theorem, application of Fourier transforms to partial ordinary differential equation (One dimensional heat and wave equations only).

UNIT 5 Z-Transform:

Definition, properties and formulae, Convolution theorem, inverse Z transform, application of Z-transform to difference equation.

Recommended reference books:

1. "Advanced Engineering Mathematics" by H. K. Dass, S.Chand and Sons.
2 "Higher Engineering Mathematics" by B.S.Grewal, Khanna Publisher.

Certified True Copy
Registrar
Jagan Nath University, Jaipur

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

BTME 308 : BASIC MECHANICAL ENGINEERING LAB

Credit 1 **Max. Marks: 50(IA: 30, ETE: 20)**

0L+0T+2P **End Term Exam: 2Hours**

1 Exposure to a wide range of applications of mechanical engineering through a variety of activities, including hands-on assembly and disassembly of machines, such as, bicycle, sewing machine, pumps, engines, air-conditioners, machine-tools, amongst others; observational study of complex systems via cut sections, visits, videos and computer simulations; design of simple machines/systems including specifications formulation; visits to industries.

2 Note: Student will be required to submit written report indicating the learning achieved by Hands on assembly/Disassembly.

BTME403 : Machining & Machine Tools

Credit 4 **Max. Marks: 100(IA: 30, ETE: 70)**

3L+1T+0P **End Term Exam: 3Hours**

UNIT I

Classification of metal removal process and machines: Concept of generatrix and directrix Geometry of single point cutting tool and tool angles, tool nomenclature in ASA, ORS, NRS and interrelationship. Concept of orthogonal and oblique cutting.Mechanism of Chip Formation: Type of chips. Mechanics of metal cutting; interrelationships between cutting force, shear angle, strain and strain rate. Various theories of metal cutting. Thermal aspects of machining and measurement of chip tool interface temperature. Friction in metal cutting. Introduction to tool geometry of milling cutters and drills.

UNIT II

Concept of machinability, machinability index, factors affecting machinability. Different mechanism of tool wear. Types of tool wear (crater, flank etc), Measurement and control of tool wear, Concept of

tool life,Taylor's tool life equation (including modified version). Different tool materials and their applications including effect of tool coating. Introduction to economics of machining.

Cutting fluids: Types, properties, selection and application methods

UNIT III

Basic machine tools: Constructional configuration, specifications and estimation of machining time on lathe, drilling, shaping, milling, grinding and broaching machine. Special Purpose Machine Tools: Automatic lathes, capstan and turret lathe machines, operational planning and turret tool layout, sequence of operations.

UNIT IV

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

Certified True Copy
Registrar
Jagan Nath University, Jaipur

Introduction to Grinding-Need and different methods of grinding, Abrasives; natural and synthetic, manufacturing and selection of grinding wheels, Wheel specifications, mounting and dressing. Surface finishing: Honing, lapping, super-finishing, polishing and buffing. Thread Manufacturing: casting; thread chasing; thread cutting on lathe; thread rolling, die threading and tapping; thread milling and thread grinding.

UNIT V

GearManufacturing Processes: hot rolling; stamping; powder metallurgy; extruding etc. Gear generating processes: gear hobbling, gear shaping. Gear finishing processes: shaving, grinding, lapping, shot blasting, phosphate coating, Gear testing. High Velocity Forming Methods: Definition; Hydraulic forming, Explosive forming, Electro-hydraulic forming, Magnetic pulse forming.

Recommended Reference books:

1. Production Technology by P.C. Sharma
2. Manufacturing Technology by R.K. Rajput

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

Certified True Copy
Registrar
Jagan Nath University, Jaipur

BTME409 Production Practice-II

Credit 1 | **Max. Marks: 50(IA: 30, ETE: 20)**

0L+0T+2P | **End Term Exam: 2Hours**

List of Experiments:

1. To study of single point cutting tool geometry and to grind the tool as per given tool geometry.
2. To study the milling machine, milling cutters, indexing heads indexing methods and to prepare a gear on milling machine.
3. To machine a hexagonal / octagonal nut using indexing head on milling machine.
4. To cut BSW/Metric internal threads on lathe machine.
5.

a) To cut multi-start Square/Metric threads on lathe machine.

b) Boring using a boring bar in a centre lathe.

6. Study of capstan lathe and its tooling and prepare a tool layout & job as per given drawing.
7. Demonstration on milling machine for generation of plane surfaces and use of end milling cutters.
8. Grinding of milling cutters and drills.
9. Exercise on cylindrical and surface grinders to machine surfaces as per drawing.
10. Cylindrical grinding using grinding attachment in a centre lathe

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

Certified True Copy
Registrar
Jagan Nath University, Jaipur

JAGANNATH UNIVERSITY JAIPUR

BTME 411 Thermal Engineering Lab-I

Credit 1 **Max. Marks: 50(IA: 30, ETE: 20)**

0L+0T+2P **End Term Exam: 2Hours**

1. Study of working of four stroke petrol engine and four stroke diesel engine with the help of cut section models.

2. Study of working of two stroke petrol and two stroke diesel engine with the help of cut section models.

3. To draw valve timing diagram for a single cylinder diesel engine.

4. Study of various types of boilers.

5. Study of various types of mountings and accessories.

6. Demonstration of steering system and measurement of steering geometry angles and their impact on vehicle performance.

7. Study of braking system with specific reference to types of braking system, master cylinder, brake shoes.

8 . Study of transmission system including clutches, gear box assembly and differential.

9. Study of fuel supply system of a petrol engine (fuel pump and simple carburetor)

10. Study of fuel supply system of a Diesel engine (fuel pump and fuel injector)

11. Study of Ignition systems of an IC Engine (Battery and Magneto ignition system) and Electronic ignition system.

12. Study of Lubrication system of an IC Engine (mist, splash and pressure lubrication)

13. Study of cooling systems of an IC Engine (air cooling and water cooling)

BTME503: Measurement & Metrology

Credit 4 **Max. Marks: 100(IA: 30, ETE: 70)**

3L+1T+0P **End Term Exam: 3Hours**

UNIT I:

Concept of measurement: General concept of measurement, Need for measurement, Generalized measuring system, Units, Standards, Sensitivity, Readability, Range of accuracy, Precision, Accuracy Vs precision, Uncertainty. Repeatability and reproducibility, Errors in measurement, Types of error, Systematic and random error, Comparison between systematic error and random error, Correction, Calibration, Interchangeability.

UNIT II:

Linear and angular measurements: Linear measuring instruments: Vernier caliper, Micrometer, Interval measurements:- Slip gauges, Checking of slip gauges for surface quality, Optical flat, Limit gauges:- Gauge design, Problems on gauge design, Application of limit gauges; Comparators:- Mechanical comparators, Electrical comparator, Optical comparator, Pneumatic comparator; Sine bar, Use of sine bar, Limitations of sine bars, Sources of error in sine bars, Bevel protractor, Applications of bevel protractor , Autocollimator, Angle Dekkor

UNIT III:

Form measurement: Introduction, Screw thread measurement, Thread gauges, Measurement of gears: Gear errors, Spur gear measurement, Parkinson gear tester, Problems on gear measurement. Surface finish measurement:-Introduction, Elements of surface texture, Analysis of surface finish, Methods of measuring surface finish, Straightness measurement, Flatness testing, Roundness measurements

UNIT IV:

Laser and advances in metrology: Laser metrology, Laser telemetric system, Laser and led based distance measuring instruments, pattern formed in a laser, Principle of laser, Interferometry, Use of laser in interferometry, Laser interferometry. Machine tool metrology: Various geometrical checks on machine tool, Laser equipment for alignment testing, Machine tools tests, Alignment tests on lathe, milling machine, pillar type drilling machine, Acceptance tests for surface grinders, Coordinate measuring machine (CMM):- Types of CMM, Features of CMM, Computer based inspection, Computer aided inspection using robots.

UNIT V:

Measurement of power, flow and temperature related properties Measurement of force, Direct methods, Indirect methods:- Accelerometer, Load cells, Bourdon tube. Torque measurement: Prony brake, Torque measurement using strain gauges, Torque measurement using torsion bars, Measurement of power: Mechanical dynamometers, D.C. dynamometer, Eddy current or

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

inductor dynamometers Measurement of flow: Orifice meter, Venturimeter, Flow nozzle, Variable area meters – rotameter, Hot wire anemometer, Pitot tube. Temperature measurement, Bimetallic strip, Calibration of temperature measuring devices, Thermocouples (Thermo electric effects), Thermistors, Pyrometers

Suggested Text / Reference Books:

1. Kalpakjian, S. and Steven R. Schmid, Manufacturing, Engineering & Technology, Pearson.
2. Rao, P.N., Manufacturing Technology–Metal Cutting and Machine Tools, Tata McGraw Hill, New Delhi, 2000.
3. Hajra Chowdary, S.K., and Hajra Chowdary, A.K., Elements of Workshop Technology, Vol. II, Asia Publishing House, Bombay.
4. I.C. Gupta, Engineering Metrology, Dhanpat Rai & Sons.
5. R. K. Jain, Engineering Metrology, Khanna Publishers.

HEAD

Certified True Copy
Registrar
Jagan Nath University, Jaipur

BTME505: SOCIOLOGY AND ECONOMICS FOR ENGINEERS

Credit 3 **Max. Marks: 100(IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3Hours**

UNIT I:

Introduction to sociological concepts-structure, system, organization, social institutions, Culture social stratification (caste, class, gender, power).State & civil society. Social change in contemporary India: Modernization and globalization, Secularism and communalism, Nature of development,

UNIT II:

Processes of social exclusion and inclusion, Changing nature of work and organization. Political economy of Indian society. Industrial, Urban, Agrarian and Tribal society; Caste, Class, Ethnicity and Gender; Ecology and Environment

UNIT III:

Basic Principles and Methodology of Economics. Demand/Supply – elasticity –. Theory of the Firm and Market Structure. Basic Macroeconomic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes.

UNIT IV:

Public Sector Economics –Welfare, Externalities, Labour Market. Components of Monetary and Financial System, Central Bank – Monetary Aggregates; Commercial Banks & their functions; Capital and Debt Markets.Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve

UNIT V:

Indian economy Brief overview of post independence period – plans. Post reform Growth, Structure of productive activity. Issues of Inclusion– Sectors, States/Regions, Groups of people (M/F), Urbanization. Employment–Informal, Organized, Unorganized, Public, Private. Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors.

Books:

1. Sociology and Economics for Engineers by MP Poonia,Premvir Kapoor)

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

BTME506.A Computer Aided Design and Graphics

Credit 3 **Max. Marks: 100(IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3Hours**

UNIT I:

Overview of Computer Graphics: Picture representation, Coordinate Systems, Raster Scan Display, DDA for line generation and Bresenham's algorithm for line and circle generation; Graphics standards: GKS, IGES, STEP, DXF. Different types of models. Parametric representation of plane curves: line, circle, ellipse,parabola and hyperbola.

UNIT II:

Parametric representation of Space Curves: Cubic spline curve, Bezier Curve and B Spline Curves. Blending of Curves. Parametric representation of Surfaces: Hermite Bicubic surfaces, Bezier surfaces and Bspline surfaces.

UNIT III:

Solid Representation: B-rep. and CSG. Comparison between three types of models.

UNIT IV:

Two and Three Dimensional Transformation of Geometric Models: Translation, Scaling Reflection, Rotation and Shearing, Homogeneous Representation, Combined Transformation. **Projection of Geometric models**: Parallel and Perspective Projection.

UNIT V:

Clipping: Point clipping, Line clipping, Cohen- Sutherland algorithm etc., Viewing transformation.

Hidden line and surface removal: Techniques and Algorithms. Shading and Rendering.

Books:

1. Computer-Aided Graphics and Design by Daniel L Ryan

BTME506.C STATISTICS FOR DECISION MAKING

Credit 3 **Max. Marks: 100(IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3Hours**

UNIT I

Introduction - Statistical Terminology: Descriptive statistics or exploratory data analysis, inferential statistics, population, sample, variable, parameter, statistic, random sample. Collecting Data: Historical data, types of studies (comparative,descriptive or noncomparative, observational, experimental), samplesurveys, sampling and nonsampling errors, bias, representative sample, judgment sampling, quota sampling, simple random samples, sampling rate, sampling frame, stratified random sampling, multistage cluster sampling, probability-proportional-to-size sampling, systematicsampling.

UNIT II

Summarizing and Exploring Data: Variable types (categorical,qualitative, nominal, ordinal, numerical, continuous, discrete, interval, ratio), summarizing categorical data (frequency table, bar chart, Pareto chart, pie chart), summarizing numerical data (mean, median), skewness, outliers, measures of dispersion (quantiles, range, variance,
standard deviation, interquartile range, coefficient of variation) s tandardized z-scores, histogram, bivariate numerical data (scatter plot, simple correlation coefficient, sample covariance), straight line regression, summarizing time-series data, data smoothing, forecasting techniques.

Basic Concepts of Inference: Estimation, hypothesis testing, pointestimation, confidence interval estimation, estimator, estimate, bias and variance of estimator, mean square error, precision and standard error, confidence level and limits, null and alternative hypothesis, type I and II error, probabilities of type I and II error, acceptance sampling, simple and composite hypothesis, P-value, one-sided and two –sided tests.

UNIT III

Inference for Single Samples: Inference for the mean (large samples), confidence intervals for the mean, test for the mean, sample size determination for the z-interval, one-sided and two - sided z-test, inference for the mean (small samples), t distribution. Inference for Two Samples: Independent sample design, matched pair design, pros and cons of each design, side by side box plots, comparing means of two populations, large sample confidence interval for the difference of two means, large sample test of hypothesis for the difference of two means, inference for small samples (confidence intervals and tests of hypothesis).

UNIT IV

Inference for Proportions and Count Data: Large sample confidence interval for proportion, sample size determination for a confidence interval for proportion, Large sample hypothesis test on proportion, comparing two proportions in the independent sample design (confidence interval and test of hypothesis), chi-square statistic

UNIT V

Simple Linear Regression and Correlation: Dependent and independent variables, probability model for simple linear regression, least squares fit, goodness of fit of the LS line, sums of squares, analysis of variance, prediction of future observation, confidence and prediction

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

intervals, Multiple Linear Regression: Probability model for multiple linear regression, least squares fit, sums of squares. Use Excel, R, and MATLAB®_in the class.

Books:

1. Statistical analysis for decision making by Morris Hamburg

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

Certified True Copy
Registrar
Jagan Nath University Jaipur

JAGANNATH UNIVERSITY * JAIPUR *

BTME602: NEWER MACHINING METHODS

Credit 3

Max. Marks: 100(IA: 30, ETE: 70)

3L+0T+0P

End Term Exam: 3Hours

UNIT I

Introduction and classification of advanced machining process, consideration in process selection, difference between traditional and non-traditional process, Hybrid process.

Abrasive finishing processes: AFM, MAF (for Plain and cylindrical surfaces).

UNIT II

Mechanical advanced machining process: Introduction, Mechanics of metal removal, process principle, Advantages, disadvantages and applications of AJM,USM,WJC.

UNIT III

Thermo electric advanced machining process: Introduction, Principle, process parameters,advantages, disadvantages and applications about EDM, EDG, LBM, PAM, EBM

UNIT IV

Electrochemical and chemical advanced machining process: ECM, ECG, ESD, Chemical machining,

Anode shape prediction and tool design for ECM process. Tool (cathode) design for ECM Process.

UNIT V

Intorduction to Micro and nanomachining, Nanoscale Cutting, Diamond Tools in Micromachining, Conventional Processes: Microturning, Microdrilling and Micromilling, Microgrinding, Non-Conventional Processes: Laser Micromachining, Evaluation of Subsurface Damage in Nano and Micromachining, Applications of Nano and Micromachining in Industry.

Recommended Reference books:

1. Production Technology by P.C. Sharma
2. Manufacturing Technology by R.K. Rajput

JAGANNATH UNIVERSITY * JAIPUR *

JAGANNATH UNIVERSITY * JAIPUR *

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

Certified True Copy
Registrar
Jagan Nath University, Jaipur

BTME603: MECHATRONICS

Credit 4 **Max. Marks: 100(IA: 30, ETE: 70)**

3L+1T+0P **End Term Exam: 3Hours**

UNIT I

Introduction: Introduction, scope and applications of Mechatronics systems. Process control automation, FMS and CNC Machines.

MEMS: Basics of Micro- and Nanotechnology, microprocessor-based controllers and Microelectronics

UNIT II

Introduction to Sensors: Linear and Rotational Sensors, Acceleration, Force, Torque, Power, Flow and Temperature Sensors, Light Detection, Image, and Vision Systems, Integrated Micro-sensors,

Introduction to Actuators: Electro-mechanical Actuators, Electrical Machines, Piezoelectric Actuators, Hydraulic and Pneumatic Actuation Systems, MEMS: Micro-transducers Analysis, Design and Fabrication.

UNIT III

Systems and Controls: The Role of Controls in Mechatronics, Role of Modelling in Mechatronics Design, Signals and Systems: Continuousand Discrete-time Signals, Z-Transforms and Digital Systems, Continuous- and Discrete-time State-space Models.

Advanced Control Systems: Digital Signal Processing for Mechatronics Applications, Control System Design, Adaptive and Nonlinear Control Design, Neural Networks and Fuzzy Systems, Design Optimization of Mechatronics Systems.

UNIT IV

Data Acquisition and related Instrumentation: Introduction to Data Acquisition Measurement Techniques: Sensors and Transducers, Quantizing theory, Analog to Digital Conversion, Digital to Analog (D/A) conversation, Signal Conditioning.

Real time Instrumentation: Computer-Based Instrumentation Systems, Software Design and Development, Data Recording and Logging.

UNIT V

Design of Mechatronics systems: Introduction of mechatronics systems: Home appliances, ABS (anti-lock braking system) and other areas in automotive engineering, Elevators and escalators, Mobile robots and manipulator arms, Sorting and packaging systems in production

lines, Computer Numerically Control (CNC) production machines, Aeroplanes and helicopters, Tank fluid level and temperature control systems.

Suggested Text / Reference Books:

1. D. Shetty & R. Kolk, Mechatronics System Design, PWS Publishers
2. Mechatronics – HMT, Tata McGraw Hill Publishing Company Ltd.
3. Aditya P. Mathur, Introduction to Microprocessors, Tata McGraw Hill.

C. R. Venkataramana, Mechatronics, Sapna Book house, Bangalore

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

Certified True Copy
Registrar
Jagan Nath University, Jaipur

BTME608: INDUSTRIAL ENGINEERING LAB-I

Credit 1 **Max. Marks: 50(IA: 30, ETE: 20)**

0L+0T+2P **End Term Exam: 2Hours**

1 Case study on X bar charts and process capability analysis
2 P Chart:
(a)Verify the Binomial Distribution of the number of defective balls by treating the balls with a red colour to be defective.
(b) Plot a P-chart by taking a sample of n=20 and establish control limits
3 To plot C-chart using given experimental setup
4 Operating Characteristics Curve:
(a) Plot the operating characteristics curve for single sampling attribute plan for n = 20 ; c = 1 , 2 , 3 Designate the red ball to defective.
(b) Compare the actual O.C. curve with theoretical O.C. curve using approximation for the nature of distribution
5 Distribution Verification:
(a) Verification of Normal Distribution.
(b) To find the distribution of numbered cardboard chips by random drawing one at a time with replacement. Make 25 subgroups in size 5 and 10 find the type of distribution of sample average in each case. Comment on your observations
6 Verification of Poisson distribution
7 Central Limit Theorem:
(a) To show that a sample means for a normal universe follow a normal distribution
(b) To show that the sample means for a non normal universe also follow a normal Distribution.
8 Solve problems using available Statistical Process Control software in lab

JAGANNATH UNIVERSITY * JAIPUR *

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

Certified True Copy
Registrar
Jagan Nath University, Jaipur

JAGANNATH UNIVERSITY * JAIPUR *

BTME609: MECHATRONICS LAB

Credit 1

Max. Marks: 50(IA: 30, ETE: 20)

0L+0T+2P

End Term Exam: 2Hours

1Study the following devices (a) Analog & digital multimeter (b) Function/ Signal generators (c) Regulated d. c. power supplies (constant voltage and constant current operations)
2 Displacement Measurement using Capacitive & inductive Pick –ups.
3 Study of Speed Measurement System: (a) Magnetic Pick-up (b) Stroboscope
4 Study of Load Measurement System Load Cell
5 Measurement of temperature using thermocouple, thermistor and RTD
6 Measurement of displacement using POT, LVDT & Capacitive transducer
7 Torque measurement using torque measuring devices
8 Strain Measurement using strain gauge
9 Frequency to Voltage Converter and vice versa
10 Position and velocity measurement using encoders
11Study on the application of data acquisition system for industrial purposes
12 Speed control of DC motor using PLC.
13 Study of Load Measurement System Load Cell

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

Certified True Copy
Registrar
Jagan Nath University, Jaipur

Jagannath University, Jaipur

Mechanical Engineering

Reintroduced Subjects 2016-20

BTME703: OPERATIONS RESEARCH

Credit 3
3L+0T+0P

Max. Marks: 100(IA: 30, ETE: 70)
End Term Exam: 3Hours

Unit: I

Overview of Operations Research

Linear Programming: Applications and model formulation, Graphical method, Simplex method, duality and Sensitivity analysis. Transportation Model and Assignment Model including travelling salesman problem.

Unit: II

Integer Linear Programming: Enumeration and cutting Plane solution concept, Gomory's all integer cutting plane method, Branch and Bound Algorithms, applications of zero-one integer programming.

Replacement Models: Capital equipment replacement with time, group replacement of items subjected to total failure.

Unit: III

Queuing Theory: Analysis of the following queues with Poisson pattern of arrival and exponentially distributed service times, Single channel queue with infinite customer population, Multichannel queue with infinite customer population,

Competitive Situations and Solutions: Game theory, two person zero sum game, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy, approximate solution, and simplified analysis for other competitive situations. Application of linear programming

Unit: IV

Theory of Decision making: Decision making under certainty, risk and uncertainty. Decision trees.

Deterministic Inventory control models: functional role of inventory, inventory costs, model building, Single item inventory control model without shortages, with shortage and quantity discount. Inventory control model with uncertain demand, service level, safety stock, P and Q systems, two bin system. Single period model. Selective Inventory control techniques.

Unit: V

Probabilistic Inventory control models: Instantanoues demand without setup cost and with setup cost, Continuous demand without setup cost

Simulation: Need of simulation, advantages and disadvantages of simulation method of simulation. Generation of Random numbers, Generation of Normal Random numbers. Use of random numbers for system simulation. , Monte Carlo simulation, simulation language ARENA, Application of simulation for solving queuing Inventory Maintenance, Scheduling and other industrial problems

TEXT BOOK

1 Operations Research, Ravindran, Phillips and Solberg, Wiley India.

REFERENCE BOOKS

1 Introduction to Operations Research, Hillier F.S. and Lieberman G.J., CBS Publishers.
2 Operations Research, Taha H.A., Pearson Education
3 Linear Programming and Network Flows, Bazaraa, Jarvis and Sherali, Wiley India.

JAGANNATH UNIVERSITY * JAIPUR *

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

JAGANNATH UNIVERSITY * JAIPUR *

Certified True Copy
Registrar
Jagan Nath University, Jaipur

BTME701: FINITE ELEMENT METHODS

Credit 4 **Max. Marks: 100(IA: 30, ETE: 70)**

3L+1T+0P **End Term Exam: 3Hours**

UNIT I

Introduction to FEM and its applicability, Review of :Matrix algebra, Gauss elimination method, Uniqueness of solution, Banded symmetric matrix and bandwidth.

Structure analysis: Two-force member element, Local stiffness matrix, coordinate transformation, Assembly, Global stiffness matrix, imposition of Boundary conditions, Properties of stiffness matrix

UNIT II

One-dimensional Finite Element Analysis: Basics of structural mechanics, stress and strain tensor, constitutive relation, Principle of minimum Potential, General steps of FEM, Finite element model concept / Discretization, Derivation of finite elements, equations using potential energy approach for linear and quadratic 1-D bar element,

shape functions and their properties, Assembly, Boundary conditions, Computation of stress and strain.

UNIT III

Two Dimensional Finite Element Analysis: Finite element formulation using three nodded triangular (CST) element , Plane stress and Plain strain problems, Shape functions, node numbering and connectivity, Assembly,

Boundary conditions, Isoparametric formulation of 1-D bar elements, Numerical integration using gauss quadrature formula, computation o tress and strain.

UNIT IV

Finite Element Formulation from Governing Differential Equation: Method of Weighted ResidualsCollocation, Sub domain method, Least Square method and Galerkin's method, Application to one dimensional problems, one-dimensional heat transfer, etc. introduction to variational formulation (Ritz Method.)

UNIT V

Higher Order Elements: Lagrange's interpolation formula for one and two independent variable, Convergence of solution, compatibility, element continuity, static condensation, p and h methods of mesh refinement, Aspect ratio and element shape,

Application of FEM, Advantages of FEM, Introduction to concept of element mass matrix in dynamic analysis.

Suggested Text / Reference Books:

1. Text Book of Finite Element Analysis, Seshu P., Prentice Hall India.
2. Finite Element Procedure in Engineering Analysis, Bathe K.J., Prentice Hall India.
3. An Introduction to the Finite Element Method, Reddy J.N., Tata McGraw-Hill, New Delhi.
4. Concepts & Applications of Finite Element Analysis, Cook and Plesha, Willey India New Delhi.
5. Introduction to Finite Elements in Engineering, Chandupatla and Belegundu, Prentice Hall India.

BTME705: OPERATIONS MANAGEMENT

Credit 3 **Max. Marks: 100(IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3Hours**

UNIT I

Introduction to operations management (OM), the scope of OM; Historical evolution of OM; Trends in business; the management process. Operations Strategy, Competitiveness and Productivity

Demand Forecasting: components of forecasting demand, Approaches to forecasting: forecasts based on judgment and opinion, Time series data. Associative forecasting techniques, Accuracy and control of forecasts, Selection of forecasting technique.

UNIT II

Product and Service design, Process selection, Process types, Productand process matrix, Process analysis.Capacity Planning: Defining and measuring capacity, determinants of effective capacity, capacity strategy, steps in capacity planning process, determining capacity requirements, Capacity alternatives, Evaluation of alternatives; Cost-Volume analysis.

UNIT III

Facility Location: Need for location decisions, factors affecting location, qualitative and quantitative techniques of location. Facilities layout: Product, Process, Fixed position, combination and cellular layouts; Designing product and process layout, line balancing. Material Handling

Planning levels: long range, Intermediate range and Short range planning, Aggregate planning: Objective, Strategies, and techniques of aggregate planning. Master scheduling; Bill of materials, MRP; inputs processing and outputs, and overview of MRPII , use of MRP to assist in planning capacity requirements, Introduction to ERP

UNIT IV

Production Control: Capacity control and priority control, production control functions; Routing, scheduling, dispatching, expediting and follow up. Techniques of production control in job shop production, batch production and mass production systems. sequencing: priority rules, sequencing jobs through two work centers, scheduling services Introduction to Just-in-time (JIT) and Lean Operations: JIT production, JIT scheduling, synchronous production, Lean operations system

UNIT V

Supply Chain Management (SCM): Need of SCM, Bullwhip effect, Elements of SCM, Logistics steps in creating effective supply chain, Purchasing and supplied management.

Project Management: Nature of projects, project life cycle, Work breakdown structure, PERT and CPM, Time-Cost trade-offs: Crashing. Resource allocation, leveling

Suggested Text / Reference Books:

1. Works Organisation and Management, Basu S.K., Sahu K.C., Datta N.K., Oxford and IBH.

2. Principles of Industrial Organization, Dexter S. Kimball, Read Books.
3. Principles of Industrial Management, Alford and Beatty, Revised Edition, Ronald Press Co.
4. Essentials of Industrial Management, McGraw-Hill industrial organization and management series, Lawrence L. Bethel, McGraw-Hill.
5. Engineering Economics, Riggs, Tata McGraw-Hill

JAGANNATH UNIVERSITY * JAIPUR *

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

JAGANNATH UNIVERSITY * JAIPUR *

Certified True Copy
Registrar
Jagan Nath University, Jaipur

BTME706.A: MICRO AND NANO MANUFACTURING

Credit 3 **Max. Marks: 100(IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3Hours**

UNIT I

Nanoscale Cutting:- Introduction, Material representation and microstructure, Atomic interaction; Nonomachining:- Introduction, Nanometric machining, Theoretical basis of machining; Meso-micromcahining:- Introduction, size effects in micromachining, mechanism for large plastic flow, origin of the size effect, Mesomachining processes. Product quality in micromachining, Burr formation in micromachining operations.

UNIT II

Microturning:- Characteristic features and applications, Microturning tools and tooling systems, Machine tools for microturning

Microdrilling: Characteristic features and applications, Microdrills and tooling systems, Machine tools for microdrilling Micromilling:- Characteristic features and applications, Micromills and tooling systems, Machine tools for micromilling, Micro machining high aspect ratio microstructures, micromolding, micromolding processes, micromolding tools, micromold design, micromolding applications, limitations of micromolding.

UNIT III

Microgrinding and Ultra-precision Processes: Introduction, Micro and nanogrinding, Nanogrinding apparatus, Nanogrinding procedures, Nanogrinding tools, Preparation of nanogrinding wheels, Bonding systems, Vitrified bonding

Non-Conventional Processes: Laser Micromachining:- Introduction, Fundamentals of lasers, Stimulated emission, Types of lasers, Laser microfabrication, Nanosecond pulse microfabrication, Shielding gas, Effects of nanosecond pulsed microfabrication, Picosecond pulse microfabrication, Femtosecond pulse microfabrication, Laser nanofabrication.

UNIT IV

Diamond Tools in Micromachining: Introduction, Diamond technology, Hot Filament CVD (HFCVD), Preparation of substrate, Selection of substrate material, Pre-treatment of substrate, Modified HFCVD process.

Deposition on complex substrates, Diamond deposition on metallic (molybdenum) wire, Deposition on WC-Co microtools, Diamond deposition on tungsten carbide, (WC-Co) microtool, Performance ofdiamond-coated microtool

UNIT V

Evaluation of Subsurface Damage in Nano and Micromachining:

Introduction, Destructive evaluation technologies, Cross-sectional microscopy, Preferential etching, Angle lapping/angle polishing, X-ray diffraction, Micro-Raman spectroscopy.

Applications of Nano and Micromachining in Industry: Introduction, Typical machining methods, Diamond turning, Shaper/planner machining, Applications in optical manufacturing, Aspheric lens,

Fresnel lens, Microstructured components, Semiconductor wafer production.

Suggested Text / Reference Books:

1. MEMS and Microsystems: Design, Manufacture, and Nanoscale Engineering By Tai-Ran Hsu
2. Foundation of MEMS" by Chang Liu. Pearson Education.
3. Rai - Choudhury P. "MEMS and MOEMS Technology and Applications", PHI Learning Private Limited, 2009.
4. Sabrie Solomon, "Sensors Handbook," Mc Graw Hill, 1998.
5. Marc F Madou, "Fundamentals of Micro Fabrication", CRC Press, 2nd Edition, 2002.

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

Certified True Copy
Registrar
Jagan Nath University, Jaipur

BTME706.B: ROBOTICS

Credit 3

Max. Marks: 100(IA: 30, ETE: 70)

3L+0T+0P

End Term Exam: 3Hours

UNIT I

Introduction to Robotics: Evolution of Robots and Robotics, Laws of Robotics, What is and What is not a Robot, Progressive Advancement in Robots.

Robot Anatomy, Human Arm Characteristics, Design and Control Issues, Manipulation and Control, Sensors and Vision, ProgrammingRobots, The Future Prospects, Notations.

UNIT II

Robot End Effectors: Classification of end effectors, drive system for grippers, Mechanical, Magnetic, Vaccum, Adhesive grippers, Hooks, Scoops, Miscellaneous devices, Gripper force analysis and Design, Active and Passive Gripeers

Coordinate Frames, Mapping and Transforms: Coordinate Frames, Description of Objects in Space, Transformation of Vectors, Inverting a Homogeneous Transform, Fundamental Rotation Matrices.

UNIT III

Symbolic Modeling of Robots: Direct Kinematic Model, Mechanical Structure and Notations, Description of Links and Joints, Kinematic Modeling of the Manipulator,

Denavit – Hartenberg Notation, Kinematic Relationship between Adjacent Links, Manipulator Transformation Matrix. Introduction to Inverse Kinematic model, Solvability of Inverse Kinematics model,

Solution techniques.

UNIT IV

Robotic Sensors: The Meaning of Sensing, Sensors in Robotics, Kinds of Sensors used in Robotics, Choosing the right sensors

Robotic vision: Introduction to Robotic Vision, Industrial Applications of Vision-Controlled Robotic Systems, Process of Imaging, Architecture of Robotic Vision Systems, Image Acquisition, Image Representation and Image Processing

UNIT V

Robot Applications: Industrial Applications, Material Handling, Processing Applications, Assembly Applications, Inspection Application, Principles for Robot Application and Application Planning, Justification of Robots, Robot Safety, Non-Industrial Applications.

Robot Programming: Robot languages, Classification of Robot language, Computer control and robot software, VAL system and language

Recommended Reference Books:

1. Mechatronics Engineering ,Tomkinson,D.and Horne .J. Mc Graw Hill ,
2. Deb, S R, Robotics Engineering

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

BTME706.C: CNC MACHINES AND PROGRAMMING

Credit 3

Max. Marks: 100(IA: 30, ETE: 70)

3L+0T+0P

End Term Exam: 3Hours

UNIT I

Introduction: Definition of NC, Applications of NC ,Historical Developments in Automation, Classification of NC Systems, Comparison of NC and Conventional Machines, Advantages of NC

UNIT II

NC Hardware: Architecture of NC Systems, Design Considerations, Mechanical Elements, Structure, Guideways and Slides, Guideway Elements, Transmission Systems, Spindle Unit, Coolant system, Lubrication System, Tool and work Changing Mechanisms, Electrical Elements, Drives, Sensors, Control Loops, Computing Elements/ Firmware, Interpolators

UNIT III

NC Software: Introduction, Manual Part Programming, Computer- Assisted Part Programming, Language Based , Geometric ModelingBased, Automatic Part Program Generation,

UNIT IV

CAPP Systems , 5 Axis Programming, Post-Processing, Programming Robots and CMMs NC Simulation, Kinematic simulation, Volumetric simulation, Applications of Volumetric NC Simulation, Verification

UNIT V

Advanced Topics:, Adaptive Control, Off-line adaptive control, Various optimisation criteria, Hardware Based AC, Software Based AC, Tooling and Instruments for NC Special Considerations in High Speed Cutting (HSC) and Die Sinking, Rapid Product Development, CAM, FMS, CIM

Recommended reference Books:

1. CAD/CAM – Theory and Zeid, Ibraham Tata Mc Graw Hill
2. Geometric Modeling Mortenson John Wiley& Sons
3. Automation, Production Systems and CIM Groover & Zimmer PHI
4. Computer aided manufacturing Chang, Wysk and Wang PHI
5. Computer Aided Design and Manufacturing Besant and Lui EWP
6. Numerical Control and Computer Aided Manufacture Kundra, Rao, Tiwari Tata Mc Graw Hill

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

BTME707: THERMAL ENGINEERING LAB-II

Credit 1 **Max. Marks: 50(IA: 30, ETE: 20)**

0L+0T+2P **End Term Exam: 2Hours**

1 To perform constant speed load test on a single cylinder diesel engine and to plot performance curves: indicated thermal efficiency, brake thermal efficiency, mechanical efficiency Vs. Brake power, and heat balance sheet.
2 To estimate the Indicated Power, Friction Power and Mechanical Efficiency of a multi-cylinder Petrol Engine. (Morse Test)
3 Analysis of engine exhaust gases using Orsat apparatus / gas analyzer.
4 To study refrigeration cycle, determination of coefficient of performance of cycle and tonnage capacity of refrigeration unit.
5 To determine the COP and tonnage capacity of a Mechanical heat pump.
6 To study various controls used in Refrigeration and Air conditioning system.
7 Determination of dryness fraction of steam.
8 Study and Performance of Simple Steam Turbine
9 Performance characteristics of Pelton wheel turbine.
10 Performance characteristics of Francis turbine.
11 Performance characteristics of Kaplan turbine.
12 Performance characteristics of variable speed centrifugal pump.
13 Performance characteristics of rated speed centrifugal pump.

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

Certified True Copy
Registrar
Jagan Nath University, Jaipur

BTME708: FINITE ELEMENT LAB

Credit 1 **Max. Marks: 50(IA: 30, ETE: 20)**

0L+0T+2P **End Term Exam: 2Hours**

1 Laboratory work for the solution of solid mechanics problems, heat transfer problems, and free vibration problems

A: by using FE packages such as NASTRAN/ ANSYS/ SIMULIA/ ABAQUS

2 Introduction of GUI of the software in the above mentioned areas realistic problems.

3 Analysis of beams and frames (bending and torsion problems)

4 Plane stress and plane strain analysis problems

5 Problems leading to analysis of axisymmetric solids

6 Problems leading to analysis of three dimensional solids

(a) Heat transfer problems

(b) Modal analysis problem

B: by writing own code for finite element analysis using MATLAB for:

7 Plane stress and plane strain analysis problems

8 Modal Analysis problem

JAGANNATH UNIVERSITY JAIPUR

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

Certified True Copy
Registrar
Jagan Nath University, Jaipur

JAGANNATH UNIVERSITY JAIPUR

BTME801: COMPUTER INTEGRATED MANUFACTURING SYSTEMS

Credit 4 **Max. Marks: 100(IA: 30, ETE: 70)**

3L+1T+0P **End Term Exam: 3Hours**

UNIT I

Introduction to CIM: Overview of Production Systems, the product cycle, Automation in Production Systems, computer's role in manufacturing, sources and types of data used in manufacturing. The Beginning of CAM: Historical Background, Numerical Control (NC): Basic components of an NC system, coordinate system and motions control systems. Computer Numerical Control (CNC): features of CNC, machine control unit, CNC software. Direct Numerical Control and Distributed Numerical Control. Applications, advantages and disadvantages of NC. Adaptive control of machining system.

UNIT II

NC Part programming: Manual and computer assisted part programming, Part programming with APT. NC part programming using CAD/CAM software. NC cutter path verification.

UNIT III

Computer Aided Process Planning: Traditional Process Planning, Retrieval process planning system, Generative Process Planning, Machinability data systems, computer generated time standards.

Group Technology: Introduction, part families, part classification and coding, coding system and machining cells.

UNIT IV

Computer Aided Production Management Systems: Introduction to computer aided PPC, Introduction to computer aided inventory management, manufacturing resource planning (MRPII), computer process monitoring and shop floor control, computer process control. Computer Aided Quality Control; Computer in quality control, contact inspection methods, Non contact inspection methods, optical and non optical computer aided testing.

UNIT V

Computer Aided Material Handling; Computer control on material material handling for automated inspection and assembly. Computer Integrated Manufacturing Systems: Introduction, types special manufacturing systems, flexible manufacturing systems (FMS).

Collaborative Engineering; Introduction, Faster Design throughput, Web based design, Changing design approaches, extended enterprises, concurrent engineering, Agile and lean manufacturing

Recommended reference Books:

1. CAD/CAM – Theory and Zeid, Ibraham Tata Mc Graw Hill
2. Geometric Modeling Mortenson John Wiley& Sons
3. Automation, Production Systems and CIM Groover & Zimmer PHI
4. Computer aided manufacturing Chang, Wysk and Wang PHI
5. Computer Aided Design and Manufacturing Besant and Lui EWP

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

BTME802: LAWS FOR ENGINEERS

Credit 3 **Max. Marks: 100(IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3Hours**

UNIT I

Constitutional Law: The Preamble; Fundamental Rights; Directive principles of State policy; Fundamental Duties; Emergency provisions – kinds, legal requirements and legal effects.

General Principles of Contract under Indian Contract Act, 1872:

General principles of contract – Sec. 1 to 75 of Indian Contract Act and including Government as contracting party, Kinds of government contracts and dispute settlement, Standard form contracts; nature, advantages, unilateral character, principles of protection against possibility of exploitation, judicial approach to such contracts,

exemption clauses, clash between two standard form contracts.

UNIT II

Introduction to Human Rights: Theoretical foundation, Historical development of human rights; Human Rights in Indian tradition and Western tradition; Covenant on Civil & Political Rights 1966 including

Optional Protocol – I (Individual Complaint Mechanism) & Optional Protocol – II (Abolition of Death Penalty); Covenant on Economic, Social and Cultural Rights 1966 including Optional Protocol – I (2002);

Enforcement of Human Rights in India including Supreme Court, High

Courts, Statutory Commissions – NHRC, NCW, NCM, NC-SC/ST etc.

Labour Laws: Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen Compensation Act, 1923.

UNIT III

Right to Information Act, 2005: Evolution and concept; Practice and procedures; Official Secret Act, 1923; Indian Evidence Act, 1872;

Information Technology – legislation and procedures, Cyber crimes – issues and investigations.

Law relating to Intellectual property: Introduction–meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; International instruments on IP – Berne convention, Rome convention, TRIPS, Paris convention and international organizations relating IPRs, WTO etc;

UNIT IV

Law relating to Copyright in India, Meaning of copyright – literary, dramatics and musical works, sound records and cinematographic films, computer programs, Ownership of copyrights, Criteria of infringement, Piracy in Internet – Remedies and procedures in India;

Law relating to Trademarks under Trademark Act, 1999 including Rationale of protection of trademarks as Commercial aspect and Consumer rights, Trademarks, registration, procedures, Distinction between trademark and property mark, Doctrine of deceptive similarity, Passing off an infringement and remedies;

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

Certified True Copy
Registrar
Jagannath University, Jaipur

JAGANNATH UNIVERSITY * JAIPUR *

Law relating to Patents under Patents Act, 1970, Patentable inventions with special reference to biotechnology products, Patent protection forcomputer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee,
Duration of patents – law and policy considerations, Infringement and related remedies.

UNIT V

Corporate Law: Meaning of corporation; Law relating to companies, public and private (Companies Act, 1956) general provisions; Law and multinational companies – International norms for control, FEMA 1999, Corporate liability, civil and criminal.

Election provisions under Indian Constitution (Art.324–329): Representation of Peoples Act and Prevention of Corruption Act, 1988; Superintendence, directions and control of elections to be vested in Election Commission; Election to the house of people and to the legislative assemblies of States to be on the basis of adult suffrage. Candidate electoral rights.

Books:

1. Law for Professional Engineers by Donald L. Marston

JAGANNATH UNIVERSITY ★ JAIPUR ★

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

Certified True Copy
Registrar
Jagan Nath University, Jaipur

JAGANNATH UNIVERSITY ★ JAIPUR ★

BTME804.B: COMPUTATIONAL FLUID DYNAMICS

Credit 3 **Max. Marks: 100(IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3Hours**

UNIT I

Introduction to Computational Fluid Dynamics and Principles of Conservation: Conservation of mass, linear momentum: Navier-Stokes equation, Conservation of Energy, General scalar transport equation, Reynolds transport theorem,

Classification of Partial Differential Equations and Physical Behaviour: Elliptic, parabolic and hyperbolic partial differential equations

Approximate Solutions of Differential Equations: Error Minimization Principles, Approximate solutions of differential equations, variational approach, Weighted residual approach: trial function and weighting

function, Essential and natural boundary conditions, Least square method, Galerkin's method, Rayleigh-Ritz method

UNIT II

Fundamentals of Discretization: Pre-processing, Solution, Postprocessing, Finite Element Method, Finite difference method, Well posed boundary value problem, Conservativeness, Boundedness, Transportiveness, Finite volume method (FVM), 1-D steady state heat conduction without and with constant source term

Finite Volume Method: FV Discretization of a 1-D steady state diffusion type problem, Composite material with position dependent thermal conductivity, Source term linearization, Implementation of boundary conditions, 1-D unsteady state diffusion problems: implicit, fully explicit and Crank-Nicholson scheme

UNIT III

Solution of Systems of Linear Algebraic Equations: Solution techniques for systems of linear algebraic equations: Elimination, Iteration and Gradient Search method, L-U decomposition technique, Tridiagonal matrix algorithm (TDMA): Thomas algorithm

Iteration methods: Generalized analysis of the iterative methods, Sufficient condition for convergence, Scarborough criteria of for convergence Relaxation methods, Preferential characteristics of iterative methods, Multigrid method, Line by line TDMA, Alternating direction implicit method, Gradient search methods: Steepest descent method, Conjugate gradient method

UNIT IV

Discretization of Convection-Diffusion Equations: A Finite Volume Approach: Central difference scheme, Upwind scheme, Exponential scheme and Hybrid scheme, Power law scheme, Generalized convection-diffusion formulation, The concept of false diffusion, QUICK scheme.

Discretization of Navier Stokes Equations: Discretization of the Momentum Equation: Stream Function-Vorticity approach and Primitive variable approach, Staggered grid and Collocated grid, SIMPLE Algorithm, SIMPLER Algorithm

UNIT V

Introduction to Turbulence Modeling: Vorticity transport equation, Homogeneous turbulence and isotropic turbulence, Reynolds average Navier stokes (RANS) equation, Necessity of turbulence modeling,

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

Turbulence model: Eddy viscosity, Mixing length, The S-T model, RNG S-T model, S-U model, Reynolds stress model (RSM),Large eddy Simulation (LES),Direct numerical simulation (DNS)
The basic structure of a CFD code: Pre-processor, Solver and Postprocessor,
User-defined-subroutines, Solution to some basic problems in heat transfer and fluid flow

Books:

1. An Introduction to Computational Fluid Dynamics by Versteeg B

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

Certified True Copy
Registrar
Jagan Nath University, Jaipur

JAGANNATH UNIVERSITY * JAIPUR *

BTME804.C: TOTAL QUALITY MANAGEMENT

Credit 3 **Max. Marks: 100(IA: 30, ETE: 70)**

3L+0T+0P **End Term Exam: 3Hours**

UNIT I

Introduction to TQM: Definition, Basic approach, Guru's of TQM, TQM framework, benefits. Leadership: Characteristics of Quality Leadership, Leadership Concepts, The 7 Habits of Highly Effective People, The Deming Philosophy, The Role of TQM Leaders, Quality Council, Core Values, Concepts, and Framework, Quality Statements, Strategic Planning Communications, Decision Making. Customer Satisfaction: Introduction, Customer Perception of Quality, Feedback, Using Customer Complaints, Service Quality, Translating Needs into Requirements, Customer Retention.

UNIT II

Continuous Process Improvement: Introduction, Process, The Juran Trilogy, Improvement Strategies, Types of Problems PDSA Cycle, Problem-Solving Method, DMAIC, Kaizen, Reengineering. Supplier Partnership: Principles of Customer/Supplier Relationship Partnering, Sourcing Supplier, Selection ,Supplier Certification

Supplier Rating, Relationship Development. Performance Measures: Basic Concepts, Strategy, performance

measure presentation, Cost of Quality, Malcolm Baldrige and Rajiv Gandhi National Quality Award, Balanced Score Card

UNIT III

Lean Enterprise: Historical Review, Lean Fundamentals, Value Stream Map, Implementing Lean, Benefits.

Six Sigma: Statistical Aspects, Improvement Methodology, Organizational Structure Benefits. Benchmarking: Benchmarking Defined, Reasons to Benchmark, Process, deciding what to benchmark, Pitfalls and Criticisms.

UNIT IV

Quality Management Systems: Benefits of ISO Registration, ISO Series of Standards, Sector-specific Standards, ISO 9001 Requirements, Implementation, Documentation, Writing the Documents, Internal Audits, Registration.

Environmental Management Systems: ISO 14000 Series Standards, Concepts of ISO 14001, ISO 14001, Requirements, Benefits, Integrating QMS and EMS. Other EMS Systems, Relationship to Health and Safety

Quality Function Deployment: The QFD Team, Benefits, the voice of the Customer, Organization of Information, House of Quality, Building a House of Quality, QFD Process. Total Productive Maintenance: The Plan, Learning the New Philosophy,Promoting the Philosophy, Training, Improvement Needs, Goal, Developing Plans, Autonomous Work Groups

UNIT V

Management Tools: Forced Field Analysis, Nominal Group Technique, Affinity Diagram, Interrelationship Digraph, Tree Diagram, Matrix Diagram, Prioritization Matrices, Process Decision Program Chart, Activity Network Diagram

Experimental Design: Introduction, Basic Statistics, Hypothesis, t Test F Test. One Factor at a Time Orthogonal Design, Point and Interval Estimate, Two Factors Full Factorials.

Taguchi's Quality Engineering: Introduction, Loss Function,

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

Orthogonal Arrays, Signal-to-Noise Ratio, Parameter Design, Tolerance Design, Case study

Reference Books:

1. Amitav Mitra, "Fundamentals of Quality Control", Pearson Education
2. Feigenbaum, "Total Quality Control", McGraw Hill & Co.
3. Suresh Dalela, "Quality Systems", Standard Publishers & Distributors
4. Montgomery DC, "Introduction to Statistical Quality Control", John Wiley & Sons Inc.

BTME809: INDUSTRIAL ENGINEERING LAB-II

Credit 1 **Max. Marks: 50(IA: 30, ETE: 20)**

0L+0T+2P **End Term Exam: 2Hours**

1 Determination of time standard for a given job using stopwatch timestudy.
2 Preparation of flow process chart, operation process chart and manmachine charts for an existing setup and development of an improved process.
3 Study of existing layout of a workstation with respect to controls and displays and suggesting improved design from ergonomic viewpoint.
4 To carry out a work sampling study.
5 To conduct process capability study for a machine in the workshop.
6 To design a sampling scheme based on OC curve.
7 To conduct Shewart's experiments on known population
8 Generation of random numbers for system simulation such as facility planning, job sh

JAGANNATH UNIVERSITY JAIPUR

HEAD
DEPARTMENT OF ENGINEERING & TECHNOLOGY
JAGANNATH UNIVERSITY, JAIPUR

JAGANNATH UNIVERSITY

Certified True Copy
Registrar
Jagan Nath University, Jaipur