

***Faculty of Engineering & Technology***  
***P.K.University***  
***Shivpuri (MP)***



**Evaluation Scheme & Syllabus for**  
**Department of Mechanical Engineering**  
**B.Tech. First Year**  
**(I & II Semester)**

**(Effective from session 2019-20)**

# **EVALUATION SCHEME**

## **SEMESTER I**

<b>SEMESTER I</b>						
		THEORY		PRACTICAL		TOTAL
<b>SUBJECT CODE</b>	<b>SUBJECT NAME</b>	SESS.(30)	EXT.(70)	SESS.(25)	EXT.(25)	
BTME-101	Engineering Mathematics-I	30	70	NA	NA	NA
BTME-102	Engineering Physics-I	30	70	25	25	150
BTME-103	Engineering Chemistry	30	70	25	25	150
BTME-104	Basic Electrical Engineering	30	70	25	25	150
BTME-105	Computer System & Programming in C	30	70	25	25	150

## **SEMESTER II**

<b>SEMESTER II</b>						
		THEORY		PRACTICAL		TOTAL
<b>SUBJECT CODE</b>	<b>SUBJECT NAME</b>	SESS.(30)	EXT.(70)	SESS.(25)	EXT.(25)	
BTME-201	Engg. Maths-II	30	70	NA	NA	100
BTME-202	Engineering Physics-II	30	70	25	25	150
BTME-203	Elements of Mechanical Engg	30	70	25	25	150
BTME-204	Professional Communication	30	70	25	25	150
BTME-205	Basic Electronics	30	70	NA	NA	100

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**BTME-101 ENGINEERING MATHEMATICS – I**

**LTP-310**

**Unit - 1: Differential Calculus – I**

Successive Differentiation, Leibnitz's theorem, Limit, Continuity and Differentiability of functions of several variables, Partial derivatives, Euler's theorem for homogeneous functions, Total derivatives, Change of variables, Curve tracing: Cartesian and Polar coordinates.

**Unit - 2: Differential Calculus - II**

Taylor's and Maclaurin's Theorem, Expansion of function of several variables, Jacobian, Approximation of errors, Extrema of functions of several variables, Lagrange's method of multipliers (Simple applications).

**Unit - 3: Matrix Algebra**

Types of Matrices, Inverse of a matrix by elementary transformations, Rank of a matrix (Echelon & Normal form), Linear dependence, Consistency of linear system of equations and their solution, Characteristic equation, Eigen values and Eigen vectors, Cayley-Hamilton Theorem, Diagonalization, Complex and Unitary Matrices and its properties

**Unit - 4: Multiple Integrals**

Double and triple integrals, Change of order of integration, Change of variables, Application of integration to lengths, Surface areas and Volumes – Cartesian and Polar coordinates. Beta and Gamma functions, Dirichlet's integral and its applications.

**Unit - 5: Vector Calculus**

Point function, Gradient, Divergence and Curl of a vector and their physical interpretations, Vector identities, Tangent and Normal, Directional derivatives. Line, Surface and Volume integrals, Applications of Green's, Stoke's and Gauss divergence theorems (without proof).

**Text Books:**

1. E. Kreyszig, Advanced Engineering Mathematics, John-Wiley & Sons
2. B. V. Ramana, Higher Engineering Mathematics, Tata Mc Graw- Hill Publishing Company Ltd.
3. R.K.Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publishing House.

**Reference Books:**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Peter V. O' Neil, Advanced Engineering Mathematics, Thomas ( Cengage) Learning.
3. Thomas & Finley, Calculus, Narosa Publishing House
4. Rukmanadachari, Engineering Mathematics – I, Pearson Education.

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**BTME-102 ENGINEERING PHYSICS-I**

**LTP-310**

**Unit – I: Relativistic Mechanics**

Inertial & non-inertial frames, Galilean transformations, Michelson-Morley experiment, Einstein's postulates, Lorentz transformation equations, Length contraction & Time dilation, Relativistic addition of velocities; Variation of mass with velocity, Mass energy equivalence, Concept of rest mass of photon.

**Unit – II: Modern Physics.**

Black body radiation spectrum, Weins law and Rayleigh-Jeans law, Assumption of quantum theory of radiation, Planck's law. Wave-particle duality, de-Broglie matter waves, Bohr's quantization rule, Phase and Group velocities, Davisson-Germer experiment, Heisenberg uncertainty principle and its applications, Wave function and its significance, Schrödinger's wave equation ( Time dependent and time independent) – particle in one dimensional potential box, Eigen values and Eigen function.

**Unit – III: Wave Optics.**

**Interference:** Coherent sources, Interference in thin films (parallel and wedge shaped film), Newton's rings and its applications..

**Diffraction:** Single, double and N- Slit Diffraction, Diffraction grating, Grating spectra, dispersive power, Rayleigh's criterion and resolving power of grating.

**Unit – IV: Polarization and Laser**

**Polarization:** Phenomena of double refraction, Nicol prism, Production and analysis of plane, circular and elliptical polarized light, Retardation Plate, Optical Activity, Fresnel's theory, Specific rotation.

**Laser:** Spontaneous and stimulated emission of radiation, population inversion, Einstein's Coefficients, Concept of 3 and 4 level Laser, Construction and working of Ruby, He-Ne lasers and laser applications.

**Unit – V: Fiber Optics and Holography**

**Fiber Optics:** Fundamental ideas about optical fiber, Propagation mechanism, Acceptance angle and cone, Numerical aperture, Single and Multi Mode Fibers, Dispersion and Attenuation.

**Holography:** Basic Principle of Holography, Construction and reconstruction of Image on hologram and applications of holography.

## Reference Books:

1. Concepts of Modern Physics - Arthur Beiser (Mc-Graw Hill)
2. Introduction to Special Theory of Relativity- Robert Resnick (Wiley)
3. Optics –Ajoy Ghatak ( Tata McGraw Hill Education Private Ltd. New Delhi)
4. Optics - Brijlal & Subramanian (S. Chand )
5. Engineering Physics- C. Mani Naidu(Pearson)
6. Lasers Principles, Types and Applications- K R Nambiar (New Age)

## ENGINEERING PHYSICS LAB

L T P-0 0 2

### List of Experiments

Any ten experiments, at least four from each group:

#### Group -A

1. To determine the wavelength of monochromatic light by Newton's ring.
2. To determine the wavelength of monochromatic light with the help of Fresnel's biprism.
3. To determine the focal length of two lenses by nodal slide and locate the position of cardinal points.
4. To determine the specific rotation of cane sugar solution using polarimeter.
5. To determine the wavelength of spectral lines using plane transmission grating.
6. To study the polarization of light by simple reflection using laser.
7. Measurement of Wavelength of a laser (He-Ne) light using single slit diffraction.

#### Group – B

8. To determine the specific resistance of a given wire using Carey Foster's bridge.
9. To study the variation of magnetic field along the axis of current carrying - Circular coil and then to estimate the radius of the coil.
10. To verify Stefan's Law by electrical method.
11. To calibrate the given ammeter and voltmeter by potentiometer.
12. To study the Hall effect and determine Hall coefficient, carrier density and - mobility of a given semiconductor using Hall effect set up.
13. To determine the energy band gap of a given semiconductor material.
- 14 To determine E.C.E. of copper using Tangent or Helmholtz galvanometer.
15. To draw hysteresis curve of a given sample of ferromagnetic material and from - this to determine magnetic susceptibility and permeability of the given specimen.
16. To determine the ballistic constant of a ballistic galvanometer.
17. To determine the coefficient of viscosity of a liquid.
18. Measurement of fiber attenuation and aperture of fiber.
19. High resistance by leakage method.
20. Magnetic Susceptibility of paramagnetic solution.

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**BTME -103 ENGINEERING CHEMISTRY**

**L T P- 3 1 0**

- Unit-1** Molecular orbital theory and its applications to homo-nuclear diatomic molecules. Band theory of solids. Liquid crystals and its applications. Point defects in Solids. Structure and applications of Graphite and Fullerenes. Concepts of nano-materials and its applications
- Unit-2** Polymers: Basic concepts of polymer- blends and composites. Conducting and biodegradable polymers. Preparations and applications of some industrially important polymers(Buna N, Buna S, Neoprene, Nylon 6, Nylon 6,6 , Terylene). General methods of synthesis of organometallic compound (Grignard Reagent) and their applications in polymerization.
- Unit-3** Electrochemistry: Galvanic cell, electrode potential, Lead storage battery. Corrosion, causes and its prevention. Setting and hardening of cement, applications of cement. Plaster of paris. Lubricants- Classification, mechanism and applications..
- Unit-4** Hardness of water. Disadvantage of hard water. Boiler troubles, Techniques for water softening; Lime-soda, Zeolite, Ion exchange resin, Reverse osmosis. Phase Rule and its application to water system.
- Unit-5** Fuels; Classification of fuels. Analysis of Coal. Determination of Calorific values (bomb calorimeter & Dulong's method). Biogas. Elementary ideas and simple applications of UV, Visible, IR and H1NMR spectral Techniques.

**Textbook**

1. Chemistry for Engineers, by S. Vairam and Suba Ramesh; Wiley India

**Reference Books**

1. Textbook of Engineering Chemistry by Dr. Gopal Krishna Bhatt, Acme Publishers
2. Chemistry (9th ed), by Raymond Chang, Tata McGraw-Hill
3. Chemistry Concepts and Applications by Steven S. Zumdahl; Cengage Learning
4. Engineering Chemistry, Wiley India
5. Engineering Chemistry Author: Abhijit Mallick, Viva Books
6. Text Book of Engineering Chemistry by Harsh Malhotra; Sonali Publications
7. Concise Inorganic Chemistry by J.D. Lee; Wiley India
8. Organic Chemistry (6 ed) by Morrison & Boyd; Pearson Education
9. Physical Chemistry by Gordon M. Barrow; Mc-Graw Hill
10. Organic Chemistry, Volume 1(6 ed)& 2 (5ed) by I. L. Finar; Pearson Education

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**BTME-103 ENGINEERING CHEMISTRY**

**L T P- 002**

**LIST OF EXPERIMENTS**

1. Determination of alkalinity in the given water sample.
2. Determination of temporary and permanent hardness in water sample using EDTA .
3. Determination of available chlorine in bleaching powder.
4. Determination of chloride content in water sample.
5. Determination of iron content in the given solution by Mohr's method.
6. pH- metric titration.
7. Viscosity of an addition polymer like polyester by viscometer.
8. Determination of iron concentration in sample of water by colorimetric method.  
The method involves the use of KCN as a chelating agent and the measurements are carried out at 480nm.
9. Element detection and functional group identification in organic compounds.
10. Preparation of Bakelite and Urea formaldehyde resin.

Note: Institute can replace two experiments from the aforesaid experiments as per

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**BTME-104 BASIC ELECTRICAL ENGINEERING**

**L T P -3 1 0**

**DETAILED SYLLABUS**

**Unit-I : Electrical Circuit Analysis:**

Introduction, Circuit Concepts: Concepts of network, Active and passive elements, Voltage and current sources, Concept of linearity and linear network, Unilateral and bilateral elements, Source transformation, Kirchhoff's laws, Loop and nodal methods of analysis, Star-delta transformation, AC fundamentals: Sinusoidal, square and triangular waveforms – Average and effective values, Form and peak factors, Concept of phasors, phasor representation of sinusoidally varying voltage and current.

**Unit-II: Steady- State Analysis of Single Phase AC Circuits:**

Analysis of series and parallel RLC Circuits, Concept of Resonance in series & parallel circuits, bandwidth and quality factor; Apparent, active & reactive powers, Power factor, Concept of power factor improvement and its improvement (Simple numerical problems)

**Network theorems (AC & DC with independent sources):** Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem (Simple numerical problems)

**Unit-III : Three Phase AC Circuits:**

Three phase system-its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations, Three-phase power and its measurement (simple numerical problems).

**Measuring Instruments:** Types of instruments, Construction and working principles of PMMC and moving iron type voltmeters & ammeters, Single phase dynamometer wattmeter, Use of shunts and multipliers (Simple numerical problems on shunts and multipliers)

**Unit-IV: Magnetic Circuit:**

Magnetic circuit concepts, analogy between electric & magnetic circuits, B-H curve, Hysteresis and eddy current losses, Magnetic circuit calculations (Series & Parallel).

**Single Phase Transformer:** Principle of operation, Construction, EMF equation, Equivalent circuit, Power losses, Efficiency (Simple numerical problems), Introduction to auto transformer.



**Unit-V: Electrical Machines:**

**DC machines:** Principle & Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems)

**Three Phase Induction Motor:** Principle & Construction, Types, Slip-torque characteristics, Applications (Numerical problems related to slip only)

**Single Phase Induction motor:** Principle of operation and introduction to methods of starting, applications.

**Three Phase Synchronous Machines:** Principle of operation of alternator and synchronous motor and their applications.

**Text Books:**

1. "Basic Electrical Engineering", S N Singh; Prentice Hall International
2. "Basic Electrical Engineering", Kuldeep Sahay, New Age International Publishers
3. "Fundamentals of Electrical Engineering", B Dwivedi, A Tripathi; Wiley India
4. "Principles of Electrical Engineering", V. Del Toro,; Prentice Hall International
5. "Electrical Engineering", J. B. Gupta, Kataria and Sons

**Reference Books:**

1. "Electrical and Electronics Technology", Edward Hughes; Pearson
2. "Engineering Circuit Analysis", W.H. Hayt & J.E. Kimerly; Mc Graw Hill
3. "Basic Electrical Engineering", C L Wadhwa; New Age International
4. "Basic Electrical Engineering", T.K. Nagsarkar, M.S. Shukhija; Oxford University Press

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**BTME-104 ELECTRICAL ENGINEERING LABORATORY**

**L T P - 0 0 2**

**LIST OF EXPERIMENTS**

**Note: A minimum of ten experiments from the following should be performed**

1. Verification of Kirchhoff's laws
2. Verification of Superposition theorem
3. Verification of Thevenin's Theorem and Maximum Power Transfer Theorem.
4. Measurement of power and power factor in a single phase ac series inductive circuit and study improvement of power factor using capacitor
5. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
6. Connection and measurement of power consumption of a fluorescent lamp (tube light).
7. Measurement of power in 3- phase circuit by two wattmeter method and determination of its power factor for star as well as delta connected load.
8. Determination of parameters of ac single phase series RLC circuit
9. To observe the B-H loop of a ferromagnetic material in CRO.
10. Determination of (i) Voltage ratio (ii) polarity and (iii) efficiency by load test of a single phase transformer
11. Determination of efficiency of a dc shunt motor by load test
12. To study running and speed reversal of a three phase induction motor and record speed in both directions.

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**BTME-105 COMPUTER SYSTEM AND PROGRAMMING IN C**

**L T P - 3 0 0**

**Unit1:**

**Basics of Computer:** Introduction to digital computer, basic operations of computer, functional components of computer, Classification of computers.

**Introduction to operating system:** [DOS, Windows, Linux and Android] purpose, function, services and types.

**Number system:** Binary, octal and hexadecimal number systems, their mutual conversions, Binary arithmetic.

**Basics of programming:** Approaches to Problem Solving, Concept of algorithm and flow charts, Types of computer languages:- Machine Language, Assembly Language and High Level Language, Concept of Assembler, Compiler, Loader and Linker.

**Unit2:**

Standard I/O in “C”, **Fundamental data types-** Character type, integer, short, long, unsigned, single and double floating point, Storage classes- automatic, register, static and external, Operators and expression using numeric and relational operators, mixed operands, type conversion, logical operators, bit operations, assignment operator, operator precedence and associativity.

**Fundamentals of C programming:** Structure of C program, writing and executing the first C program, Components of C language. Standard I/O in C.

**Unit3:**

**Conditional program execution:** Applying if and switch statements, nesting if and else, use of break and default with switch, program loops and iterations: use of while, do while and for loops, multiple loop variables, use of break and continue statements.

**Functions:** Introduction, types of functions, functions with array, passing values to functions, recursive functions.

**Unit 4:**

**Arrays:** Array notation and representation, manipulating array elements, using multi dimensional arrays. Structure, union, enumerated data types

**Unit 5:**

**Pointers:** Introduction, declaration, applications File handling, standard C preprocessors, defining and calling macros, conditional compilation, passing values to the compiler.

**Reference:**

1. The C programming by Kernighan Brain W. and Ritchie Dennis M., Pearson Education .
2. Computer Basics and C Programming by V.Rajaraman , PHI Learning Pvt. Limited – 2015.
3. Programming in C by Kochan Stephen G. Pearson Education – 2015.
4. Computer Concepts and Programming in C by D.S. Yadav and Rajeev Khanna, New Age International Publication .
5. Computer Concepts and Programming in C by Vikas Gupta, Wiley India Publication
6. Computer Fundamentals and Programming in C. Reema Thareja, Oxford Publication
7. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill
8. Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Third Edition , Cengage Learning - 2007.
9. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson Addison-Wesley, 2006.
10. Computer Concepts and Programming by Anami, Angadi and Manvi, PHI Publication
11. Computer Fundamental and C programming by K K Gupta, Acme Learning Publication

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**BTME-105 COMPUTER PROGRAMMING LAB**

- 1.WAP that accepts the marks of 5 subjects and finds the sum and percentage marks obtained by the student.
- 2.WAP that calculates the Simple Interest and Compound Interest. The Principal , Amount, Rate of Interest and Time are entered through the keyboard.
- 3.WAP to calculate the area and circumference of a circle.
- 4.WAP that accepts the temperature in Centigrade and converts into Fahrenheit using the formula  $C/5=(F-32)/9$ .
- 5.WAP that swaps values of two variables using a third variable.
- 6.WAP that checks whether the two numbers entered by the user are equal or not.
- 7.WAP to find the greatest of three numbers.
- 8.WAP that finds whether a given number is even or odd.
- 9.WAP that tells whether a given year is a leap year or not.
- 10.WAP that accepts marks of five subjects and finds percentage and prints grades according to the following criteria:  
Between 90-100%-----Print 'A'  
80-90%-----Print 'B'  
60-80%-----Print 'C'  
Below 60%-----Print 'D'
- 11.WAP that takes two operands and one operator from the user and perform the operation and prints the result by using Switch statement.
- 12.WAP to print the sum of all numbers up to a given number.
- 13.WAP to find the factorial of a given number.
- 14.WAP to print sum of even and odd numbers from 1 to N numbers.
- 15.WAP to print the Fibonacci series.
- 16.WAP to check whether the entered number is prime or not.
- 17.WAP to find the sum of digits of the entered number.
- 18.WAP to find the reverse of a number.
- 19.WAP to print Armstrong numbers from 1 to 100.
- 20.WAP to convert binary number into decimal number and vice versa.
- 21.WAP that simply takes elements of the array from the user and finds the sum of these elements.
- 23.WAP to find the minimum and maximum element of the array.

24. WAP to search an element in an array using Linear Search.
25. WAP to sort the elements of the array in ascending order using Bubble Sort technique.
26. WAP to add and multiply two matrices of order  $n \times n$ .
27. WAP that finds the sum of diagonal elements of a  $m \times n$  matrix.
28. WAP to implement `strlen()`, `strcat()`, `strcpy()` using the concept of Functions.
29. Define a structure data type `TRAIN_INFO`. The type contains Train No.: integer type Train name: string Departure Time: aggregate type `TIME` Arrival Time : aggregate type `TIME` Start station: string End station : string The structure type `Time` contains two integer members: hour and minute. Maintain a train timetable and implement the following operations:
  - (i) List all the trains (sorted according to train number) that depart from a particular section.
  - (ii) List all the trains that depart from a particular station at a particular time.
  - (iii) List all the trains that depart from a particular station within the next one hour of a given time.
  - (iv) List all the trains between a pair of start station and end station.
30. WAP to swap two elements using the concept of pointers.
31. WAP to compare the contents of two files and determine whether they are same or not.
32. WAP to check whether a given word exists in a file or not. If yes then find the number of times it occurs.

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**BTME-201 ENGINEERING MATHEMATICS - II**

**L T P- 3 1 0**

**Unit - 1: Ordinary Differential Equations**

Linear differential equations of  $n$ th order with constant coefficients, Complementary function and Particular integral, Simultaneous linear differential equations, Solution of second order differential equations by changing dependent & independent variables, Method of variation of parameters, Applications to engineering problems (without derivation).

**Unit - 2: Series Solution and Special Functions**

Series solution of second order ordinary differential equations with variable coefficient (Frobenius method), Bessel and Legendre equations and their series solutions, Properties of Bessel function and Legendre polynomials.

**Unit - 3: Laplace Transform**

Laplace transform, Existence theorem, Laplace transforms of derivatives and integrals, Initial and final value theorems, Unit step function, Dirac- delta function, Laplace transform of periodic function, Inverse Laplace transform, Convolution theorem, Application to solve simple linear and simultaneous differential equations.

**Unit - 4: Fourier Series and Partial Differential Equations**

Periodic functions, Dirichlet's Conditions, Fourier series of arbitrary periods, Euler's Formulae, Even and odd functions, Half range sine and cosine series, Gibbs Phenomena.

Solution of first order Lagrange's linear partial differential equations, Second order linear partial differential equations with constant coefficients.

**Unit - 5: Applications of Partial Differential Equations**

Classification of second order partial differential equations, Method of separation of variables for solving partial differential equations, Solution of one and two dimensional wave and heat conduction equations, Laplace equation in two dimension, Equation of transmission lines.

**Text Books:**

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2. B. V. Ramana, Higher Engineering Mathematics, Tata Mc Graw- Hill Publishing Company Ltd.
3. R.K.Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publishing House.

**Reference Books:**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Peter V. O' Neil, Advanced Engineering Mathematics, Thomas (Cengage) Learning.
3. Chandrika Prasad, Advanced Mathematics for Engineers, Prasad Mudranalaya
4. A. C. Srivastava & P. K. Srivastava, Engineering Mathematics, Vol. – II, PHI Learning Pvt. Ltd.
5. Rukmangadachari, Engineering Mathematics – II, Pearson Education.

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**BTME-202 ENGINEERING PHYSICS- II**

**LTP-**

**Unit – I: Crystal Structures and X-ray Diffraction**

Space lattice, basis, Unit cell, Lattice parameter, Seven crystal systems and Fourteen Bravais lattices, Co-ordination number, Atomic radius and Packing factor of different cubic structures, Crystal structure of NaCl and diamond, Lattice planes and Miller Indices, Diffraction of X-rays by crystal, Laue's experiment, Bragg's Law, Bragg's spectrometer. Compton Effect.

**Unit – II: Dielectric and Magnetic Properties of Materials**

**Dielectric Properties:** Dielectric constant and Polarization of dielectric materials, Relation between E, D and P, Types of Polarization (Polarizability). Equation of internal fields in liquid and solid (One-Dimensional), Clausius-Mossotti equation, Frequency dependence of dielectric constant, Dielectric Losses, Important applications of dielectric material, Ferroelectricity, Piezoelectricity.

**Magnetic Properties:** Magnetization, Origin of magnetic moment, Dia, para and ferro magnetism, Langevin's theory for diamagnetic material, Phenomena of hysteresis and its applications.

**Unit – III: Electromagnetic Theory**

Equation of continuity, Maxwell's Equations (Integral and Differential Forms) and its derivations, Displacement Current, Poynting vector and Poynting theorem, EM - Wave equation and its propagation characteristics in free space, non-conducting and conducting media, energy density of electromagnetic wave, Skin depth.

**Unit – IV: Band Theory of Solids**

Free electron Theory, Formation of bands in Solids, Classification of solids on band theory, Density of states, Fermi-Dirac distribution, Concept of effective mass, Charge carrier density (electrons and holes), Conductivity of semiconductors, carrier concentrations Fermi energy, Position of Fermi level in intrinsic and in extrinsic semiconductors. Temperature dependence of conductivity in semiconductors.

**Unit – V: Physics of some technologically important Materials**

**Superconductors:** Temperature dependence of resistivity in superconducting materials, Effect of magnetic field (Meissner effect), Temperature dependence of critical field, London equations, Josephson theory, persistent currents, Type I and Type II superconductors, BCS theory (Qualitative), High temperature superconductors and Applications of Super-conductors.



**Nano-Materials:** Basic principle of nanoscience and technology, structure, properties and uses of Fullerene, Carbon nanotubes Single and double walled nanotubes, synthesis of nanotubes, Properties and Applications of nanotubes.

**Reference books:**

1. Concept of Modern Physics - by Beiser (Tata Mc-Graw Hill)
2. Solid State Physics - by C. Kittel, 7th edition (Wiley Eastern)
3. Materials Science and Engineering - by V. Raghavan (Prentice- Hall India)
4. Solid State Physics - by S.O. Pillai, 5th edition (New Age International)
5. Introduction to Electrodynamics - by David J. Griffith (PH I)
6. Engineering Physics- C. Mani Naidu(Pearson)
7. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New D

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**PROFESSIONAL COMMUNICATION  
LABORATORY PRACTICALS**

**LTP-**

Interactive and Communicative Practical with emphasis on Oral Presentation/Spoken Communication based on International Phonetic Alphabets (I.P.A)

**LIST OF PRACTICALS**

1. Group Discussion: Practical based on Accurate and Current Grammatical Patterns.
2. Conversational skills for Interviews under suitable Professional Communication Lab conditions with emphasis on Kinesics.
3. Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistics / Kinesics.
4. Presentation Skills of Technical Paper/Project Reports/Professional Reports based on proper Stress and Intonation Mechanics.
5. Official /Public Speaking based on Rhythmic Patterns.
6. Theme-Presentation /Key-Note Presentation based on correct argumentation methodologies.
7. Individual Speech Delivery/Conferences with skills to defend Interjections/Quizzes.
8. Argumentative Skills/Role Play Presentation with Stress and Intonation.
9. Comprehensions Skills based on Reading and Listening Practical on a model Audio-Visual Usage.

**Reference Books**

1. Bansal R.K.& Harrison: Phonetics in English, Orient Longman , New Delhi.
2. Sethi & Dhamija: A Course in Phonetics and Spoken English, Prentice Hall, New Delhi.
3. L.U.B. Pandey & R.P.Singh, A Manual of Practical Communication, A.I.T.B.S. Pub. India Ltd. Krishan Nagar, Delhi.
4. Joans Daniel, English Pronouncing Dictionary, Cambridge Univ. Press.

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**BTME-203 ELEMENTS OF MECHANICAL ENGINEERING**

**L T P: 3-1-0**

**UNIT-I:**

**Force System:** Force, Parallelogram Law, Lami's theorem, Principle of Transmissibility of forces. Moment of a force, Couple, Varignon's theorem, Resolution of a force into a force and a couple. Resultant of coplanar force system. Equilibrium of coplanar force system, Free body diagrams, Determination of reactions.

**Concept of Centre of Gravity and Centroid and Area Moment of Inertia,** Perpendicular axis theorem and Parallel axis theorem

**UNIT-II:**

**Plane Truss:** Perfect and imperfect truss, Assumptions and Analysis of Plane Truss by Method of joints and Method of section.

**Beams:** Types of beams, Statically Determinate Beams, Shear force and bending moment in beams, Shear force and bending moment diagrams, Relationships between load, shear and bending moment.

**UNIT-III:**

**Simple stress and strain:** Normal and shear stresses. One Dimensional Loading; members of varying cross section, bars in series. Tensile Test diagram for ductile and brittle materials, Elastic constants, Strain energy.

**Bending (Flexural) Stresses:** theory of pure bending, neutral surface and neutral axis, stresses in beams of different cross sections.

**Engineering Materials:** Importance of engineering materials, classification, mechanical properties and applications of Ferrous, Nonferrous and composite materials.

**UNI-IV:**

**Basic Concepts and Definitions of Thermodynamics:** Introduction and definition of thermodynamics, Microscopic and Macroscopic approaches, System, surrounding and universe, Concept of continuum, Thermodynamic equilibrium, Thermodynamic properties, path, process and cycle, Quasi static process, Energy and its forms, Work and heat. Thermodynamic definition of work.

**Zerth law of thermodynamics:** Temperature and its' measurement.

**First law of thermodynamics:** First law of thermodynamics, Internal energy and enthalpy. First law analysis for non-flow processes. Non-flow work Steady flow energy equation; Boilers, Condensers, Turbine, Throttling process, Pumps etc.

**UNIT-V:**

**Second law:** Thermal reservoir, Kelvin Planck statement, Heat engines, Efficiency; Clausius' statement Heat pump, refrigerator, Coefficient of Performance. Carnot cycle, Carnot theorem and its corollaries. Clausius inequality, Concept of Entropy.

**Properties of pure substances:** P-v, T-s and h-s diagram, dryness fraction and steam tables. Rankine Cycle.

**Internal Combustion Engines:** Classification of I.C. Engines and their parts, working principle and comparison between 2 Stroke and 4 stroke engine, difference between SI and CI engines. P-v and T-s diagrams of Otto and Diesel cycles, comparison of efficiency.

**Books & References:**

1. Engineering Mechanics: Statics by J.L Meriam, Wiley
2. Engineering Mechanics : Statics and Dynamics by R. C. Hibbler, Pearson
3. Strength of Materials by Timoshenko & Young
4. Mechanics of Solid by R. C. Hibbler, Pearson
5. Engineering Thermodynamics by P.K.Nag, McGraw Hill
6. Thermodynamics An Engineering Approach by Cengel & Boles, McGraw Hill
7. Engineering Thermodynamics by P. Chattopadhyay, OXFORD Publication
8. Internal Combustion Engine by V Ganesan, McGraw Hill Pub .
9. An Introduction to Mechanical Engineering by Wickert & Lewis, Cengage Learning
10. Engineering Mechanics By S. S. Bhavikatti, K. G. Rajashekarappa, New Age International
11. Engineering Mechanics by R K Bansal, Laxmi Publications
12. Fundamentals of Mechanical Engineering by Sawhney, PHI
13. Basic Mechanical Engineering by Pravin Kumar, Pearson

***Department of Electrical Engineering***  
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***I Year II Semester***

**ELEMENTS OF MECHANICAL ENGINEERING LAB**

**LTP: 0-0-2**

**Note: Any 10 experiments (Minimum of 3 from each module) are to be conducted.**

**Module 1:**

1. To conduct the tensile test and determine the ultimate tensile strength, percentage elongation for a mild steel specimen.
2. To conduct the Impact-tests (Izod / Charpy) on Impact-testing machine to find the Impact Strength of the specimen.
3. To determine the hardness of the given specimen using Vicker/Brinell/Rockwell hardness testing machine.
4. To conduct experiment on Torsion of Rod/wire.

**Module 2:**

1. To Study the working of 2 stroke Diesel/Petrol engine.
2. To Study and working of 4 stroke Petrol/Diesel engine.
3. To Study the model of Babcock and Wilcox and Lancashire boiler.
4. To Study various types of Mounting and Accessories of Boilers.

**Module 3:**

1. To verify the parallelogram, and Triangle law.
2. To verify the polygon law of force.
3. To determine the coefficient of friction on inclined surface.
4. To determine the efficiency and Mechanical Advantage of Worm & Worm-wheel.
5. To conduct experiment on Force Analysis on simple truss and Jib-crane Apparatus.
6. To conduct friction experiment on screw-jack.

***Department of Electrical Engineering***  
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***I Year II Semester***

**BTME-204 PROFESSIONAL COMMUNICATION**

**LTP-**

<b>Unit-1 Fundamentals of Communications</b>	Technical Communication: features: Distinction between General And Technical Communication; Language as a tool of communications; Levels of communication: Interpersonal, Organizational, Mass communication; The flow of communication: Downward, Upward, Lateral/Horizontal (Peer group) : Importance of technical communication; Barriers to Communication.
<b>Unit-II Written Communication</b>	Words and Phrases: Word formation, Synonyms and Antonyms; Homophones; Select vocabulary of about 500-1000 New words; correct Usage: all Parts of Speech; Modals; Concord; Articles; Infinitives; Transformation of sentences; Requisites f Sentence Construction: Paragraph Development: Techniques and Methods- Inductive, Deductive, Spatial , Linear, Chronological etc.
<b>Unit-III Business Communication</b>	Principles, Sales & Credit letters; Claim and Adjustment Letters; Job Application and Resumes. Reports: Types; Significance; Structure, Style & Writing of Reports. Technical Proposal; Parts; Types; Writing of Proposal; Significance; Negotiation skills.
<b>Unit-IV Presentation Strategies and Soft Skills.</b>	Nuances and Modes of Delivery; Body Language; Dimensions of Speech: Syllable; Accent; Pitch; Rhythm; Intonation; Paralinguistic features of voice; Interpersonal communication: Definition; Types; Team work; Attitude; Way to improve Attitude Listening Skills : Types; Methods for improving Listening Skills.
<b>Unit –V Value- Based</b>	Following essays from the prescribed text book with emphasis on Mechanics of writing.

### **Text Readings**

- (i) Humanistic and Scientific Approaches to Human Activity by Moody E. Prior
- (ii) The Language of Literature and Science by A. Huxley
- (iii) Man and Nature by J. Bronowski
- (iv) Science and Survival by Barry Commoner
- (v) The Mother of the Sciences by A.J. Bahm.

### **Text Book**

1. Improve your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
2. Technical Communication- Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2007, New Delhi.
3. Functional skills in Language and Literature, by R.P. Singh, Oxford Univ. Press, 2005, New Delhi.

### **Reference Books**

1. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt. Ltd, 2011, New Delhi.
2. Business Correspondence and Report Writing by Prof. R.C., Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd. , 2001, New Delhi.
3. Word Power Made Easy by Norman Lewis, W.R. Goyal Pub. & Distributors, 2009, Delhi.

***Department of Electrical Engineering***  
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***I Year II Semester***

**BTME-205 BASIC ELECTRONICS**

**LTP-310**

**Unit I**

**PNP-N junction diode:** Introduction of Semiconductor Materials Semiconductor Diode: Depletion layer, V-I characteristics, ideal and practical, diode resistance, capacitance, Diode Equivalent Circuits, Transition and Diffusion Capacitance, Zener Diodes breakdown mechanism (Zener and avalanche) Diode Application: Series, Parallel and Series, Parallel Diode Configuration, Half and Full Wave rectification, Clippers, Clampers, Zener diode as shunt regulator, Voltage-Multiplier Circuits Special Purpose two terminal Devices :Light-Emitting Diodes, Varactor (Varicap) Diodes, Tunnel Diodes, Liquid-Crystal Displays.

**Unit-II**

**Bipolar Junction Transistors and Field Effect Transistor:** Bipolar Junction Transistor: Transistor Construction, Operation, Amplification action. Common Base, Common Emitter, Common Collector Configuration DC Biasing BJTs: Operating Point, Fixed-Bias, Emitter Bias, Voltage-Divider Bias Configuration. Collector Feedback, Emitter-Follower Configuration. Bias Stabilization. CE, CB, CC amplifiers and AC analysis of single stage CE amplifier (re Model ). Field Effect Transistor: Construction and Characteristic of JFETs. AC analysis of CS amplifier, MOSFET (Depletion and Enhancement)Type, Transfer Characteristic,

**Unit- III**

**Operational Amplifiers :**Introduction and Block diagram of Op Amp, Ideal & Practical characteristics of Op Amp, Differential amplifier circuits, Practical Op-Amp Circuits (Inverting Amplifier, Non inverting Amplifier, Unity Gain Amplifier, Summing Amplifier, Integrator, Differentiator).

**OPAMP Parameters:** Input offset voltage, Output offset voltage, Input biased current, Input offset current Differential and Common-Mode Operation

**Unit- IV**

**Electronic Instrumentation and Measurements:** Digital Voltmeter : Introduction, RAMP Techniques Digital Multimeters: Introduction Oscilloscope: Introduction, Basic Principle, CRT , Block Diagram of Oscilloscope, Simple CRO, Measurement of voltage, current phase and frequency using CRO, Introduction of Digital Storage Oscilloscope and Comparison of DSO with Analog Oscilloscope.



## **Unit- V**

**Fundamentals of Communication Engineering:** Elements of a Communication System, Need of Modulation, Electromagnetic spectrum and typical applications. Basics of Signal Representation and Analysis, Introduction of various analog modulation techniques, Fundamentals of amplitude modulation, Modulation and Demodulation Techniques of AM.

### **Text Books:**

1. Robert L. Boylestand / Louis Nashelsky “*Electronic Devices and Circuit Theory*”, Latest Edition, Pearson Education.
2. H S Kalsi, “*Electronic Instrumentation*”, Latest Edition, TMH Publication,.
3. George Kennedy, “*Electronic Communication Systems*”, Latest Edition, TMH,

### **Reference Books:**

1. David A. Bell, “*Electronic Devices and Circuits*”, Latest Edition, Oxford University Press.
2. Jacob Millman, C.C. Halkias, Staya brataJit, “*Electronic Devices and Circuits*”, Latest Edition , TMH.
3. David A. Bell, *Electronic Instrumentation and Measurements*, Latest Edition, Oxford University Press India.

***Faculty of Engineering & Technology***  
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***Shivpuri (MP)***



**Evaluation Scheme & Syllabus for**  
**Department of Mechanical Engineering**  
**B.Tech. Second Year**  
**(III & IV Semester)**

**(Effective from session 2019-20)**

# EVALUATION SCHEME

SEMESTER III						
		THEORY		PRACTICAL		TOTAL
SUBJECT CODE	SUBJECT NAME	SESS.(30)	EXT.(70)	SESS.(25)	EXT.(25)	
BTME-301	Mathematics-III	30	70	NA	NA	100
BTME-302	Fluid Mechanics	30	70	25	25	150
BTME-303	Material Science	30	70	25	25	150
BTME-304	Mechanics of solid	30	70	NA	NA	100
BTME-305	Thermodynamics	30	70	25	25	150
BTME-306	Environment & Ecology	30	70	NA	NA	100
SEMESTER IV						
		THEORY		PRACTICAL		TOTAL
SUBJECT CODE	SUBJECT NAME	SESS.(30)	EXT.(70)	SESS.(25)	EXT.(25)	
BTME-401	Nano Science	30	70	NA	NA	100
BTME-402	Electrical Machines & Controls	30	70	25	25	150
BTME-403	Applied Thermodynamics	30	70	NA	NA	100
BTME-404	Manufacturing Science & Technology -I	30	70	25	25	150
BTME-405	Measurement and Metrology	30	70	NA	NA	100
BTME-406	Universal Human Value & Proff. Ethics	30	70	NA	NA	100
	Machine Drawing	NA	NA	25	25	50

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II Year III Semester***

**BTME 301: ENGINEERING MATHS–III**

**UNIT I**

**Numerical Techniques – I:** Zeroes of transcendental and polynomial equations, Bisection method, Regula-falsi method, Newton-Raphson method, Rate of convergence of above methods.

**Interpolation:** Finite differences, Newton's forward and backward interpolation. Lagrange's and Newton's divided difference formula for unequal intervals.

**UNIT II**

**Numerical Techniques –II:** Solution of system of linear equations, Matrix Decomposition methods, Jacobi method, Gauss- Seidal method.

**Numerical differentiation & Integration:** Trapezoidal rule, Simpson's one third and three-eight rules, Solution of ordinary differential equations (first order, second order and simultaneous) by Euler's, Picard's and fourth-order Runge- Kutta methods.

**UNIT III**

**Statistical Techniques:** Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of least squares, Fitting of straight lines, Polynomials, Exponential curves, Correlation, Linear, non – linear and multiple regression analysis, Binomial, Poisson and Normal distributions. Tests of significations: Chi-square test, t-test.

**UNIT IV**

**Function of Complex variable:** Analytic function, C-R equations, Harmonic Functions, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions, Taylor's and Laurent's series, Singularities, Zeroes and Poles, Residue theorem.

**UNIT V**

**Integral Transforms:** Fourier integral, Complex Fourier transform, Inverse Transforms, Convolution Theorems, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equations, wave equations and Laplace equations, Z-Transform and its application to solve difference equation.

**Text Books:**

1. R.K. Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publication House..
2. Jain, Iyenger Jain, Numerical Methods for Scientific and Engineering Computation, New Age International, New Delhi
3. J.N. Kapur, Mathematical Statistics, S. Chand & company Ltd.

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**BTME302: FLUID MECHANICS**

**UNIT I :** Fluid and continuum, Physical properties of fluids, Rheology of fluids. Pressure-density-height relationship, manometers, pressure transducers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis.

**UNIT II :** Types of fluid flows: Continuum & free molecular flows. Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two and three dimensional flows, streamlines, continuity equation for 3D and 1D flows, circulation, stream function and velocity potential.

**UNIT III:** Potential Flow: source, sink, doublet and half-body. Equation of motion along a streamline and its integration, Bernoulli's equation and its applications- Pitot tube, orifice meter, venturimeter and bend meter, notches and weirs, momentum equation and its application to pipe bends. resistance to flow, Minor losses in pipe in series and parallel, power transmission through a pipe, siphon, water hammer, three reservoir problems and pipe networks.

**UNIT IV :**Equation of motion for laminar flow through pipes, Stokes' law, transition from laminar to turbulent flow, turbulent flow, types of turbulent flow, isotropic, homogenous turbulence, scale and intensity of turbulence, measurement of turbulence, eddy viscosity, mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces, Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sub-layer, separation and its control.

**UNIT V :** Drag and lift, drag on a sphere, a two dimensional cylinder, and an aerofoil, Magnus effect. Similarity Laws: geometric, kinematics and dynamic similarity, undistorted and distorted model studies, Dimensional analysis, Buckingham's Pi theorem, important dimensionless numbers and their significance.

**BOOKS:**

1. Hibbler, "Fluid Mechanics in SI Units" 1/e Pearson Education, Noida.
2. Fox & Donald, "Introduction to Fluid Mechanics" John Wiley & Sons Pvt Ltd,
3. Cengel & Cimbala, "Fluid Mechanics" TMH, New Delhi.
4. AK Jain "Fluid Mechanics" Khanna Publication.
5. Pnueli & Gutfinger, "Fluid Mechanics" Cambridge University Press
6. Modi & Seth "Hydraulics & Fluid Mechanics" Standard Publications.
7. Gupta, "Fluid Mechanics & Hydraulic Machines" Pearson Education, Noida

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II Year III Semester***

**BTME302 LIST OF PRACTICAL**

1. To verify the momentum equation using the experimental set-up on impact of jet.
2. To determine the coefficient of discharge of an orifice of a given shape. Also to determine the coefficient of velocity and the coefficient of contraction of the orifice mouth piece.
3. To calibrate an orifice meter and study the variation of the co-efficient of discharge with the Reynolds number.
4. To calibrate a Venturimeter and study the variation of the co-efficient of discharge with the Reynolds number.
5. To calibrate a bend meter and study the variation of the co-efficient of discharge with the Reynolds number.
6. To draw a flow-net using Electrical Analogy Method.
7. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
8. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
9. To study the variation of friction factor, 'f' for turbulent flow in commercial pipes.
10. To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.

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**BTME303: MATERIAL SCIENCE**

**UNIT I : Introduction:** Importance of materials, historical perspective, Future aspects of engg. materials.

**Crystal Structure:** brief on BCC, FCC and HCP Structures, coordination number and atomic packing factors. Bravais lattices, Miller indices, crystal imperfections-point line and surface imperfections. Atomic Diffusion: Phenomenon, Ficks laws of diffusion, factors affecting diffusion.

**Ferrous and non-ferrous materials:** Properties, Composition and uses of Grey cast iron, malleable iron, SG iron and steel, copper alloys-brasses and bronzes, Aluminium alloys. Introduction to BIS & ASTM codes and practice on material and testing.

**UNIT II :Mechanical Behaviors:** Stress-strain diagram showing ductile and brittle behaviour of materials, mechanical properties in plastic range, yield strength off set yield strength, ductility, ultimate tensile strength, toughness, Plastic deformation of single crystal by slip and twinning, Hardness Tests.

**Fracture Creep Fatigue:** Fracture: Type I, Type II and Type III. Creep: Description of the phenomenon with examples. Three stages of creep, creep properties, stress relaxation. Fatigue: Types of fatigue loading with examples, Mechanism of fatigue, fatigue properties, fatigue testing and S-N diagram.

**UNIT III :Solidification:** Mechanism of solidification, Homogenous and Heterogeneous nucleation, crystal growth, cast metal structures. Phase Diagram I: Solid solutions Hume Rothary rule, substitution and interstitial solid solutions, intermediate phases, Gibbs phase rule.

**Phase Diagram:** Construction of equilibrium diagrams involving complete and partial solubility, lever rule. Iron carbon equilibrium diagram description of phases, solidification of steels and cast irons, invariant reactions.

**UNIT IV :Heat Treating of Metals:** TTT curves, continuous cooling curves, annealing and its types. Normalizing, hardening, tempering, mastempering, austempering, hardenability, surface hardening methods like carburizing, cyaniding, nitriding, flame hardening and induction hardening, age hardening of aluminium-copper alloys.

Comparative study of microstructure of various Ferrous, nonferrous metals and alloys.

## **UNIT V**

**Composite materials:** Definition, classification, types of matrix materials & reinforcements, fundamentals of production of FRP's and MMC's advantages and application of composites.

**Ceramics:** Structure types and properties and applications of ceramics. Mechanical/ Electrical behavior and processing of Ceramics.

**Plastics:** Various types of polymers/ plastics and its applications. Mechanical behavior and processing of plastics, Future of plastics. Introduction to Smart materials & Nano-materials and their potential applications.

### **Books and References:**

1. Elements of Material Science & Engineering by Van Vlack, Pearson
2. Callisters Materials Science and Engineering, by William D. Callister, Jr, (Adopted by R. Balasubramaniam), Wiley India Pvt. Ltd
3. Material Science and Engineering by Smith, Hashemi and Prakash, MCGRAW HILL INDIA
4. The Science and Engineering of materials, by Askeland & Balani, Cengage Learning
5. Introduction to Materials Science for Engineers by Shackelford, Pearson
6. Material Science by Narula, MC-GRAW HILL INDIA.
7. Materials Science and Engineering - A First Course by Raghavan, PHI



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**BTME303: LIST OF PRACTICAL**

**(A). Experiments on Material Science** (at least 5 of the following):

1. Preparation of a plastic mould for small metallic specimen.
2. Preparation of specimen for micro structural examination-cutting, grinding, polishing, etching.
3. Determination of grain size for a given specimen.
4. Comparative study of microstructures of different specimens of different materials (mild steel, gray C.I., brass, copper etc.)
5. Experiments on heat treatment such as annealing, normalizing, quenching, case hardening and comparison of hardness before and after heat treatment.
6. Material identification of, say, 50 common items kept in a box.
7. Experiment on Faraday's law of electrolysis.

**(B) Experiments on Material Testing** (at least 5 of the following):

1. Strength test of a given mild steel specimen on UTM with full details and stress versus strain plot on the machine.
2. Impact test on impact testing machine like Charpy, Izod or both.
3. Hardness test of given specimen using Rockwell and Vickers/Brinell testing machines.
4. Spring index test on spring testing machine.
5. Fatigue test on fatigue testing machine.
6. Creep test on creep testing machine.
7. Torsion test of a rod using torsion testing machine.

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**BTME304: MECHANICS OF SOLIDS**

**UNIT I : Compound stress and strains:** Introduction, normal stress and strain, shear stress and strain, stresses on inclined sections, strain energy, impact loads and stresses, state of plane stress, principal stress and strain, maximum shear stress, Mohr's stress circle, three dimensional states of stress & strain, equilibrium equations, generalized Hook's law, theories of failure. Thermal Stress.

**UNIT II : Stresses in Beams:** Pure Bending, normal stresses in beams, shear stresses in beams due to transverse and axial loads, composite beams.

**Deflection of Beams:** Equation of elastic curve, cantilever and simply supported beams, Macaulay's method, area moment method, fixed and continuous beams

**Torsion:** Torsion combined bending & torsion of solid & hollow shafts, torsion of thin walled tubes.

**UNIT III : Helical and Leaf Springs:** Deflection of springs by energy method, helical springs under axial load and under axial twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously both for open and closed coiled springs, laminated springs.

**Columns and Struts:** Buckling and stability, slenderness ratio, combined bending and direct stress, middle third and middle quarter rules, struts with different end conditions, Euler's theory for pin ended columns, effect of end conditions on column buckling, Rankine Gordon formulae, examples of columns in mechanical equipments and machines.

**UNIT IV: Thin cylinders & spheres:** Introduction, difference between thin walled and thick walled pressure vessels, thin walled spheres and cylinders, hoop and axial stresses and strain, volumetric strain.

**Thick cylinders:** Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures, compound cylinders, stresses in rotating shaft and cylinders, stresses due to interference fits.

**UNIT V: Curved Beams:** Bending of beams with large initial curvature, position of neutral axis for rectangular, trapezoidal and circular cross sections, stress in crane hooks, stress in circular rings subjected to tension or compression.

**Unsymmetrical Bending:** Properties of beam cross-section, slope of neutral axis, stress and deflection in unsymmetrical bending, determination of shear center and flexural axis (for symmetry about both axis and about one axis) for I-section and channel section.

### **Books and References:**

1. Strength of Material by Rattan, MCGRAW HILL INDIA
2. Mechanics of material by Gere, Cengage Learning
3. Mechanics of Materials by Beer, Jhonston, DEwolf and Mazurek, MCGRAW HILL INDIA
4. Strength of Materials by Pytel and Singer, Harper Collins
- 5 . Strength of Materials by Jindal, Pearson Education.
6. Introduction to Solid Mechanics by Shames, Pearson.

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**BTME305: THERMODYNAMICS**

**UNIT I :Review of Fundamental Concepts and Definitions:** Introduction- Basic Concepts: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle Reversibility Quasi – static Process, Irreversible Process, Causes of Irreversibility Energy and its forms, Work and heat (sign convention), Gas laws, Ideal gas, Real gas, Law of corresponding states, Dalton’s law, Amagat’s law, Property of mixture of gases.

**Zeroth law of thermodynamics:** Concept of Temperature and its’ measurement, Temperature scales.

**First law of thermodynamics:** Thermodynamic definition of work, Displacement work and flow work, Displacement work for various non flow processes, Joules’ experiment, First law analysis for closed system (non flow processes), Internal energy and enthalpy. Limitations of first law of thermodynamics, PMM-I. Steady flow systems and their analysis, Steady flow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc. Analysis of unsteady processes such as filling and evacuation of vessels with and without heat transfer.

**UNIT II :Second law of thermodynamics:** Thermal reservoirs, Energy conversion, Heat engines, Efficiency, Reversed heat engine, Heat pump, Refrigerator, Coefficient of Performance, Kelvin Planck and Clausius statement of second law of thermodynamics, Equivalence of the two statements. Reversible and irreversible processes, Carnot cycle and Carnot engine, Carnot theorem and it’s corollaries, Thermodynamic Temperature Scale, PMM-II.

**Entropy :** Clausius inequality, Concept of Entropy, Entropy change of pure substance in different thermodynamic processes, Tds equation, Principle of entropy increase, T-S diagram, Statement of the third law of thermodynamics.

**UNIT III :Availability and Irreversibility:** Available and unavailable energy, Availability and Irreversibility, Second law efficiency, Helmholtz & Gibb’s function.

**Thermodynamic relations:** Conditions for exact differentials. Maxwell relations, Clapeyron equation, Joule-Thompson coefficient and Inversion curve. Coefficient of volume expansion, Adiabatic and Isothermal compressibility.

**UNIT IV :Properties of steam and Rankine cycle:** Pure substance, Property of Pure Substance (steam), Triple point, Critical point, Saturation states, Sub-cooled liquid state, Superheated vapour state, Phase transformation process of water, Graphical representation of pressure, volume and temperature, P-T, P-V and P-h diagrams, T-S and H-S diagrams, use of property diagram, Steam-Tables & Mollier chart, Dryness factor and its measurement, processes involving steam in closed and open systems. Simple Rankine cycle.

**Air-water vapour mixture and Psychrometry:** Psychrometric terms and their definitions, Psychrometric chart, Different Psychrometric processes and their representation on Psychrometric chart.

**UNIT V:Refrigeration Cycles:** Reversed Carnot Cycle for gas and vapour. Refrigeration capacity, unit of refrigeration. Air Refrigeration cycles; Reversed Brayton Cycle and Bell Coleman Cycle. Vapour compression refrigeration cycle; simple saturated cycle and actual vapour compression refrigeration cycle. Analysis of cycles, effect of superheating, sub-cooling and change in evaporator and condenser pressure on performance of vapour compression refrigeration cycle. Refrigerants; their classification and desirable properties. Vapour absorption refrigeration system.

#### **Books and References:**

1. Basic and Applied Thermodynamics by PK Nag, MCGRAW HILL INDIA
2. Thermodynamics for Engineers by Kroos & Potter, Cengage Learning
3. Thermodynamics by Shavit and Gutfinger, CRC Press.
4. Thermodynamics- An Engineering Approach by Cengel, MCGRAW HILL INDIA.
5. Basic Engineering Thermodynamics, Joel, Pearson.
6. Fundamentals of Engineering Thermodynamics by Rathakrishnan, PHI.
7. Engineering Thermodynamics by Dhar, Elsevier.
8. Engineering Thermodynamics by CP Arora.

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**BTME305: THERMODYNAMICS**

**BTME305 LIST OF PRACTICAL**

1. Study of Fire Tube boiler.
2. Study of Water Tube boiler .
3. Study and working of Two stroke petrol Engine.
4. Study and working of Four stroke petrol Engine.
5. Determination of Indicated H.P. of I.C. Engine by Morse Test.
6. Prepare the heat balance sheet for Diesel Engine test rig.
7. Prepare the heat balance sheet for Petrol Engine test rig.
8. Study and working of two stroke Diesel Engine.
9. Study and working of four stroke Diesel Engine.
10. Study of Velocity compounded steam turbine.
11. Study of Pressure compounded steam turbine .
12. Study of Impulse & Reaction turbine.
13. Study of steam Engine model.
14. Study of Gas Turbine Model.

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**BTME-306 : ENVIRONMENT & ECOLOGY**

**UNIT-I:** Definition, Scope & Importance, Need For Public Awareness • Environment definition, Eco system - Balanced ecosystem, Human activities - Food, Shelter, Economic and social Security. Effects of human activities on environment - Agriculture, Housing, Industry, Mining and Transportation activities, Basics of Environmental Impact Assessment. Sustainable Development.

**UNIT-II :** Natural Resources Water Resources - Availability and Quality aspects. Water borne diseases, Water Induced diseases, Fluoride problem in drinking water. Mineral Resources, Forest Wealth, Material Carbon, Nitrogen and Sulphur Cycles. Energy - Different types of energy, Electromagnetic radiation. Conventional and Non-Conventional sources - Hydro Electric, Fossil Fuel based Nuclear, Solar, Biomass and Bio.gas. Hydrogen gas and alternative future source of Energy.

**UNIT-III:** Environmental Pollution and their effects. Water pollution, Land pollution. Noise pollution, Public Health aspects, Air Pollution, Solid waste management, e-waste management Current Environmental Issues of Importance: Population Growth, Climate Change and Global warming- Effects, Urbanization, Automobile pollution. Acid Rain Ozone Layer depletion, Animal Husbandry,

**UNIT-IV :** Environment-ill Protection- Role of Government, Legal aspects, initiatives by Non-governmental organizations (NGO), Environmental Education,

**Text books:**

1. Environmental Studies - Benny Joseph - Tata McgrawHiU-2008
2. Environmental Studies - Dr. D.I. Manjunath, Pearson Education-2006.
3. Environmental Science & Technology - M. Anaji Reddy - BS Publication ..

***Department of Mechanical Engineering  
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P.K. University, Shivpuri (MP)  
II Year IV Semester***

**BTME-401: NANO SCIENCE**

**UNIT I : Introduction:** Definition of Nano-Science and Nano Technology, Applications of Nano-Technology. Quantum Theory for Nano Science: Particle in a box, Potential step: Reflection and tunneling (Quantumleak). Penetration of Barrier, Potential box (Traped particle in 3D: Nanodot). Physics of Solid State Structures: Size dependence of properties, crystal structures, face centered cubic nanoparticles; Tetrahedrally bounded semiconductor structures; lattice vibrations. Energy Bands: Insulators, semiconductor and conductors; Reciprocal space; Energy bands and gaps of semiconductors; effective masses; Fermi Surfaces. Localized Particles: Acceptors and deep traps; mobility; Excitons.

**UNIT II: Quantum Nanostructure:** Preparation of quantum wells, Wires and Dots, Size and Dimensionality effect, Fermi gas; Potential wells; Partial confinement; Single electron Tunneling, Infrared detectors; Quantum dot laser superconductivity. Properties of Individual Nano Particles: Metal nano clusters; Magic numbers; Theoretical modeling of nanoparticles; geometric structure; electronic structure; Reactivity, Fluctuations, Magnetic clusters; Bulk to nanostructure, semiconducting nanoparticles, Optical Properties, Photofragmentation, Columbic Explosion. Rare Gas & amp; Molecular clusters; Inert gas clusters; Superfluid clusters; Molecular clusters.

**UNIT III: Growth Techniques of Nano materials:** Litho and Nonlitho graphic techniques, RF Plasma, Chemical methods, Thermolysis, Pulsed laser method, Self-assembly, E-beam evaporation, Chemical Vapour Deposition, Pulsed Laser Deposition.

**UNIT IV: Methods of Measuring Properties:** Structure: X-ray Diffraction Technique, Particle size determination, surface structure. Microscopy: Scanning Probe Microscopy (SPM), Atomic Force Microscopy (AFM), Field Ion Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy (TEM). Spectroscopy: Infra red and Raman Spectroscopy, X-ray Spectroscopy, Magnetic resonance, Optical and Vibrational Spectroscopy, Luminescence.

**UNIT V: Carbon Nano Materials: Bucky Ball and Carbon Nano- Tubes:** Nano structures of carbon (fullerene), Fabrication, Structure. Electrical, Mechanical and Vibrational properties and applications. Nano Diamond, Boron Nitride Nano-tubes, Single Electron Transistors, Molecular Machine, Nano-Biometrics, Nano Robots.

**Text/Reference Books:**

1. CP Poole Jr, FJ Owens, "Introduction to Nanotechnology".



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**II Year IV Semester**

**BTME402: ELECTRICAL MACHINES & CONTROLS**

**UNIT I : Single phase Transformer:** Efficiency Voltage regulation, O.C.& S.C. Tests.

**Three Phase Transformer:** Three phase transformer connections, 3-phase to 2-phase or 6-phase connections and their applications. **Auto Transformer:** Volt- Amp relations, efficiency, advantages & disadvantages, applications. **D.C. Motors:** Concept of starting, speed control, losses and efficiency.

**UNIT II : Three phase Induction Motor:** Construction, equivalent circuit, torque equation and torque- slip characteristics, speed control. **Alternator:** Construction, e.m.f. equation, Voltage regulation and its determination by synchronous impedance method. **Synchronous Motor:** Starting, effect of excitation on line current (V-curves), synchronous condenser. **Servo Motor:** Two phase A.C. servo motor & its application.

**UNIT III : Modeling of Mechanical System:** linear mechanical elements, force-voltage and force current analogy, electrical analog of simple mechanical systems; concept of transfer function & its determination for simple systems. **Control System:** Open loop & closed loop controls, servo mechanisms; concept of various types of system. **Signals:** Unit step, unit ramp, unit impulse and periodic signals with their mathematical representation and characteristics.

**UNIT IV : Time Response Analysis:** Time response of a standard second order system and response specifications, steady state errors and error constants. **Stability:** Concept and types of stability, Routh Hurwitz Criterion and its application for determination of stability, limitations; Polar plot, Nyquist stability Criterion and assessment of stability.

**UNIT V : Root Locus Techniques:** Concept of root locus, construction of root loci. **Frequency Response Analysis:** Correlation between time and frequency responses of a second order system; Bode plot, gain margin and phase margin and their determination from Bode and Polar plots. **Process control:** Introduction to P, PI and PID controllers their characteristics, representation and applications.

**Text and Reference Books:**

1. IJ Nagrath & D. P. Kothari, "Electrical machines" Tata McGraw Hill.
2. BR Gupta & Vandana Singhal, "Fundamentals of Electrical Machines", New Age International.
3. K. Ogata, "Modern Control Engineering" Prentice Hall of India.
4. BC Kuo, "Automatic Control systems." Wiley India Ltd.

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**BTME402: ELECTRICAL MACHINES & CONTROLS**

**List of Practical**

**A. Electrical Machines**

1. To obtain speed-torque characteristics and efficiency of a dc shunt motor by direct loading.
2. To obtain efficiency of a dc shunt machine by no load test.
3. To obtain speed control of dc shunt motor using (a) armature voltage control (b) field control.
4. To determine polarity and voltage ratio of single phase and three phase transformers.
5. To obtain efficiency and voltage regulation by performing O.C. and S.C. tests on a single phase transformer at full load and 0.8 p.f. loading.
6. To obtain 3-phase to 2-phase conversion using Scott connection.

**B. Control Systems:**

1. To determine transient response of a second order system for step input for various values of constant 'K' using linear simulator unit and compare theoretical and practical results.
2. To study P, PI and PID temperature controller for an oven and compare their performance.
3. To determine speed – torque characteristics of an a.c. 2-phase servo motor.
4. To study and calibrate temperature using Resistance Temperature Detector (RTD)

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II Year IV Semester***

**BTME403: APPLIED THERMODYNAMICS**

**UNIT I**

**Gas power cycle:** 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 cycles. **I.C. Engine:** Testing of two stroke and four stroke SI and CI engines for performance Related numerical problems, heat balance, Motoring Method, Willian's line method, swinging field dynamometer, Morse test.

**UNIT II**

**Vapour Power cycles:** Rankine cycle, effect of pressure and temperature on Rankine cycle, Reheat cycle, Regenerative cycle, Feed water heaters, Binary vapour cycle, Combined cycles, Cogeneration. **Fuels and Combustion:** Combustion analysis, heating values, air requirement, Air/Fuel ratio, standard heat of reaction and effect of temperature on standard heat of reaction, heat of formation, Adiabatic flame temperature.

**UNIT III**

**Boilers:** Classifications and working of boilers, boiler mountings and accessories, Draught and its calculations, air pre heater, feed water heater, super heater. Boiler efficiency, Equivalent evaporation. Boiler trial and heat balance. **Condenser:** Classification of condenser, air leakage, condenser performance parameters.

**UNIT IV**

**Steam and Gas Nozzles:** Flow through Convergent and convergent-divergent nozzles, variation of velocity, area and specific volume, Choked flow, throat area, Nozzle efficiency, Off design operation of nozzle, Shock waves stationary normal shock waves, Effect of friction on nozzle, Super saturated flow.

**Steam Turbines :** Classification of steam turbine, Impulse and Reaction turbines, Staging, Stage and Overall efficiency, Reheat factor, Bleeding, Velocity diagram of simple and compound multistage impulse and reaction turbines and related calculations, work done, efficiencies of reaction, Impulse reaction turbines, state point locus, Losses in steam turbines, Governing of turbines, Comparison with steam engine.

## **UNIT V**

**Gas Turbine:** Gas turbine classification, Brayton cycle, Principles of gas turbine, Gas turbine cycles with intercooling, reheat and regeneration and their combinations, Stage efficiency, Polytropic efficiency. Deviation of actual cycles from ideal cycles.

**Jet Propulsion:** Introduction to the principles of jet propulsion, Turbojet and turboprop engines and their processes, Principle of rocket propulsion, Introduction to Rocket Engine.

### **Books and References:**

1. Basic and Applied Thermodynamics by P.K. Nag, MCGRAW HILL INDIA
2. Applied thermodynamics by Onkar Singh, New Age International
3. Applied Thermodynamics for Engineering Technologists by Eastop, Pearson Education
4. Applied Thermodynamics by Venkanna And Swati, PHI
5. Theory of Stream Turbine by WJ Kearto

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**BTME404: MANUFACTURING SCIENCE & TECHNOLOGY-I**

**UNIT I**

**Introduction:** Importance of manufacturing. Economic & technological considerations in manufacturing. Classification of manufacturing processes. Materials & manufacturing processes for common items. **Metal Forming Processes:** Elastic & plastic deformation, yield criteria (Mises' and Tresca's). Hot working versus cold working. Analysis (equilibrium equation method) of Forging process for load estimation with sliding friction, sticking friction and mixed condition for slab and disc. Work required for forging, Hand, Power, Drop Forging.

**UNIT II**

**Metal Forming Processes (continued):** Analysis of Wire/strip drawing and maximum-reduction, Tube drawing, Extrusion and its application. Condition for Rolling force and power in rolling. Rolling mills & rolled-sections. Design, lubrication and defects in metal forming processes.

**UNIT III**

**Sheet Metal working:** Presses and their classification, Die & punch assembly and press work methods and processes. Cutting/Punching mechanism, Blanking vs. Piercing. Compound vs. Progressive die. Flat-face vs Inclined-face punch and Load (capacity) needed. Analysis of forming process like cup/deep drawing. Bending & spring-back.

**UNIT IV**

**Casting (Foundry):** Basic principle & survey of casting processes. Types of patterns and allowances. Types and properties of moulding sand, sand testing. Elements of mould and design considerations, Gating, Riser, Runnes, Core. Solidification of casting, Sand casting, defects & remedies and inspection. Cupola furnace. Die Casting, Centrifugal casting, Investment casting, Continuous casting, CO2 casting and Stir casting etc.

**UNIT V**

**Unconventional Metal forming processes:** Unconventional metal forming or High Energy Rate Forming (HERF) processes such as explosive forming, electromagnetic, electro-hydraulic forming. **Powder Metallurgy:** Introduction to Powder metallurgy manufacturing process. Application and, advantages. **Jigs & Fixtures:** Locating & Clamping devices & principles. Jigs and Fixtures and its applications. **Manufacturing of Plastic components:** Review of plastics, and its past, present & future uses. Injection moulding. Extrusion of plastic section. Welding of plastics. Future of plastic & its applications. Resins & Adhesives.

**Books and References :**

1. Manufacturing Science by Ghosh and Mallik
2. Production Engg. Science by PC Pandey
3. Manufacturing Engineering & Technology by Kalpakjian, Pearson
4. Manufacturing Technology by P.N. Rao., MCGRAW HILL INDIA
5. Manufacturing Processes by Lindberg, Pearson.
6. Manufacturing Processes for Engineering materials by Kalpakjian, Pearson.

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**BTME404: MANUFACTURING SCIENCE & TECHNOLOGY-I**

**List of Practical:**

1. Design of pattern for a desired casting (containing hole).
2. Pattern making with proper allowance.
3. Making a mould (with core) and casting.
4. Sand testing methods (at least one, such as grain fineness number determination)
5. Injection moulding with plastics
6. Forging - hand forging processes
- 7 Jigs & Fixture experiment
8. Tube bending with the use of sand and on tube bending m/c.
9. Press work experiment such as blanking/piercing, washer, making etc.
10. Wire drawing/extrusion on soft material.
11. Rolling-experiment.

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**BTME405: MEASUREMENT AND METROLOGY**

**UNIT I**

**Mechanical Measurements:** Introduction to measurement and measuring instruments. General concept–Generalized measurement system and its elements-Unit sand standards-measuring instruments: sensitivity, stability, range, accuracy and precision-static and dynamic response-repeatability-systematic, Source of error, statistical analysis of error and random errors-correction, calibration. Dimensional and geometric tolerance

**Sensors and Transducers:** Types of sensors, types of transducers and their characteristics.

**UNIT II**

**Time Related Measurements:** Stroboscope, frequency measurement by direct comparison. Measurement of displacement **Measurement of Pressure:** Gravitational, directing acting, elastic and indirect type pressure transducers. Measurement of very low pressures (high vacuum).

**Strain Measurement:** Types of strain gauges and their working, strain gauge circuits, temperature compensation. Strain rosettes, calibration.

**UNIT III**

**Flow Measurement:** Hot Wire Anemometry, Laser Doppler Velocity Meter, Rotameter

**Temperature Measurement:** Thermometers, bimetallic thermocouples, thermistors and pyrometers. **Measurements of Force, Torque:** Different types of load cells, elastic transducers, pneumatic & hydraulic systems. Seismic instruments **Measurements of Acceleration, and Vibration:** Accelerometers vibration pickups and decibel meters, vibrometers.

**UNIT IV**

**Coordinate measuring machine (CMM):** Need, constructional features and types,

**Metrology and Inspection:** Standards of linear measurement, line and end standards. Interchange ability and standardization. Linear and angular measurements devices and systems

**Comparators:** Sigma, Johansson's Microkrator. Limit gauges classification, Taylor's Principle of Gauge Design

## **UNIT-V**

**Limits, Fits & Tolerance and Surface roughness:** Introduction to Limits, Fits, Tolerances and IS standards, Limit-gauges, and surface-roughness. Measurement of geometric forms like straightness, flatness, roundness. Tool makers microscope, profile projector, autocollimator.

**Interferometry:** principle and use of interferometry, optical flat. Measurement of screw threads and gears. Surface texture: quantitative evaluation of surface roughness and its measurement.

### **Books and References:**

1. Experimental Methods for Engineers by Holman, MCGRAW HILL INDIA
2. Mechanical Measurements by Beckwith, Pearson
3. Principles of Measurement Systems by Bentley, Pearson
4. Metrology of Measurements by Bewoor and Kulkarni, MCGRAW HILL INDIA
5. Measurement Systems, Application Design by Doeblein, MCGRAW HILL INDIA
6. Hume KJ, "Engineering Metrology", MacDonald and Co
7. Jain, RK, "Engineering Metrology" Khanna Publishers
8. Jain, R.K., "Mechanical Measurement" Khanna Publishers
9. Gupta SC, Engineering Metrology, Dhanpat Rai Publications

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### **BTME405: MEASUREMENT AND METROLOGY**

#### **List of Practical**

1. Study the working of simple measuring instruments- Vernier calipers, micrometer, and tachometer.
2. Measurement of effective diameter of a screw thread using 3 wire methods.
3. Study and Measurement of angle using sine bar & slip gauges.
4. Study & angular measurement using level protector.
5. Adjustment of spark plug gap using feeler gauges.
6. Study of dial indicator & its constructional details.
7. Use of dial indicator to check a shape run use.
8. Use of dial indicator and V Block to check the circularity and plot the polar Graph.
9. Study and understanding of limits, fits & tolerances.
10. To study the displacement using LVDT
11. Study of temperature measuring equipments.
12. Experiment on measurement of flow.



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**BTME406: MACHINE DRAWING-II LAB**

**UNIT 1:**

- Course Introduction** - Need, Basic Guidelines, Content and Process for Value Education
1. Understanding the need, basic guidelines, content and process for Value Education
  2. Self Exploration–what is it? - its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self exploration
  3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
  4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
  5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
  6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

**UNIT 2:**

**Understanding Harmony in the Human Being - Harmony in Myself!**

7. Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’
8. Understanding the needs of Self (‘I’) and ‘Body’ - Sukh and Suvidha
9. Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of ‘I’ and harmony in ‘I’
11. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Swasthya - Practice Exercises and Case Studies will be taken up in Practice Sessions.

**UNIT 3:**

**Understanding Harmony in the Family and Society- Harmony in Human Human Relationship**

13. Understanding Harmony in the family – the basic unit of human interaction
14. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship
15. Understanding the meaning of Vishwas; Difference between intention and competence
16. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship
17. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals

18. Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha )- from family to world family! - Practice Exercises and Case Studies will be taken up in Practice Sessions.

#### **UNIT 4:**

**Understanding Harmony in the Nature and Existence** - Whole existence as Co-existence

19. Understanding the harmony in the Nature

20. Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature

21. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space

22. Holistic perception of harmony at all levels of existence - Practice Exercises and Case Studies will be taken up in Practice Sessions.

#### **UNIT 5:**

**Implications of the above Holistic Understanding of Harmony on Professional Ethics**

23. Natural acceptance of human values

24. Definitiveness of Ethical Human Conduct

25. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

26. Competence in professional ethics:

a) Ability to utilize the professional competence for augmenting universal human order

b) Ability to identify the scope and characteristics of people-friendly and ecofriendly production systems,

c) Ability to identify and develop appropriate technologies and management patterns for above production systems.

27. Case studies of typical holistic technologies, management models and production systems

28. Strategy for transition from the present state to Universal Human Order:

a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers

b) At the level of society: as mutually enriching institutions and organizations

#### **Books and References:**

1. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2

2. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow, Reprinted 2008.

3. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.

4. Susan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986,

5. A.N. Tripathy, 2003, Human Values, New Age International Publishers.

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II Year IV Semester***

**BTME407: MACHINE DRAWING-II LAB**

**Introduction:** Conventional representation of machine components and materials, Conventional representation of surface finish, Roughness number symbol, Symbols of Machine elements and welded joints. Classification of Drawings: Machine drawings, Production drawing, part drawing and assembly drawing. Introduction to detail drawing and bill of materials (BOM).

**Limits, Fits and Tolerances:** General aspects, Nominal size and basic dimensions, Definitions, Basis of fit or limit system, Systems of specifying tolerances, Designation of holes, Shafts and fits, Commonly used holes and shafts. List of Standard Abbreviation used.

**Part Modeling:** Introduction to part modeling of simple machine components using any 3D software (like CATIA, PRO E, UGNX, Autodesk Inventor or SOLIDWORKS) covering all commands/ features to develop a part model (***Minimum 24 machine components need to be developed***).

**Part Modeling & Assemblies of:** Plummer Block Bearing, Machine Vice, Screw Jack, Engine Stuffing box, Lathe Tailstock, Feed Check Valve and Rams Bottom Safety Valve.

**Books and References:**

1. Textbook of Machine Drawing, K C John, PHI
2. Machine Drawing by K.R. Gopalakrishna, Subhas Stores.
3. A Textbook of Machine Drawing by PS Gill from S.K. Kataria & Sons
4. Machine Drawing-KL Narayana, P Kannaiah, KV Reddy, New Age publications
5. Engineering Graphics with AutoCAD, Bethune, PHI
6. Machine Drawing, N. Siddeshwar, P Kannaiah, VVS Shastry, Tata McGraw Hill
7. Fundamentals of Machine Drawing, Dr Sadhu Singh & P L Shah, Prantice Hall India
8. Autodesk Inventor by Examples, Sam Tikoo, Wiley.

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**Evaluation Scheme & Syllabus for**  
**Department of Mechanical Engineering**  
**B.Tech. Third Year**  
**(V & VI Semester)**

**(Effective from session 2019-20)**

## EVALUATION SCHEME

SEMESTER V						
		THEORY		PRACTICAL		TOTAL
SUBJECT CODE	SUBJECT NAME	SESS.(30)	EXT.(70)	SESS.(25)	EXT.(25)	
BTME-501	Managerial Economics	30	70	NA	NA	100
BTME-502	Machine Design-I	30	70	25	25	150
BTME-503	Sociology	30	70	NA	NA	150
BTME-504	Manufacturing Science & Technology-II	30	70	25	25	150
BTME-505	Heat & Mass Transfer	30	70	25	25	150
BTME-506	I.C. Engines & Compressors	30	70	NA	NA	50
SEMESTER VI						
		THEORY		PRACTICAL		TOTAL
SUBJECT CODE	SUBJECT NAME	SESS.(30)	EXT.(70)	SESS.(25)	EXT.(25)	
BTME-601	Industrial Management	30	70	NA	NA	100
BTME-602	Machine Design-II	30	70	NA	NA	100
BTME-603	Dynamics of Machines(Theory of Machines)	30	70	25	25	150
BTME-604	Refrigeration & Air-conditioning	30	70	25	25	150
BTME-605	Fluid Machinery	30	70	25	25	150
BTME-606	Cyber Security	30	70	NA	NA	100
	Design & simulation Lab	NA	NA	25	25	50

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**BTME- 501 MANAGERIAL ECONOMICS**

**UNIT I : Introduction of Engineering Economics and Demand Analysis:** Meaning and nature of Economics, Relation between science, engineering, technology and economics; Meaning of Demand, Determinants of Demand, Shifts in demand, Law of Demand, Price Elasticity of Demand & Types, Income Elasticity, Cross price Elasticity, Determinants of Elasticity, uses and Importance of elasticity.

**UNIT II: Concept of Supply:** Law of Supply, Factors affecting Supply, Elasticity of supply.

**Demand Forecasting:** Introduction, Meaning and Forecasting, Methods or Techniques of Demand Forecasting, Criteria for Good Demand Forecasting, Demand Forecasting for a New Product;

**UNIT III: Cost Analysis-** Introduction, Types of Costs, Cost-Output Relationship: Cost Function, Cost-Output Relationships in the Short Run, and Cost-Output Relationships in the Long Run; Short run and long run, Break- Even Analysis; Production functions: laws of variable proportions, law of returns; Economies of scale: Internal and external.

**UNIT IV: Market Structure:** Market Structure Perfect Competition, Imperfect competition – Monopolistic, Oligopoly, duopoly and joint venture features of price determination and various market conditions.

**UNIT V: Nature and characteristics of Indian economy,** concepts of LPG, elementary concepts of National Income, Inflation and Business Cycles, Concept of N.I. and Measurement., Meaning of Inflation, Types and causes, Phases of business cycle. Investment decisions for boosting economy (National income and per capital income)

**TEXT BOOKS-**

1. Premvir Kapoor, Sociology and Economics for Engineers, Khanna Publishing House (Edition 2018)
2. Salvatore D, "Principles of Microeconomics", Oxford University Press.
3. Koutsoyiannis A, "Modern Microeconomic", Macmillan Education Ltd.
4. Dwivedi DN, "Principles of Microeconomics", Pearson Education.
5. Cowell, FA, "Microeconomic Principles and Analysis", Oxford University Press.

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**BTME- 502 MACHINE DESIGN-I**

**UNIT I: Introduction** Definition, Design requirements of machine elements, Design procedure, Standards in design, Selection of preferred sizes, Indian Standards designation of carbon & alloy steels, Selection of materials for static and fatigue loads. Design for Static Load Modes of failure, Factor of safety, Principal stresses, Stresses due to bending and torsion, Theory of failure.

**UNIT II:** Design for Fluctuating Loads Cyclic stresses, Fatigue and endurance limit, Stress concentration factor, Stress concentration factor for various machine parts, Notch sensitivity, Design for finite and infinite life, Soderberg, Goodman & Gerber criteria. Riveted Joints Riveting methods, materials, Types of rivet heads, Types of riveted joints, Caulking and Fullering, Failure of riveted joint, Efficiency of riveted joint, Design of boiler joints, Eccentric loaded riveted joint.

**UNIT III:** Shafts Cause of failure in shafts, Materials for shaft, Stresses in shafts, Design of shafts subjected to twisting moment, bending moment and combined twisting and bending moments, Shafts subjected to fatigue loads, Design for rigidity.

**UNIT IV:** Mechanical Springs Types, Material for helical springs, End connections for compression and tension helical springs, Stresses and deflection of helical springs of circular wire, Design of helical springs subjected to static and fatigue loading.

**UNIT V:** Keys and Couplings Types of keys, splines, Selection of square & flat keys, Strength of sunk key, Couplings, Design of rigid and flexible couplings. Power Screws Forms of threads, multiple threads, Efficiency of square threads, Trapezoidal threads, Stresses in screws, Design of screw jack Note: Design data book is allowed in the examination

**Books and References:**

1. Design of Machine Elements, V.B. Bhandari, Tata McGraw Hill Co.
2. Machine Design-Sharma and Agrawal, S.K. Kataria & Sons.
3. Machine Design, U C Jindal, Pearson Education.
4. Design of Machine Elements, Sharma and Purohit, PHI.
5. Design of Machine Elements-M.F. Spott, Pearson Education
6. Machine Design-Maleev and Hartman, CBS Publishers.
7. Mechanical Engineering Design, 9e – Joseph E. Shigely, McGraw Hill Education.
8. Elements of Machine Component Design, Juvinall & Marshek, John Wiley & Sons.

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**BTME- 502 MACHINE DESIGN-I**

**List of practical's**

1. Design & drawing of Cotter joint.
2. Design & drawing of Knuckle joint
3. Design of machine components subjected to combined steady and variable loads
4. Design of eccentrically loaded riveted joint
5. Design of boiler riveted joint
6. Design of shaft for combined constant twisting and bending loads
7. Design of shaft subjected to fluctuating loads
8. Design and drawing of flanged type rigid coupling
9. Design and drawing of flexible coupling
10. Design and drawing of helical spring
11. Design and drawing of screw jack



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**BTME-503 SOCIOLOGY**

**Unit-I**

**Industrial Sociology:** Nature, Scope and Importance of Industrial Sociology. Social Relations in Industry, Social Organisation in Industry- Bureaucracy, Scientific Management and Human Relations.

**Unit-II**

**Rise and Development of Industry :** Early Industrialism – Types of Productive Systems – The Manorial or Feudal system. The Guild system, The domestic or putting-out system, and the Factory system. Characteristics of the factory system. Causes and Consequences of industrialization. Obstacles to and Limitations of Industrialization.

**Unit-III**

**Industrialization in India. Industrial Policy Resolutions** – 1956. Science. Technology and Innovation Policy of India 2013.

**Unit-IV**

**Contemporary Issues :** Grievances and Grievance handling Procedure.

**Industrial Disputes:** causes, Strikes and Lockouts. Preventive Machinery of Industrial Disputes: Schemes of Workers Participation in Management- Works Committee, Collective Bargaining, Bi-partite & Tri-partite Agreement, Code of Discipline, Standing Orders. Labour courts & Industrial Tribunals,

**Text and References books:**

1. GISBERT PASCAL, Fundamentals of Industrial sociology, Tata McGraw Hill Publishing Co., New Delhi, 1972.
2. SCHNEIDER ENGNO V., Industrial Sociology 2nd Edition, McGraw Hill Publishing Co., New Delhi, 1979.
3. MAMORIAC.B. And MAMORIA S., Dynamics of Industrial Relations in India.
4. SINHAG.P. and P.R.N. SINHA, Industrial Relations and Labour Legislations, New Delhi, Oxford and IBH Publishing Co., 1977.
5. NADKARNI, LAKSHMI, Sociology of Industrial Worker, Rawat, Jaipur, 1998.
6. BHOWMICKSHARIT, Industry, Labour and Society, Orient, 2012.

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***III Year V Semester***

**BTME- 504 MANUFACTURING SCIENCE& TECHNOLOGY-II**

**Unit I A. Metal Cutting-** Mechanics of metal cutting. Geometry of tool and nomenclature .ASA system Orthogonalvs obliquecutting. Mechanics of chip formation, types of chips. Shear angle relationship. Merchant’s force circlediagram. Cutting forces, power required. Heat generation and cutting tool temperature, Cuttingfluids/lubricants.Tool materials. Tool wear and tool life. Machinability.Dynamometer, Brief introduction to machine tool vibration and surface finish.Economics of metal cutting.

**Unit-II Machine Tools**

- (i) Lathe: Principle, construction, types, operations, Turret/capstan, semi/Automatic, Tool layout
- (ii) Shaper, slotter, planer: Construction, operations & drives.
- (iii) Milling: Construction, Milling cutters, up & down milling. Dividing head & indexing. Max chip thickness & power required.
- (iv) Drilling and boring: Drilling, boring, reaming tools. Geometry of twist drills.

**Unit-III Grinding &Super finishing**

- (i) Grinding: Grinding wheels, abrasive & bonds, cutting action. Grinding wheel specification. Grinding wheel wear - attritions wear, fracture wear. Dressing and Truing. Max chip thickness and Guest criteria. Surface and cylindrical grinding. Center less grinding
- (ii) Super finishing: Honing, lapping and polishing. Limits, Fits & Tolerance and Surface roughness: Introduction to Limits, Fits, Tolerances and IS standards, Limit-gauges, and surface-roughness.

**Unit-IV B. Metal Joining (Welding)**

Survey of welding and allied processes.Gas welding and cutting, process and equipment. Arc welding: Power sources and consumables. TIG&MIG processes and their parameters.Resistance welding - spot, seam projection etc. Other welding processes such as atomic hydrogen, submerged arc, electro slag, friction welding. Soldering & Brazing. Adhesive bonding. Thermodynamic and Metallurgical aspects in welding and weld, Weld ability, Shrinkage/residual stress in welds. Distortions & Defects in welds and remedies. Weld decay in HAZ

**Unit-V C. Introduction to Unconventional Machining and Welding**

Need & benefits, application and working principle of EDM, ECM, LBM, EBM, USM.AJM, WJM. Similarly, non-conventional welding applications such as LBW, USW, EBW, Plasma- arc welding, Diffusion welding, Explosive welding/cladding. Introduction to Hybrid machining processes

**Books and References:**

1. Manufacturing Science – A. Ghosh and A.K. Mallik,Affiliated East-West Press
2. 3. Production Technology - R.K. Jain Khanna Publishers.

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**BTME- 504 MANUFACTURING SCIENCE& TECHNOLOGY-II**

**List of practical's**

1. Shear-angle determination (using formula) with tube cutting (for orthogonal) on lathe machine.
2. To study about Lathe machine
3. Tool grinding (to provide tool angles) on tool-grinder machine.
4. To study about Gear cutting on milling machine.
5. Machining a block on shaper machine.
6. Finishing of a surface on surface-grinding machine.
7. Drilling holes on drilling machine and study of twist-drill.
8. Study of different types of tools and its angles & materials.
9. Experiment on tool wear and tool life.
10. Experiment on jigs/Fixtures and its uses
11. Gas welding experiment
12. Arc welding experiment

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**BTME- 505 HEAT & MASS TRANSFER**

**UNIT-1**

**Introduction to Heat Transfer:** Thermodynamics and Heat Transfer. Modes of Heat Transfer: Conduction, convection and radiation. Effect of temperature on thermal conductivity of materials; Introduction to combined heat transfer mechanism.

**Conduction :** General differential heat conduction equation in the rectangular, cylindrical and spherical coordinate systems. Initial and boundary conditions. Steady State one-dimensional Heat conduction : Simple and Composite Systems in rectangular, cylindrical and spherical coordinates with and without energy generation; Concept of thermal resistance. Analogy between heat and electricity flow; Thermal contact resistance and overall heat transfer coefficient; Critical radius of insulation.

**UNIT-II**

**Fins:** Heat transfer from extended surfaces, Fins of uniform cross-sectional area; Errors of measurement of temperature in thermometer wells. Transient Conduction: Transient heat conduction; Lumped capacitance method; Time constant; Unsteady state heat conduction in one dimension only.

**UNIT-III**

**Forced Convection:** Basic concepts; Hydrodynamic boundary layer; Thermal boundary layer; Approximate integral boundary layer analysis; Analogy between momentum and heat transfer in turbulent flow over a flat surface; Mixed boundary layer; Flow over a flat plate; Flow across a single cylinder and a sphere; Flow inside ducts; Thermal entrance region, Empirical heat transfer relations; Relation between fluid friction and heat transfer; Liquid metal heat transfer.

**Natural Convection :** Physical mechanism of natural convection; Buoyant force; Empirical heat transfer relations for natural convection over vertical planes and cylinders, horizontal plates and cylinders, and sphere, Combined free and forced convection.

**UNIT-4**

**Thermal Radiation :** Basic radiation concepts; Radiation properties of surfaces; Black body radiation Planck's law, Wien's displacement law, Stefan Boltzmann law, Kirchoff's law; ; Gray body; Shape factor; Black-body radiation; Radiation exchange between diffuse non black bodies in an enclosure; Radiation shields; Radiation combined with conduction and convection; Absorption and emission in gaseous medium; Solar radiation; Green house effect.

## **UNIT-5**

**Heat Exchanger :**Types of heat exchangers; Fouling factors; Overall heat transfer coefficient; Logarithmic mean temperature difference (LMTD) method; Effectiveness-NTU method; Compact heat exchangers.

**Condensation and Boiling:**Introduction to condensation phenomena; Heat transfer relations for laminar film condensation on vertical surfaces and on outside & inside of a horizontal tube; Effect of non-condensable gases; Dropwise condensation; Heat pipes; Boiling modes, pool boiling; Hysteresis in boiling curve; Forced convection boiling.

### **Introduction to Mass Transfer:**

Introduction; Fick's law of diffusion; Steady state equimolar counter diffusion; Steady state diffusion through a stagnant gas film.

### **Texts Books:**

1. Fundamentals of Heat and Mass Transfer, by Incropera & DeWitt, John Wiley and Sons
2. Heat and Mass Transfer by Cengel, McGraw-Hill
3. Heat Transfer by J.P. Holman, McGraw-Hill
4. Heat and Mass Transfer by Rudramoorthy and Mayilsamy, Pearson Education
5. Heat Transfer by Ghoshdastidar, Oxford University Press
6. A text book on Heat Transfer, by Sukhatme, University Press.
7. Heat Transfer by Venkateshan, Ane Books Pvt Ltd
8. Schaum's outline of Heat Transfer by Pitts & Sisson McGraw-Hill
9. Heat and Mass Transfer by R Yadav, Central Publishing House.

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**BTME- 505 HEAT & MASS TRANSFER**

**List of practical's**

1. Conduction – Experiment on Composite plane wall
2. Conduction – Experiment on Composite cylinder wall
- 3 Conduction - Experiment on critical insulation thickness
4. Conduction – Experiment on Thermal Contact Resistance
5. Convection - Pool Boiling experiment
6. Convection - Experiment on heat transfer from tube-(natural convection).
7. Heat exchanger - Parallel flow experiment And Counter flow experiment
8. Convection - Heat transfer through fin-(natural convection) .
9. Convection - Heat transfer through tube/fin-(forced convection).
- 10 Experiment on solar collector.
- 11 Experiment on Stefan's Law, on radiation determination of emissivity, etc.

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**BTME-506 I C ENGINES & COMPRESSORS**

**Unit-1 Introduction to I.C Engines:** Engine classification and basic terminology, Two and four stroke engines, SI and CI engines, Valve timing diagram. Thermodynamic analysis of Air standard cycles, Otto cycle, Diesel cycle, Dual cycle, Stirling cycle, Ericsson cycles, Comparison of Otto, Diesel and Dual cycles. Fuel air cycle, factors affecting the fuel air cycle, Actual cycle.

**Unit-II SI Engines:** Combustion in SI engine, Flame speed, Ignition delay, abnormal combustion and its control, combustion chamber design for SI engines. Carburetion, Mixture requirements, Carburetors and fuel injection system in SI Engine. Ignition system requirements, Magneto and battery ignition systems, ignition timing and spark plug, Electronic ignition, Scavenging in 2 Stroke engines, Supercharging and its effect

**Unit-III CI Engine:** Combustion in CI engines, Ignition delay, Knock and its control, Combustion chamber design of CI engines. Fuel injection in CI engines, Requirements, Types of injection systems, Fuel pumps, Fuel injectors, Injection timings. Exhaust emissions from SI engine and CI engine and its control

**Unit-IV Engine Cooling and Lubrication:** Different cooling systems, Radiators and cooling fans, Engine friction, Lubrication principle, Type of lubrication, Lubrication oils, Crankcase ventilation. **Fuels:** Fuels for SI and CI engine, Important qualities of SI and CI engine fuels, Rating of SI engine and CI engine fuels, Dopes, Additives, Gaseous fuels, LPG, CNG, Biogas, Producer gas, Alternative fuels for IC engines. **Testing and Performance:** Performance parameters, Basic measurements, Blow by measurement, Testing of SI and CI engines

**Unit V Compressors:** Classification, Reciprocating compressors, Single and Multi stage compressors, Inter cooling, Volumetric efficiency. Rotary compressors, Classification, Centrifugal compressor Axial compressors, Surging and stalling, Roots blower, Vane compressor.

**Text Books:** 1. Fundamentals of Internal Combustion Engine by Gill, Smith, Ziurs, Oxford & IBH Publishing

2. Fundamentals of Internal Combustion Engines by H.N. Gupta, Prentice Hall of India

3. A Course in Internal Combustion Engines, by Mathur & Sharma, Dhanpat Rai & Sons.

4. I.C Engine Analysis & Practice by E.F. Obert.

5. I.C Engine, by V. Ganeshan, Tata McGraw Hill Publishers.

6. I.C Engine, by R. Yadav, Central Publishing House, Allahabad

7. Reciprocating and Rotary Compressors, by Chlumsky, SNTI Publications, Czechoslovakia

8. Turbines, Compressors and Fans, by S.M. Yahya, Tata McGraw Hill Pub.

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**BTME-506 I C ENGINES & COMPRESSORS**

**List of practical's**

1. Study about SI engine.
2. Study about of CI engine
3. Study of carburetor with its types.
4. Experiment on SI engine in mores test.
5. Experiment on 2-stroke petrol engine by brake dynamometer.
6. Study about of injector in CI engine
7. Experiment on 4 stroke petrol engine by using of eddy current dynamometer.
8. To study about various types of cooling and lubrication system of engine.
9. To study about the air compressor.



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**BTME-601: INDUSTRIAL MANAGEMENT**

**Unit-I**

**Introduction:** Concept, Development, application and scope of Industrial Management.  
**Productivity:** Definition, measurement, productivity index, types of production system, Industrial Ownership.

**Unit-II**

**Management Function:** Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Social responsibilities of Management,  
Introduction to Human resources management: Nature of HRM, functions and importance of HRM.

**Unit-III**

**Work Study:** Introduction, definition, objectives, steps in work study, Method study: definition, objectives, and steps of method study, Work Measurement: purpose, types of study — stop watch methods — steps — allowances — standard time calculations — work sampling, Production Planning and Control  
**Inventory Control:** Inventory, Cost, Deterministic Models, and Introduction to supply chain management.

**Unit-IV**

**Quality Control:** Process control, SQC, Control charts, Single, Double and Sequential Sampling, Introduction to TQM.

**Unit-V**

Project Management: Project network analysis, CPM, PERT and Project crashing and resource Leveling

**BOOKS AND REFERENCE:**

1. Statistical Quality Control by Grant and Leavarworth, McGraw Hill
2. Industrial Management By O P Khan.
3. Problems in Operations Research by- Prem Kumar Gupta & D.S. Hira, S. Chand

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**BTME 602 MACHINE DESIGN-II**

**UNIT I:** Principle of transmission and conjugate action Spur Gears Tooth forms, System of gear teeth, contact ratio, Standard proportions of gear systems, Interference in involute gears, Backlash, Selection of gear materials, Gear manufacturing methods, Design considerations, Beam strength of gear tooth, Dynamic tooth load, Wear strength of gear tooth, Failure of gear tooth, Design of spur gears, AGMA and Indian standards.

**Helical Gears :** Terminology, Proportions for helical gears, Forces components on a tooth of helical gear, Virtual number of teeth, Beam strength & wear strength of helical gears, Dynamic load on helical gears, Design of helical gears.

**UNIT II : Bevel Gears:** Terminology of bevel gears, Force analysis, Virtual number of teeth, Beam strength and wear strength of bevel gears, Effective load of gear tooth, Design of a bevel gear system.

**Worm Gears:** Types of worms, Terminology, Gear tooth proportions, Efficiency of worm gears, Heat dissipation in worm gearing, Strength and wear tooth load for worm gears, Design of worm gearing system.

**UNIT III : Sliding Contact Bearing:** Types, Selection of bearing, Plain journal bearing, Hydrodynamic lubrication, Properties and materials, Lubricants and lubrication, Hydrodynamic journal bearing, Heat generation, Design of journal bearing, Thrust bearing-pivot and collar bearing, Hydrodynamic thrust bearing.

**UNIT IV: Rolling Contact Bearing:** Advantages and disadvantages, Types of ball bearing, Thrust ball bearing, Types of roller bearing, Selection of radial ball bearing, Bearing life, Selection of roller bearings, Dynamic equivalent load for roller contact bearing under constant and variable loading, Reliability of Bearing, Selection of rolling contact bearing, Lubrication of ball and roller bearing, Mounting of bearing

**UNIT V : IC Engine :** Selection of type of IC engine, General design considerations, Design of cylinder and cylinder head; Design of piston and its parts like piston ring and gudgeon pin etc.; Design of connecting rod; Design of crankshaft

**Books and References:**

1. Design of Machine Elements-V.B. Bhandari, Tata McGraw Hill Co.
2. Machine Design-Sharma and Agrawal, S.K. Kataria & Sons.
3. Machine Design, U C Jindal, Pearson Education.
4. Design of Machine Elements, Sharma and Purohit, PHI.
5. Design of Machine Design-M.F. Spott, Pearson Education
6. Machine Design-Maleev and Hartman, CBS Publishers.

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**BTME 602 MACHINE DESIGN-II**

**List of practical:**

1. Design & drawing of Spur gear.
2. Design & drawing of sliding Bearing
3. To study about different type of gear.
4. Design of helical gear.
5. Design of piston in IC engine.
6. Design of valve mechanism of IC engine
7. Design of crank shaft subjected to fluctuating loads

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**BTME- 603- DYNAMICS OF MACHINES**

**UNIT- I Dynamics of Engine Mechanisms:** Displacement, velocity and acceleration of piston; turning moment on crankshaft, turning moment diagram; fluctuation of crankshaft speed, analysis of flywheel.

**UNIT –II Governor Mechanisms:** Types of governors, characteristics of centrifugal governors, gravity and spring controlled centrifugal governors, hunting of centrifugal governors, inertia governors.

**UNIT -III Balancing of Inertia Forces and Moments in Machines:** Balancing of rotating masses, two plane balancing, determination of balancing masses (graphical and analytical methods), balancing of rotors, balancing of internal combustion engines (single cylinder engines, in-line engines, V-twin engines, radial engines, Lanchester technique of engine balancing.

**UNIT -IV Friction:** Frictional torque in pivots and collars by uniform pressure and uniform wear rate criteria. Boundary and fluid film lubrication, friction in journal and thrust bearings, concept of friction circle and axis, rolling friction. **Clutches:** Single plate and multi plate clutches, Cone clutches. **Belt drives;** Velocity ratio, limiting ratio of tension; power transmitted; centrifugal effect on belts, maximum power transmitted by belt, initial tension, creep; chain and rope drives;

**Brakes:** Band brake, block brakes, Internal and external shoe brakes, braking of vehicles. Dynamometer: Different types and their applications.

**UNIT -V Introduction,** Classification of Vibration Systems, Harmonic motion, Vector representation of harmonic motion, Natural frequency & response, Effects of vibration, superposition of simple harmonic motions, beats, Fourier analysis-analytical and numerical methods. Single Degree Freedom System, Equation of motion, Newton's method, D'Alembert's principle, Energy method etc., Free vibration, Natural frequency, Equivalent systems, Displacement, Velocity and acceleration, Response to an initial disturbance, Torsional vibrations, Damped vibrations, Vibrations of systems with viscous damping, Logarithmic decrement, Energy dissipation in viscous damping, Forced vibrations with rotating and reciprocating unbalance **Critical speed of shafts,** Whirling of uniform shaft, Shaft with one disc with and without damping, Multi-disc shafts, Secondary critical speed

**TEXT BOOKS:**

1. Ambekar, AG; Mechanism and Machine Theory; PHI
2. Rattan SS; Theory of machines; TMH
3. Sharma and Purohit; Design of Machine elements; PHI
4. Mechanical Vibrations – G. K. Groover, Jain Brothers, Roorkee

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**BTME 604 REFRIGERATION & AIR CONDITIONING**

**UNIT-I Refrigeration:** Introduction to refrigeration system, Methods of refrigeration, Carnot refrigeration cycle, Unit of refrigeration, Refrigeration effect & C.O.P.

**Air Refrigeration cycle:** Open and closed air refrigeration cycles, Reversed Carnot cycle, Bell Coleman or Reversed Joule airrefrigeration cycle, Aircraft refrigeration system, Classification of aircraft refrigeration system. Bootstrap refrigeration, Regenerative, Reduced ambient, Dry air rated temperature .

**UNIT-II Vapour Compression System:** Single stage system, Analysis of vapour compression cycle, Use of T-S and P-H charts, Effect of change in suction and discharge pressures on C.O.P, Effect of sub cooling of condensate & superheating of refrigerant vapour on C.O.P of the cycle, Actual vapour compression refrigeration cycle, Multistage vapour compression system requirement, Removal of flash gas, Intercooling, Different configuration of multistage system, Cascade system.

**UNIT-III Vapour Absorption system:** Working Principal of vapour absorption refrigeration system, Comparison between absorption & compression systems, Elementary idea of refrigerant absorbent mixtures, Temperature – concentration diagram & Enthalpy – concentration diagram , Adiabatic mixing of two streams, Ammonia – Water vapour absorption system, Lithium- Bromide water vapour absorption system, Comparison. Three fluid systems.

**Refrigerants:** Classification of refrigerants, Nomenclature, Desirable properties of refrigerants, Common refrigerants, Secondary refrigerants and CFC free refrigerants. Ozone layer depletion and global warming considerations of refrigerants

**UNIT-IV Air Conditioning:** Introduction to air conditioning, Psychometric properties and their definitions, Psychometric chart, Different Psychometric processes, Thermal analysis of human body, Effective temperature and comfort chart, Cooling and heating load calculations, Selection of inside & outside design conditions, Heat transfer through walls & roofs, Infiltration & ventilation, Internal heat gain, Sensible heat factor ( SHF), By pass factor, Grand Sensible heat factor ( GSHF), Apparatus dew point (ADP). Air Washers, Cooling towers & humidifying efficiency.

**UNIT-V Refrigeration Equipment & Application:** Elementary knowledge of refrigeration & air conditioning equipment e.g compressors, condensers, evaporators & expansion devices, Food preservation, Cold storage, Refrigerates Freezers, Ice plant, Water coolers, Elementary knowledge of transmission and distribution of air through ducts and fans, Basic difference between comfort and industrial air conditioning.

**TEXT BOOKS:**

1. Refrigeration and Air conditioning by C.P Arora, McGraw-Hill
2. Refrigeration and Air conditioning, by Manohar Prasad, New Age International (P) Ltd. Pub.
3. Refrigeration and Air conditioning by R. C. Arora, PHI
4. Principles of Refrigeration by Roy J. Dossat. Pearson Education
5. Refrigeration and Air conditioning by stoecker & Jones. McGraw-Hill
7. Refrigeration and Air conditioning by Arora & Domkundwar. Dhanpat Rai

**SEMESTER – VI**

**BTME 604 REFRIGERATION & AIR CONDITIONING**

**List of practical:**

1. Experiment on refrigeration test rig and calculation of various performance parameters.
2. Study of different types of expansion devices used in refrigeration system.
3. Study of different types of evaporators used in refrigeration systems.
4. To study basic components of air-conditioning system.
5. Experiment on air-conditioning test rig & calculation of various performance parameters.
6. Experiment on air washers
7. Study of window air conditioner.
8. Study & determination of volumetric efficiency of compressor.
9. Visit of a central air conditioning plant and its detailed study.

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**BTME -605 FLUID MACHINERY**

**UNIT-I Introduction**

Impulse of Jet and Impulse Turbines: Classification of Fluid Machines & Devices, Application of momentum and moment of momentum equation to flow through hydraulic machinery, Euler's fundamental equation. Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat & curve), Classification of turbines, Impulse turbines, Constructional details, Velocity-triangles, Power and efficiency calculations, Governing of Pelton wheel

**UNIT-II Reaction Turbines**

Francis and Kaplan turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Degree of reaction, Draft tube, Cavitation in turbines, Principles of similarity, Unit and specific speed, Performance characteristics, Selection of water turbines.

**UNIT-III Centrifugal Pumps**

Classifications of centrifugal pumps, Vector diagram, Work done by impellor, Efficiencies of centrifugal pumps, Specific speed, Cavitation & separation, Performance characteristics.

**UNIT-IV Positive Displacement and other Pumps**

Reciprocating pump theory, Slip, Indicator diagram, Effect of acceleration, air vessels, Comparison of centrifugal and reciprocating pumps, Performance characteristics.

**UNIT-V**

Hydraulic accumulator, Hydraulic intensifier, Hydraulic Press, hydraulic crane, hydraulic lift, hydraulic Ram, hydraulic coupling, hydraulic torque converter, air lift pump, jet pump.

**TEXT BOOKS:**

1. Hydraulic Machines by Jagdish Lal, Metropolitan book co. pvt ltd.
2. Hydraulic Machines by K Subramanya, Tata McGraw Hill
3. Fluid Mechanics and Machinery by C.S.P.Ojha, R. Berndtsson, P.N. Chandramouli, Oxford University Press
4. Fluid Mechanics and Fluid Power Engineering by D S Kumar, S K Kataria & Sons

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III Year VI Semester*

**BTME -605 FLUID MACHINERY**

**List of Practical:**

1. Impact of Jet experiment.
2. Experiment on Pelton wheel.
3. Experiment on Francis turbine.
4. Experiment on Kaplan turbine.
5. Experiment on Reciprocating pump.
6. Experiment on centrifugal pump.
7. Experiment on Hydraulic Jack/Press
8. Experiment on Hydraulic Brake
9. Experiment on Hydraulic Ram
10. Study through visit of any water pumping station/plant



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**BTME – 606 CYBER SECURITY**

**UNIT-I Introduction**

Introduction to Information Systems, Types of Information Systems, Development of Information Systems, Introduction to Information Security, Need for Information Security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis.

**UNIT-II Application Security**

Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control. Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail Viruses, Macro Viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce- Electronic Payment System, e- Cash, Credit/Debit Cards. Digital Signature, Public Key Cryptography

**UNIT-III Developing Secure Information Systems**

Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, Access Control, CC TV and Intrusion Detection Systems, Backup Security Measures.

**UNIT-IV Security Policies**

Development of Policies, WWW Policies, Email Security Policies, Policy Review Process- Corporate Policies-Sample Security Policies, Publishing and Notification Requirement of the Policies. **Evolving Technology Security** – Mobile, Cloud, Outsourcing and SCM.

**UNIT-V Information Security Standards**

ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India; IT Act 2000 Provisions, Intellectual Property Law: Copy Right Law, Software License, Semiconductor Law and Patent Law. **Case Study** – Corporate Security

**TEXT BOOKS-**

1. Schou, Shoemaker, “Information Assurance for the Enterprise”, Tata McGraw Hill.
2. CHANDER, HARISH, “Cyber Laws And It Protection ”, PHI Learning Private Limited, Delhi
3. V.K. Jain, Cryptography and Network Security, Khanna Publishing House, Delhi
4. Anshul Kaushik, Cyber Security, Khanna Publishing House

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**Evaluation Scheme & Syllabus for**  
**Department of Mechanical Engineering**  
**B.Tech. Forth Year**  
**(VII & VIII Semester)**

**(Effective from session 2019-20)**

# EVALUATION SCHEME

SEMESTER VII						
		THEORY		PRACTICAL		TOTAL
SUBJECT CODE	SUBJECT NAME	SESS.(30)	EXT.(70)	SESS.(25)	EXT.(25)	
BTME-701	Entrepreneurship Development	30	70	NA	NA	100
BTME-702	CAD	30	70	25	25	150
BTME-703	Automobile Engineering	30	70	NA	NA	100
BTME-704	Computer Aided Manufacturing	30	70	25	25	100
BTME-705	Total Quality Management	30	70	NA	NA	100
	I.C. Engine Lab	NA	NA	25	25	50
	Industrial Training					
SEMESTER VIII						
		THEORY		PRACTICAL		TOTAL
SUBJECT CODE	SUBJECT NAME	SESS.(30)	EXT.(70)	SESS.(25)	EXT.(25)	
BTME-801	Non-Conventional Energy Resources	30	70	NA	NA	100
BTME-802	Quality Control	30	70	NA	NA	100
BTME-803	Operations Research	30	70	NA	NA	100
BTME-804	Plant Layout and Material Handling	30	70	NA	NA	100
	PROJECT	NA	NA	50	50	100

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**BTME-701: ENTREPRENEURSHIP DEVELOPMENT**

**UNIT –I: Entrepreneurship-** definition. growth of small scale industries in developing countries and their positions visa-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries and sub-control types. Government policy for small scale industry; stages in starting a small scale industry.

**UNIT -II** Project identification- assessment of viability, formulation, evaluation, financing, field-study and collection of information, preparation of project report, demand analysis, material balance and output methods, benefit cost analysis, discounted cash flow, internal rate of return and net present value methods.

**UNIT -III** Accountancy- Preparation of balance sheets and assessment of economic viability, decision making, expected costs, planning and production control, quality control, marketing, industrial relations, sales and purchases, advertisement, wages and incentive, inventory control, preparation of financial reports, accounts and stores studies.

**UNIT –IV Project Planning and control:** The financial functions cost of capital approach in project planning and control. Economic evaluation, risk analysis, capital expenditures, policies and practices in public enterprises. Profit planning and programming, planning cash flow, capital expenditure and operations. Control of financial flows, control and communication.

**UNIT –V** Laws concerning entrepreneur viz, partnership laws, business ownership, sales and income taxes and workman compensation act. Role of various national and state agencies which render assistance to small scale industries.

**TEXT / REFERENCE BOOKS:**

1. Forbat, John, “Entrepreneurship” New Age International.
2. Havinal, Veerbhadrapa, “Management and Entrepreneurship” New Age International
3. Joseph, L. Massod, “Essential of Management”, Prentice Hall of India.

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**BTME-702: COMPUTER AIDED DESIGN (CAD)**

**UNIT-I Introduction:** Introduction to CAD/CAED/CAE, Elements of CAD, Essential requirements of CAD, Concepts of integrated CAD/CAM, Necessity & its importance, Engineering Applications Computer Graphics-I CAD/CAM systems,

**Computer Graphics-I** Graphics Input devices-cursor control Devices, Digitizers, Keyboard terminals, Image scanner, Speech control devices and Touch, panels, Graphics display devices-Cathode Ray Tube, Random & Raster scan display, Color CRT monitors, Direct View Storage Tubes, Flat Panel display, Hard copy printers and plotters

**UNIT-II Computer Graphics-II** Graphics standards, Graphics Software, Software Configuration, Graphics Functions, Output primitives- Bresenham's line drawing algorithm and Bresenham's circle generating algorithm Geometric Transformations: World/device Coordinate Representation, Windowing and clipping, 2 D Geometric transformations-Translation, Scaling, Shearing, Rotation & Reflection Matrix representation, Composite transformation, 3D transformations, multiple transformation .

**UNIT-III Curves:** Curves representation, Properties of curve design and representation, Interpolation vs approximation, Parametric representation of analytic curves, Parametric continuity conditions, Parametric representation of synthetic curves-Hermite cubic splines-Blending function formulation and its properties, Bezier curves-Blending function formulation and its properties, Composite Bezier curves, B-spline curves & its properties, Periodic & non-periodic B-spline curves

**UNIT-IV 3D Graphics:** Polygon surfaces-Polygon mesh representations, Quadric and Super quadric surfaces and blobby objects; Solid modeling-Solid entities, Fundamentals of Solid modeling-Set theory, regularized set operations; Half spaces, Boundary representation, Constructive solid geometry, Sweep representation, Color models. Basic application commands for 2d drafting software like AutoCAD/ Draftsight (any one) & 3d solid modeling software Solid works/Autodesk Inventor/PTCCreo /Catia.

**UNIT-V Finite Element Analysis:** Basic concept of the finite element method, comparison of FEM with direct analytical solutions; Steps in finite element analysis of physical systems, Finite Element analysis of 1-D problems like spring, bar, truss and beam elements formulation by direct approach; development of elemental stiffness equations and their assembly, solution and its post processing.

**Books and References:**

1. Computer Graphics, by Hearn & Baker, Prentice Hall of India
2. CAD/CAM, by Groover and Zimmers, Prentice Hall India Ltd.
3. CAD/CAM : Theory and Practice, by Zeid, McGraw Hill

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**BTME-702: COMPUTER AIDED DESIGN (CAD)**

**List of practical:CAD/ CAM Experiments**

1. Design of machine component or other system experiment: Writing and validation of computer program.
2. Understanding and use of any 3-D Modeling Software commands.
3. Pro/E/Idea etc. Experiment: Solid modeling of a machine component
- 4 . Writing a small program for FEM for 2 spring system and validation of program or using a FEM Package
- 5 . Root findings or curve fitting experiment: Writing and validation of computer program.
6. To study the characteristic features of CNC machine
7. Part Programming (in word address format) experiment for turning operation (including Operations such as grooving and threading) and running on CNC machine
8. Part Programming (in word address format or ATP) experiment for drilling operation (point to point) and running on CNC machine
9. Part Programming (in word address format or ATP) experiment for milling operation (contouring) and running on CNC machine

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**BTME-703: AUTOMOBILE ENGINEERING**

**UNIT-I Introduction:** Basic concepts of Automobile Engineering and general configuration of an automobile, Power and Torque characteristics. Rolling, air and gradient resistance. Tractive effort. Gear Box. Gear ratio determination.

**UNIT-II Transmission System:** Requirements. Clutches. Torque converters. Over Drive and free wheel, Universal joint. Differential Gear Mechanism of Rear Axle. Automatic transmission, Steering and Front Axle. Castor Angle, wheel camber & Toe-in, Toe-out etc.. Steering geometry. Ackerman mechanism, Under steer and Over steer.

**UNIT-III Braking System:** General requirements, Road, tyre adhesion, weight transfer, Braking ratio. Mechanical brakes, Hydraulic brakes. Vacuum and air brakes. Thermal aspects.

**Chassis and Suspension System:** Loads on the frame, Strength and stiffness, Independent front & rear suspension, Perpendicular arm type, Parallel arm type, Dead axle suspension system, Live axis suspension system, Air suspension & shock absorbers.

**UNIT-IV Electrical System:** Types of starting motors, generator & regulators, lighting system, Ignition system, Horn, Battery etc.

**Fuel Supply System:** Diesel & Petrol vehicle system such as Fuel Injection Pump, Injector & Fuel Pump, and Carburetor. MPFI System.,

**UNIT-V Emission standards and pollution control :** Indian standards for automotive vehicles-Bharat I and II, Euro-I and Euro-II norms, fuel quality standards, environmental management systems for automotive vehicles, catalytic converters, fuel additives and modern trends in automotive engine efficiency and emission control.

**Maintenance system:** Preventive maintenance, break down maintenance and overhauling.

**Books and References:**

1. Automotive Engineering- Hietner
2. Automobile Engineering - Kripal Singh.
3. Automobile Engineering - Narang.

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**BTME-703: AUTOMOBILE ENGINEERING**

**List of practical: AUTOMOBILE LAB**

1. Study & experiment on Valve mechanism.
2. Study & experiment on Gear Box.
3. Study & experiment on Differential Gear Mechanism of Rear Axle.
4. Study & experiment on Steering Mechanism.
5. Study & experiment on Automobile Braking System.
6. Study & experiment on Chassis and Suspension System.
7. Study & experiment on Ignition system of I.C. Engine.



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**BTME-704: COMPUTER AIDED MANUFACTURING (CAM)**

**UNIT-I:** Introduction to Automation: Automated Manufacturing system; Need of automation, Basic elements of automation, Levels of automation, Automation Strategies, Advantages & disadvantages of automation, Historical development and future trends.

**UNIT-II:** Fundamental of Numerical Control, elements of NC machine tools, classification of NC machinetools, Advantages, suitability and limitations of NC machine tools, Application of NC system. Definition and designation of control axes, Constructional details of Numerical Control MachineTools, MCU structure and functions, Methods of improving accuracy and productivity using NC.

**UNIT –III** Computer Numerical Control (CNC) : Features of CNC, Elements of CNC machines, the machine control unit for CNC , Direct Numerical Control(DNC) and Adaptive Controls. System Devices: Drives, Feedback devices, Counting devices, DAC and ADCs, Interpolator systems, Control loop circuit elements in PTP system, Contouring system, Incremental and absolute systems.

**UNIT –IV NC Part Programming-**

(a) Manual (word address format) programming Examples Drilling, Turning and Milling; canned cycles, Subroutine, and Macro.

(b) Computer Assisted Part programming (APT) Geometry, Motion and Additional statements, Macro- statement.

**UNIT-V** Computer Integrated manufacturing system , Group Technology, Flexible Manufacturing System, Computer aided process planning-Retrieval and Generative System. Types and generations of Robots, Structure and operation of Robot, Robot applications.

**Books and References :**

1. Automation, Production System and Computer Integrated Manufacturing, by Mikell P. Grover, PrenticeHall of India Pvt Ltd.
2. CAD/CAM – Theory and Practice, by Ibrahim Zeid, McGraw Hill
3. Computer Aided Manufacturing, by Cheng, Pearson India
4. CAD/CAM: Principles and Oerations, by P. N. Rao, McGraw Hill
5. CAD/CAM: Computer Aided Design and Manufacturing, by M. Groover, Pearson India.

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**BTME-705: TOTAL QUALITY MANAGEMENT (TQM)**

**UNIT -I Quality Concepts:** Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of proto type. **Control on Purchased Product** Procurement of various products, evaluation of supplies, capacity verification, Development of sources, and procurement procedure. **Manufacturing Quality** Methods and Techniques for manufacture, Inspection and control of product, Quality in sales and services, Guarantee, analysis of claims.

**UNIT –II Quality Management:** Organization structure and design, Quality function, decentralization, Designing and fitting organization for different types products and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction programmer. **Human Factor in Quality** Attitude of top management, co-operation, of groups, operators attitude, responsibility, causes of operators error and corrective methods.

**UNIT –III Tools and Techniques :**Seven QC tools (Histogram, Check sheet, Ishikawa diagram, Pareto, Scatter diagram, Control chart, flow chart). **Control Charts:** Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts. **Attributes of Control Charts :**Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis of C-chart.

**UNIT –IV Defects Diagnosis and Prevention:** Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

**UNIT –V ISO-9000 and its concept of Quality Management:** ISO 9000 & ISO 14000 series, Quality information system and documentation, Auditing, Taguchi method, JIT .

**Books and References:**

1. Total Quality Management, by Dale H. Besterfield, Pearson India
2. Beyond Total Quality Management, Greg Bounds, McGraw Hill.

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**BTME- 801 :NON-CONVENTIONAL ENERGY RESOURCES**

**UNIT-I**

**Solar Radiation:** Extra-terrestrial and terrestrial, radiation measuring instrument, radiation measurement and predictions.

**Solar thermal conversion:** Basics, Flat plate collectors-liquid and air type. Theory of flat plate collectors, selective coating, advanced collectors, Concentrators: optical design of concentrators, solar water heater, solar dryers, solar stills, solar cooling and refrigeration.

**Solar photovoltaic:** Principle of photovoltaic conversion of solar energy; Technology for fabrication of photovoltaic devices; Applications of solar cells in PV generation systems; Organic PV cells.

**UNIT-II Wind energy characteristics and measurement:** Metrology of wind speed distribution, wind speed statistics, Weibull, Rayleigh and Normal distribution, Measurement of wind data, Energy estimation of wind regimes; Wind Energy Conversion: Wind energy conversion principles; General introduction; Types and classification of WECS; Power, torque and speed characteristics; power curve of wind turbine, capacity factor, matching wind turbine with wind regimes; Application of wind energy.

**UNIT-III Production of biomass, photosynthesis-C3&C4 plants on biomass production;** Biomass resources assessment; Co<sub>2</sub> fixation potential of biomass; Classification of biomass; Physicochemical characteristics of biomass as fuel Biomass conversion routes: biochemical, chemical and thermo chemical Biochemical conversion of biomass to energy: anaerobic digestion, biogas production mechanism, technology, types of digesters, design of biogas plants, installation, operation and maintenance of biogas plants, biogas plant manure-utilization and manure values.

**Biomass Gasification:** Different types, power generation from gasification, cost benefit analysis of power generation by gasification.

**UNIT-IV Small Hydropower Systems:** Overview of micro, mini and small hydro system; hydrology; Elements of turbine; Assessment of hydro power; selection and design criteria of turbines; site selection and civil works; speed and voltage regulation; Investment issue load management and tariff collection; Distribution and marketing issues.

**Ocean Energy:** Ocean energy resources, ocean energy routs; Principle of ocean thermal energy conversion system, ocean thermal power plants. Principles of ocean wave energy and Tidal energy conversion.

## **UNIT-V**

**Geothermal energy:** Origin of geothermal resources, type of geothermal energy deposits, site selection geothermal power plants;

**Hydrogen Energy:** Hydrogen as a source of energy, Hydrogen production and storage.

**Fuel Cells:** Types of fuel cell, fuel cell system and sub-system, Principle of working, basic thermodynamics

### **TEXT AND REFERENCES BOOKS:**

1. Kothari, Singal&Rajan; Renewable Energy Sources and Emerging Technologies, PHI Learn 2. Khan, B H, Non Conventional Energy, TMH.
3. Sukhatme and Nayak, Solar Energy, Principles of Thermal Collection and Storage, TMH.
4. Tiwari and Ghosal, Renewable Energy Resources: basic principle & application, NarosaPubl
5. KoteswaraRao, Energy Resources, Conventional & Non-Conventional, BSP Publication.

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**BTME- 802 :QUALITY CONTROL**

**UNIT-I**

**Introduction** :Concept and evaluation of quality control. Measurement & Metrology, precisionvs accuracy.Process capability, standrdisation& Interchangeability.

**Inspection and Gauges** :Inspection methods. Types of Gauges. Limits Fits and Tolerances. Non-Destructive Testings& Evaluation.

**UNIT-II**

**Control Charts for SQC** :Statistical Quality Control (SQC). Control charts for variables suchas X, R charts and control charts for attributes such as p-chart, c-chart. Construction & use of thecontrol charts.Process capability.

**UNIT-III**

**Acceptance Sampling for SQC** : Principle of acceptance sampling. Producer's and consumer'srisk. Sampling plans –single, double & sequential. Sampling by attributes and variables.

**UNIT-IV**

**Reliability** :Introduction to reliability, bath-tub curve. Life expectancy. Reliability based design.Series & Parallel System.

**Defect Diagnosis and prevention** :Basic causes of failure, curve/control of failure.

**MTBF**.Maintainability, Condition monitoring and dignostic techniques.

**Value Engineering** : Elements of value analysis, Techniques.

**Unit-V :**

**TQM** :Basic Concept, Quality control , Quality Assurance and Quality Management and TotalQuality Management. Implementation of TQM .ISO 9000 and its series, Zero defect. . Taguchi method, Six Sigma concepts.

**Other Factors in Quality** :Human Factors such as attitude and errors. Material-Quality, Quality circles, Quality in sales & service.

**BOOKS AND REFERENCE:**

1. Statistical Quality Control by Grant and Leavarworth, McGraw Hill
2. Maintenance for Reliability by Rao.

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**BTME-803: OPERATIONS RESEARCH**

**UNIT-I Introduction:** Basic of Operation Research, Origin & development of Operation Research, Applications.

**Linear Programming:** Introduction & Scope, Problem formulation, Graphical Method, Simplex Methods, primal and dual problem sensitivity analysis.

**UNIT-II Transportation Problem:** Methods of obtaining initial and optimum solution, degeneracy in Transportation problems, unbalanced Transportation Problem.

**Assignment Problem:** Methods of obtaining optimum solution, Maximization problem, travelling salesman problem.

**UNIT-III Game Theory:** two person Zero sum game, Solution with/without saddle point, dominance rule, Different methods like Algebraic, Graphical and game problem as a special case of Linear Programming. **Sequencing:** Basic assumptions, n Jobs through 2-3 machines, 2 Jobs on m machines.

**UNIT-IV Stochastic inventory models:** Single & multi period models with continuous & discrete demands, Service level & reorder policy. **Simulation:** Use, advantages & limitations, Monte-carlo simulation, Application to queuing, inventory & other problems.

**UNIT-V Queuing models:** Characteristics of Queuing Model, M/M/1 and M/M/S system, cost consideration. **Project management:** Basic Concept of network Scheduling, Rules for drawing network diagram, Applications of CPM and PERT techniques in Project planning and control; crashing of operations; resource allocation.

**BOOKS AND REFERENCES:**

1. Operations Research: Principles and Practice, by- Ravindran, Phillips, Solberg, John Wiley & Sons.
2. Principal of Operation Research, by- Harvey M. Wagner, Prentice Hall.
3. Introduction to Operation Research, by- Gillett, McGraw Hill.
4. Operations Research - An Introduction, by- Hamdy A. Taha, Pearson India.
5. Operation Research, by- Wayne L. Winston, Thomsan Learning.
6. Problems in Operations Research by- Prem Kumar Gupta & D.S. Hira, S. Chand

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**BTME- 804: PLANT LAYOUT AND MATERIAL HANDLING**

**UNIT -I**

**Introduction:** Criteria, Strategies/Tactics, Sustainability and Eco-Efficiency in Facility Design, Basic Planning, Alternative Machine Arrangements, Flow Lines, Location Models, Act/Building Details, Aisles and Security, Storage, Shipping and Receiving, Offices, Specialized Areas.

**UNIT -II**

Workstations, Unit Loads & Containers, Conveyors, Vehicles, Lifting Devices, Workstation Material Handling, Ethics in Facility Design Facilities design procedure and planning strategies, Production, activity and materials flow analysis, Space requirements and personnel services design considerations.

**UNIT -III**

**Layout construction techniques:** systematic layout planning; activity relationship analysis, pairwise exchange, graph-based construction algorithmic. **Material Handling:** Material handling principles; material handling equipment and material handling systems.

**UNIT -IV**

**Computerized Layout and Analytical Methods:** ALDEP, CORELAP, CRAFT, BLOCPLAN, etc. **Warehouse operations:** function, storage operations. **Manufacturing operation:** JIT, TQM, AM, CIM, SCM, Facility systems, **Quantitative models:** Layout model, waiting line, AS/RS, simulation model, etc.

**UNIT -V**

Assessment and evaluation of layout alternatives Projects, Use Spiral software to practice plant layout design, Apply mathematical and engineering techniques such as systematic layout planning approach, quantitative model, cost estimate to solve practical facility layout problem.

**BOOKS AND REFERENCES:**

1. Plant Layout and Material Handling, by- James M. Apple, John Wiley & Sons.
2. Plant Layout and Material Handling, by- Fred E. Meyers, Prentice Hall.
3. Facility Layout and Location: An Analytical Approach, by Richard L, Francis, Pearson India.
4. Plant Layout and Material Handling, by- B. K. Aggarwal, Jain Brothers.
5. Plant Layout and Material Handling, by- S. C. Sharma, Jain Brothers.
6. Materials Handling Handbook, by- Raymond A. Kulwiec, John Wiley & Sons.