JAGANNATH UNIVERSITY

Department of Mechanical Engineering

Academic Session 2017-2018

B. Tech (Mechanical Engineering)

Semester - I

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			
Code	**Subject/Paper**	**L**	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BT 101	Engineering mathematics-I	3	1	-	30	70	100	4
BT 102	Communication Skills	3	1	-	30	70	100	4
BT 103	Engineering Physics	3	1	-	30	70	100	4
BT 104	Computer Programming-I	3	1	-	30	70	100	4
BT 105	Environmental Engineering and Disaster Management	3	1	-	30	70	100	4
PRACTICALS/VIVA VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BT 107	Communication Skills Lab	-	-	2	30	20	50	1
BT 108	Engineering Physics Lab	-	-	2	30	20	50	1
BT 109	Computer Programming Lab	-	-	2	30	20	50	1
BT 110	Computer Aided Engineering Graphics	-	-	2	30	20	50	1
BT 111	Mechanical Workshop Practice	-	-	2	30	20	50	1
	TOTAL	15	5	10	300	450	750	25

Semester - II

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			
Code	**Subject/Paper**	**L**	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BT 201	Engineering Mathematics-II	3	1	-	30	70	100	4
BT 202	Human Values	3	-	-	30	70	100	3
BT 203	Engineering Chemistry	3	1	-	30	70	100	4
BT 204	Computer Programming-II	3	-	-	30	70	100	3
	Elective (any two)*							
BT 205A	Basic Electrical and Electronic Engineering	3	-	-	30	70	100	3
BT 205B	Basic Civil Engineering	3	-	-	30	70	100	3
BT 205C	Basic Mechanical Engineering	3	-	-	30	70	100	3
BT 205D	Engineering Mechanics	3	-	-	30	70	100	3
PRACTICALS/VIVA VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BT 206	Human Values: Activities	-	-	2	30	20	50	1
BT 207	Engineering Chemistry Lab	-	-	2	30	20	50	1
BT 208	Computer Programming-II Lab	-	-	2	30	20	50	1
BT 209	Computer Aided Machine Drawing	-	-	2	30	20	50	1
	TOTAL	**18**	**2**	**10**	**330**	**520**	**800**	**24**

BACHELOR OF TECHNOLOGY								
MECHANICAL ENGINEERING								
THIRD SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	L	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTME301	Advance Engineering Mathematics-I	3	0	0	30	70	100	3
BTME302	MEFA	3	0	0	30	70	100	3
BTME303	Engineering Mechanics	3	1	0	30	70	100	4
BTME304	Engineering Thermodynamics	3	0	0	30	70	100	3
BTME305	Materials Science and Engineering	3	0	0	30	70	100	3
BTME306	Mechanics of Solids	3	1	0	30	70	100	4
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTME307	Machine drawing practice	-	-	2	30	20	50	1
BTME308	Materials Testing Lab	-	-	2	30	20	50	1
BTME309	Basic Mechanical Engineering Lab	-	-	2	30	20	50	1
BTME310	Programming using MATLAB	-	-	2	30	20	50	1
BTME311	Mini Project	-	-	-	30	20	50	1
TOTAL		**18**	**2**	**8**	**330**	**520**	**850**	**25**

BACHELOR OF TECHNOLOGY								
MECHANICAL ENGINEERING								
FOURTH SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	L	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTME401	Data Analytics	3	-	-	30	70	100	3
BTME402	Technical Communications	3	-	-	30	70	100	3
BTME403	Digital Electronics	3	-	-	30	70	100	3
BTME404	Fluid Mechanics & Fluid Machines	3	1	-	30	70	100	4
BTME405	Manufacturing Processes	3	1	-	30	70	100	4
BTME406	Theory Of Machines	3	1	-	30	70	100	4
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTME407	Digital Electronics Lab	-	-	2	30	20	50	1
BTME408	Fluid Mechanics Lab	-	-	2	30	20	50	1
BTME409	Production Practice Lab	-	-	2	30	20	50	1
BTME410	Theory Of Machine Lab	-	-	2	30	20	50	1
BTME411	Social Outreach, Discipline & Extra Curricular Activates	-	-	-	-	-	50	1
TOTAL		18	**3**	**8**	**330**	**520**	**850**	26

BACHELOR OF TECHNOLOGY								
MECHANICAL ENGINEERING								
FIFTH SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	L	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTME501	Mechatronics Systems	3	-	-	30	70	100	3
BTME502	Heat Transfer	3	1	-	30	70	100	4
BTME503	Manufacturing Technology	3	-	-	30	70	100	3
BTME504	Design Of Machine Elements I	3	1	-	30	70	100	4
BTME505	Principles Of Management	3	-	-	30	70	100	3
BTME506.A	Steam Engineering	3	-	-	30	70	100	3
BTME506.B	Automobile Engineering	3	-	-	30	70	100	3
BTME506.C	Non Destructive Evaluation & Testing	3	-	-	30	70	100	3
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTME507	Mechatronics Lab	-	-	2	30	20	50	1
BTME508	Heat Transfer Lab	-	-	2	30	20	50	1
BTME509	Production Engineering Lab	-	-	2	30	20	50	1
BTME510	Machine Design Practice Lab	-	-	2	30	20	50	1
BTME511	Industrial Training/ Seminar	-	-	2	30	20	50	1
BTME512	Social Outreach, Discipline & Extra Curricular Activates	-	-	-	-	-	50	1
TOTAL		18	**1**	**10**	**330**	**520**	**900**	26

BACHELOR OF TECHNOLOGY								
MECHANICAL ENGINEERING								
SIXTH SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	L	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTME601	Measurement & Metrology	3	-	-	30	70	100	3
BTME602	Computer Integrated Manufacturing Systems	3	-	-	30	70	100	3
BTME603	Mechanical Vibrations	3	1	-	30	70	100	4
BTME604	Design of Machine Elements II	3	1	-	30	70	100	4
BTME605	Quality Management	3	-	-	30	70	100	3
BTME606.A	Refrigeration & Air Conditioning	3	-	-	30	70	100	3
BTME606.B	Non Conventional Machining Methods	3	-	-	30	70	100	3
BTME606.C	Micro electro and mechanical systems (MEMS) and Microsystems	3	-	-	30	70	100	3
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTME607	CIMS Lab	-	-	2	30	20	50	1
BTME608	Vibration Lab	-	-	2	30	20	50	1
BTME609	Machine Design Practice II Lab	-	-	2	30	20	50	1
BTME610	Thermal Engineering Lab	-	-	2	30	20	50	1
BTME611	Industrial Training/ Seminar	-	-	2	30	20	50	1
BTME612	Social Outreach, Discipline & Extra Curricular Activates	-	-	-	-	-	50	1
TOTAL		18	**2**	**10**	**330**	**520**	**900**	26

BACHELOR OF TECHNOLOGY								
MECHANICAL ENGINEERING								
SEVENTH SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	**L**	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTME701.A	**I.C. Engines**	3	0	0	30	70	100	3
BTME701.B	Operation Research	3	0	0	30	70	100	3
BTME701.C	Turbomachines	3	0	0	30	70	100	3
Open Elective – I (Choose Any One Subject)								
BTME702.A	**Non Destructive System**	3	0	0	30	70	100	3
BTME702.B	Environmental Engineering and Disaster Management	3	0	0	30	70	100	3
BTME702.C	Power Generation Sources	3	0	0	30	70	100	3
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTME703	FEA Lab	0	0	3	30	20	50	1
BTME704	Thermal Engineering Lab-II	0	0	3	30	20	50	1
BTME705	Quality Control Lab	0	0	2	30	20	50	1
BTME706	Industrial Training	1	0	0	60	40	100	2
BTME707	Seminar	2	0	0	60	40	100	2
BTME708	Social Outreach, Discipline & Extra Curricular Activity	-	-	-	-	-	50	1
TOTAL		9	**0**	**8**	**270**	**280**	**600**	14

BACHELOR OF TECHNOLOGY								
MECHANICAL ENGINEERING								
EIGHTH SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	**L**	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTME801.A	Hybrid and Electric Vehicles	3	0	0	30	70	100	3
BTME801.B	Supply and Operations Management	3	0	0	30	70	100	3
BTME801.C	**Additive Manufacturing**	3	0	0	30	70	100	3
Open Elective – II (Choose Any One Subject)								
BTME802.A	Finite Elements Methods	3	0	0	30	70	100	3
BTME802.B	**Energy Management**	3	0	0	30	70	100	3
BTME802.C	Waste and By-product Utilization	3	0	0	30	70	100	3
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTME803	Industrial Engineering Lab	0	0	2	30	20	50	1
BTME804	Metrology Lab	0	0	2	30	20	50	1
BTME805	Project	3	0	0	150	100	250	5
BTME807	Social Outreach, Discipline & Extra Curricular Activity	0	0	0	0	0	50	1
TOTAL		9	**0**	**4**	**270**	**280**	**600**	14

Semester - I

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			
Code	**Subject/Paper**	**L**	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BT 101	Engineering mathematics-I	3	1	-	30	70	100	4
BT 102	Communication Skills	3	1	-	30	70	100	4
BT 103	Engineering Physics	3	1	-	30	70	100	4
BT 104	Computer Programming-I	3	1	-	30	70	100	4
BT 105	Environmental Engineering and Disaster Management	3	1	-	30	70	100	4
PRACTICALS/VIVA VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BT 107	Communication Skills Lab	-	-	2	30	20	50	1
BT 108	Engineering Physics Lab	-	-	2	30	20	50	1
BT 109	Computer Programming Lab	-	-	2	30	20	50	1
BT 110	Computer Aided Engineering Graphics	-	-	2	30	20	50	1
BT 111	Mechanical Workshop Practice	-	-	2	30	20	50	1
	TOTAL	15	5	10	300	450	750	25

BT-101 ENGINEERING MATHEMATICS-I

Unit-I

Differential Calculus:

Asymptotes (Cartesian coordinates only), concavity, convexity and point of inflection, Curve tracing (Cartesian and standard Polar curves- Cardioids, Lemniscates of Bernoulli, Limacon, Equiangular Spiral only).

Unit-II

Limit, continuity and differentiability of functions of two variables, Partial differentiation, Euler's theorem on homogeneous functions, change of variables, chain rule.

Unit-III

Taylor's theorem (two variables), approximate calculations, Jacobian, maxima & minima of two and more independent variables, Lagrange's method of multipliers.

Unit-IV
Integral Calculus:
Double integral, change of order of integration, Double integral by changing into Polar form, Applications of Double integrals for evaluating areas & volumes, triple integral; Beta function and Gamma function (simple properties).

Unit-V
Vector Calculus:
Scalar and vector field, differentiation & integration of vector functions: Gradient, Directional derivative, Tangent planes and Normals.
Divergence, Curl and Differential Operator; Line, Surface and Volume integrals; Green's theorem in a plane, Gauss's and Stoke's theorem (without proof) and their applications.

Suggested Readings:

1. Thomas' Calculus, George B. Thomas, Jr., Maurice D. Weir, Joel R. Hass, Pearson Educations.
2. Calculus with Early Transcendental Functions, James Stewart, Cengage Lerning Publication.
3. Engineering Mathematics, C.B. Gupta, S.R. Singh and Mukesh Kumar, McGraw Hill Education.
4. Engineering Mathematics, S. Pal and S.C. Bhunia, Oxford University Press.
5. Higher Engineering Mathematics, B.V. Ramana, McGraw Hill Education.
6. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley.

BT-102 COMMUNICATION SKILLS

Unit-I
Communication: Meaning, Importance and Cycle of Communication, Media and Types of Communication, Formal and Informal Channels of Communication,

Barriers to Communication, Division of Human Communication and Methods to Improve Interpersonal Communication, Qualities of Good Communication.

Unit-II

Grammar: Passive Voice, Indirect Speech, Conditional Sentences, Modal Verbs, Linking Words.

Unit-III

Composition: Curriculum Vitae Writing, Business Letter Writing, Job Application Writing, Paragraph Writing, Report Writing.

Unit-IV

Short Stories: 'The Luncheon' by Somerset Maugham, 'How much Land does a Man Need?' by Leo Tolstoy, 'The Night Train at Deoli' by Ruskin Bond.

Unit-V

Poems: 'No Men are Foreign' by James Kirkup, 'If' by Rudyard Kipling, 'Where the Mind is without Fear' by Rabindranath Tagore.

Suggested Readings:

1. Communication Skills, Pushplata & Sanjay Kumar, Oxford University Press, India.
2. The Written Word, Vandana Singh, Oxford University Press, India.
3. Current English Grammar and Usage with Composition, R. P. Sinha, Oxford University Press,India.
4. Rodriques M. V., 'Effective Business Communication', Concept Publishing Company, New Delhi, 1992 reprint (2000).
5. Bansal, R K and Harrison J B, 'Spoken English' Orient Longman, Hyderabad.
6. Binod Mishra & Sangeeta Sharma, 'Communication Skills for Engineers and Scientists, PHI Learning Private Ltd, New Delhi, 2011.
7. Gartside L. 'Modern Business Correspondence, Pitman Publishing, London.

BT-103 ENGINEERING PHYSICS

Unit-I

Interference of light: Michelson's Interferometer: Production of circular & straight line fringes; Determination of wavelength of light; Determination of wavelength separation of two nearby wavelengths. Optical technology: Elementary idea of anti-reflection coating and interference filters.

Unit-II

Diffraction and Polarization of light: Fraunhofer Diffraction at Single Slit. Diffraction grating: Construction, theory and spectrum; Determination of wavelength of light. Resolving power: Raleigh criterion; Resolving power of diffraction grating and telescope. Plane, circularly and elliptically polarized light on the basis of electric (light) vector: Malus law; Double Refraction; Phase retardation plates and their use in production and detection of circularly and elliptically polarized light; Optical activity and laws of optical rotation; specific rotation and its measurement using half-shade device.

Unit-III

Elements of Material Science: Bonding in solids; covalent bonding and Metallic bonding; Classification of solids as Insulators, Semiconductors and Conductors; X-Ray diffraction and Bragg's Law. Hall Effect: Theory, Hall Coefficient and applications.

Unit-IV

Quantum Mechanics: Compton effect & quantum nature of light; Derivation of time dependent and time independent Schrodinger's Wave Equation; Physical interpretation of wave function and its properties; boundary conditions; Particle in one dimensional box.

Unit-V

Coherence and Optical Fibers: Spatial and temporal coherence; Coherence length; Coherence time and 'Q' factor for light; Visibility as a measure of Coherence and spectral purity; Optical fiber as optical wave guide; Numerical aperture; Maximum angle of acceptance and applications of optical fiber.

Laser and Holography: Theory of laser action; Einstein's coefficients; Components of laser; Threshold conditions for laser action; Theory, Design and applications of He-Ne and semiconductor lasers; Holography versus photography, Basic theory of holography; basic requirement of a Holographic laboratory; Applications of Holography in microscopy and interferometry.

Suggested Readings:

1. Engineering Physics: Malik and Singh (Tata McGraw Hill)
2. Engineering Physics: Naidu (Pearson)
3. Optics : Ajay Ghatak (Tata McGraw Hill)
4. Concept of Modern Phyiscs: A. Baiser (Tata McGraw Hill)
5. Fundamental of Optics : Jetkins and White (Tata McGraw Hill)
6. Material Science: Smith (McGraw Hill)

BT-104 COMPUTER PROGRAMMING-I

Unit-I

Computer Fundamentals: Flow chart, pseudocode. binary, octal and hexadecimal number system. ASCII, EBCDIC and UNICODE. boolean operations,

Unit-II

primary and secondary memory. Difference among low-level & high-level languages.

Unit-III

C Programming: Structure of a 'C' program, Datatypes, enumerated, assignment statements, input output statements,

Unit-IV
If statement, for loops, while loops, do-while loops, switch statement, break statement, continue statement. Datatype conversion.

Unit-V
Functions & program structure (function call and return), scope of variables, parameter passing methods, recursion v/s iteration.

Suggested Readings:
1. Fundamental of Computers By R. Thareja, Oxford University Press.
2. Programming in ANSI C by E Balagurusamy, Tata McGraw-Hill Education.
3. The C Programming Language by Brian W. Kernighan and Dennis M. Ritchie, PHI.
4. C:The Complete Reference by Herbert Schildt, McGraw-Hill Education.
5. Let us C by Yashavant P. Kanetkar, bpb publications.

BT-105 ENVIRONMENTAL ENGINEERING AND DISASTER MANAGEMENT

Unit-I
Basics of Environment: Environmental Pollution, Environmental Acts and Regulations, Ecosystem, Hydrological and chemical cycles, Energy flow in ecosystems. Biodiversity, population dynamics.

Unit-II
Water Pollution: Water pollutants, effects of oxygen demand, water quality in lakes, reservoirs and groundwater, contaminant transport, self cleaning capacity of streams and water bodies, water quality standards, Waste water management, Treatment & disposal of wastewater.
Rain water harvesting: Reuse and saving in use of water, methods of rain water harvesting.

Unit-III
Solid Waste Management: Classification of solid waste, Collection, transportation, treatment, and disposal of solid waste. Economic recovery of solid waste. Sanitary landfill, on site sanitation. Energy interaction from solid waste.

Unit-IV
Air and Noise Pollution: Primary and Secondary air pollutants, Air Pollution, Harmful effects of Air Pollution, Control of Air Pollution. Noise Pollution, Harmful effects of noise pollution, control of noise pollution, Global warming, Acid rain, Ozone depletion, Green House effect

Unit-V
Natural Disasters: Hydro-meteorological Based Disasters like Flood, Flash Flood, Cloud Burst, Drought, Cyclone, Forest Fires; Geological Based Disasters like Earthquake,

Tsunami, Landslides, Volcanic Eruptions. Man made Disasters: Chemical Industrial Hazards, Major Power Break Downs, Traffic Accidents, Fire Hazards, Nuclear Accidents. Disaster profile of Indian continent. Study of recent major disasters. Disaster Management Cycle and its components.

Disaster Management: Understanding Disasters and Hazards and related issues social and environmental. Risk and Vulnerability. Types of Disasters, their occurrence/ causes, technical terminology involved, impact and preventive measures.

Suggested Readings:

1. Towards Basics of Natural Disaster Reduction by Prof. D.K. Sinha. Researchco Book Center,Delhi.
2. Understanding Earthquake Disasters by Amita Sinvhal. Tata McGraw Hill, New Delhi.
3. Selected Resources available on www.nidmindia.nic.in
4. Basic Environmental Engineering by Prof. R.C. Gaur, New Age International Publication.

BT-107 COMMUNICATION SKILLS LAB

1. Phonetic Symbols and Transcriptions
2. Extempore
3. Group Discussion
4. Dialogue Writing
5. Listening Comprehension
6. Word Formation
7. Synonyms and Antonyms
8. Affixes

(Note: Wherever appropriate, Language Lab Software is to be used to improve listening comprehension and speaking skills.)

Suggested Readings:

1. Technical Communication: principles and Practice, Meenakshi Raman & Sangeeta Sharma, Oxford University Press, India.
2. Effective Technical Communication, Barun K. Mitra, Oxford University Press, India.
3. Binod Mishra & Sangeeta Sharma, 'Communication Skills for Engineers and Scientists, PHI Learning Private Ltd, New Delhi, 2011.
4. Communication Skills, Pushplata & Sanjay Kumar, Oxford University Press, India.
5. Bhattacharya, Indrajit, An Approach to Communication Skills, Dhanpat Rai & Co. (Pvt) Ltd., New

Delhi.
6. Wright, Crissy, Handbook of Practical Communication Skills, Jaico Publishing House, Mumbai.
7. Gimson, A C, 'An Introduction to the Pronunciation of English', ELBS.

BT-108 ENGINEERING PHYSICS LAB

1. To determine the wave length of monochromatic light with the help of Michelson's interferometer.
2. To determine the wave length of sodium light by Newton's Ring.
3. To determine the specific rotation of glucose (sugar) solution using polarimeter.
4. To determine the wave length of prominent lines of mercury by plane diffraction grating with the help of spectrometer.
5. To study the variation of a semiconductor resistance with temperature and hence determine the band gap of the semi conductor in the form of reverse baised P-N junction diode.
6. To determine the height of water tank with the help of sextant.
7. To determine the dispersive power of material of a prim for violet and yellow colour's of mercury light with the help of spectrometer.
8. To study the charge and discharge of a condenser and hence determine the same constant (both current and voltage graphs are to be plotted.
9. To verify the expression for the resolving power of a Telescope.
10. To determine the coherence length and coherence time of laser using He – Ne laser.
11. To determine the specific resistance of the material of a wire by Carey Froster's bridge.

BT-109 COMPUTER PROGRAMMING LAB

The programs shall be developed in C language related with the following concepts:

1. Eight programs using input output statements, if statement, for loops, while loops, do-while loops, switch statement, break statement, continue statement, datatype conversion etc.
2. Check a number- palindrome, prime, etc.
3. Eight programs using functions.
4. Two programs using recursion and Iteration.

BT-110 COMPUTER AIDED ENGINEERING GRAPHICS

1.Projections of Point & Lines: Positions of Point, Notation system, systematic Approach for projections of points, Front view & Top view of point, Positions of straight lines, line parallel to Both the RPs, Line perpendicular to either of the RPs, Line inclined to one RP and parallel to the other, Line Inclined to Both the RPs, Traces of a line (One drawing sheet, one assignment in sketch book)

2.Projections of planes: Positions of planes, Terms used in projections of planes, plane parallel to RP, plane inclined to one RP and perpendicular to the other RP, plane perpendicular to Both the RPs, plane Inclined to Both RPs, True shape of the plane, Distance of a point from plane, Angle between two planes (no drawing sheet required, only assignment in sketch book)

3.Projection of solids: Basic solids, Frustums and truncated solids, Positions of the solids, solid with Axis perpendicular to an RP, solid with axis inclined to one RP and parallel to the other solid with axis Inclined to Both the RPs Solid with Axis parallel to Both the RPs (One drawing sheet, one assignment in sketch book)

4.Section of solids: Theory of sectioning, section of prisms and cubes, sections of pyramids and Tetrahedron section of Cylinders, Section of cones, Section of spheres (One drawing sheet, one assignment in sketch book)

5.Development of surfaces: Methods of development, parallel line developments, Radial line Development, Anti- Development (One drawing sheet, one assignment in sketch book)

6.Isometric Projection: Principle of Isometric Projection Isometric scale, Isometric projections and Isometric Views, Isometric Views of standard shapes, Isometric views of standard solids (One drawing sheet, one assignment in sketch book)

7.Computer Aided Drafting: Introduction to CAD, Advantages of CAD software's, Auto CAD, Auto CAD Commands and tool bars, Creating the Drawing, Charging properties, Dimensioning other object, Text editing, Isometric drawing (Four assignments on the computer)

Suggested Readings:

1. Engineering Drawing Geometrical Drawing P.S.Gill , S.K.Katara & Sons
2. Engineering Drawing,Dhanarajay A Jolhe ,Tata McGraw Hill.
3. Engineering Drawing, Basant Agarwal & CM Agarwal ,Tata McGraw Hill
4. Engineering Drawing, N.D.Bhatt, Charotar Publishing House Pvt. Ltd.
5. Engineering Drawing with an introduction to AutoCAD, Dhananjay A Jolhe
6. Engineering Drawing with AutoCAD, B.V.R. Gupta and M. Rajaroy
7. AutoCAD 2017 for Engineers & Designers (Basic and Intermediate), Sham Tickoo,

BT-111 MECHANICAL WORKSHOP PRACTICE

1.Carpentry Shop:

1. T – Lap joint
2. Bridle joint

2. Foundry Shop:

1. Mould of anypattern
2. Casting of any simple pattern

3.Welding Shop:

1. Lap joint by gaswelding
2. Butt joint by arcwelding
3. Lap joint by arcwelding
4. Demonstration of brazing, soldering & gas cutting

4.Machine Shop Practice:

1. Demonstration of various machine tools such as Lathe, Shaper, Milling, Grinding and Drilling

5.Fitting Shop

1. Finishing of two sides of a square piece by filing
2. Making mechanical joint and soldering of joint on sheet metal
3. To cut a square notch using hacksaw and to drill a hole and tapping

6.Sheet Metal Shop

Making of Funnel using sheet metal

Suggested Readings:

1. Elements of Workshop Technology Hajra & Choudhary, Media Promoters & Publisher.
2. Workshop Practice HS Bawa, Tata McGraw Hill 2nd ed. India.
3. Mechanical Workshop Practice, K.C. John, PHI Learning New Delhi.
4. Workshop Technology, W.A.J.Chapman, CBS Publisher & Distributor New Delhi.

Semester - II

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			
Code	**Subject/Paper**	**L**	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BT 201	Engineering Mathematics-II	3	1	-	30	70	100	4
BT 202	Human Values	3	-	-	30	70	100	3
BT 203	Engineering Chemistry	3	1	-	30	70	100	4
BT 204	Computer Programming-II	3	-	-	30	70	100	3
	Elective (any two)*							
BT 205A	Basic Electrical and Electronic Engineering	3	-	-	30	70	100	3
BT 205B	Basic Civil Engineering	3	-	-	30	70	100	3
BT 205C	Basic Mechanical Engineering	3	-	-	30	70	100	3
BT 205D	Engineering Mechanics	3	-	-	30	70	100	3
PRACTICALS/VIVA VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BT 206	Human Values: Activities	-	-	2	30	20	50	1
BT 207	Engineering Chemistry Lab	-	-	2	30	20	50	1
BT 208	Computer Programming-II Lab	-	-	2	30	20	50	1
BT 209	Computer Aided Machine Drawing	-	-	2	30	20	50	1
	TOTAL	**18**	**2**	**10**	**330**	**520**	**800**	**24**

BT:201 ENGINEERING MATHEMATICS-II

Unit-I

Linear Algebra:

Rank of a matrix, Normal forms, consistency of systems of linear simultaneous equations and its solutions, Linear dependence and independence of vectors, Eigen values and Eigen vectors, Cayley-Hamilton theorem (without proof), orthogonal matrices, diagonalization ofmatrix.

Unit-II

Fourier Series:

Orthogonal functions, periodic functions, Fourier series of periodic functions, Euler formula, change of intervals, Even and Odd functions, half range Fourier sine and cosine series; Harmonic analysis.

Unit-III

Differential Equations:

Linear differential equations of first order, Reducible to linear form, Exact differential equations, reducible to exact form; Linear Differential Equations of Higher order with constant coefficients, Simultaneous linear differential equations.

Unit-IV

Second order linear ODE with variables coefficients, Homogenous and exact forms, Change of dependent and independent variables; Variation of parameters, Method of Undetermined coefficients, Euler-Cauchy equations.

Unit-V

Partial Differential Equations: Order and Degree, Formation; Linear partial differential equations of first order: Lagrange's form, Standard forms, Charpit's method.

Solutions of PDE of Second order using separation of variable method.

Suggested Readings:

1. Advanced Engineering Mathematics, Peter O Neil, Cengage Learning Publication.
2. Advanced Engineering Mathematics, 4th Edition, Dennis G. Zill, Warren S. Wright, Jones & Bartlett Publications.
3. Engineering Mathematics, S. Pal and S.C. Bhunia, Oxford University Press.
4. Engineering Mathematics, C.B. Gupta, S.R. Singh and Mukesh Kumar, McGrawHill Education.
5. Advanced Engineering Mathematics, Jain and Iyengar, Narosa Publications.
6. Higher Engineering Mathematics, B.V. Ramana, McGraw Hill Education.
7. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley.

BT-202 HUMAN VALUES

Unit-I

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Understanding the need, basic guidelines, content and process for Value Education

Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration

Continuous Happiness and Prosperity- A look at basic Human Aspirations

Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority

Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

Method to fulfill the above human aspirations: understanding and living in harmony at various levels

Unit-II

Understanding Harmony in the Human Being - Harmony in Myself

Understanding human being as a co-existence of the sentient 'I' and the material 'Body' Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha

Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)

Understanding the characteristics and activities of 'I' and harmony in 'I'

Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail

Programs to ensure Sanyam and Swasthya

Unit-III

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

Understanding harmony in the Family- the basic unit of human interaction

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

Understanding the meaning of Vishwas; Difference between intention and competence Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship

Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals

Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family!

Unit-IV

Understanding Harmony in the Nature and Existence - Whole existence as Co- existence Understanding the harmony in the Nature Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation innature

Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all- pervasive space Holistic perception of harmony at all levels of existence Implications of the above Holistic Understanding of Harmony on Professional Ethics Natural acceptance of human values Definitiveness of Ethical Human Conduct

Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

Unit-V

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 eco-friendly production systems, technologies and management models

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

Suggested Readings:

1. R R Gaur, R Sangal, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, Excel Books, 2009. ISBN: 978-9-350-62091-5
2. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
3. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
4. R. Subramanian, Professional Ethics includes Human Values, Oxford Univ. Press.
5. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
6. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
7. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
8. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
9. A N Tripathy, 2003, Human Values, New Age International Publishers.

SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik)

BT-203 ENGINEERING CHEMISTRY

Unit-I

Water:

Common natural impurities, hardness, determination of hardness by complexometric (EDTA method), degree of hardness. Municipal water supply, requisite of drinking water, purification of water, sedimentation, filtration, sterilization, breakpoint chlorination. Water for steam making and boiler troubles, formation of solids (Scale and Sludge formation), carryover (Foaming and Priming), boiler corrosion and caustic embrittlement, Methods of boiler water treatment(water softening) preliminary treatments, preheating, Lime-Soda process, Zeolite (Permutit) process, Deionization (Demineralization) process.

Numerical problems based on hardness, Lime-Soda and zeolite process.

Unit-II

Organic Fuels:

Origin and classification of fuels. Solid fuels-, coal, classification of coal, significance of constituents, proximate and ultimate analyses of coal, gross and net calorific value, determination of calorific value of coal by Bomb Calorimeter. Metallurgical coke, carbonization processes- Beehive coke oven and Hoffmann Oven (by-products oven) method. Liquid fuels- Advantages of liquid fuels, petroleum and refining of petroleum, reforming, cracking, synthetic petrol, knocking, octane number, anti-knocking agents. Gaseous fuels-advantages, manufacture, composition and uses of coal gas and oil gas, determination of calorific value of gaseous fuels by Junker's calorimeter, flue gas analysis by Orsat's apparatus.

Numerical problems based on determination of calorific value (bomb calorimeter/Junkers calorimeter/Dulongs formula, proximate analysis & ultimate and combustion of fuel.

Unit-III

Polymers:

Classification, constituents, general properties of polymers and their uses. Preparation properties and uses of polyethylene, polyethylene terephthalate (PET), nylon 6, nylon 66, nylon 6, 10, Kevlar, Bakelite. Elastomers – natural rubber and vulcanization, synthetic rubbers viz. Buna-S, Buna –N, Butyl and Neoprene Rubbers. Conducting polymers-.

Unit-IV

Lubricants:

Classification, types of lubrication, properties and uses. Viscosity and viscosity index, flash and fire point, cloud and pour point. Emulsification and steam emulsion number.

Corrosion and its control:

Definition and its significance. Mechanism of chemical (dry) and electrochemical (wet) corrosion, galvanic corrosion, concentration type corrosion and pitting

corrosion. Protection from corrosion- protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design.

Unit-V

Inorganic Engineering Materials:

Cement: Manufacture of Portland cement. Rotary kiln technology. Chemistry of hardening and setting of cement. Role of gypsum. Refractories: Definition properties and classification. Silica and fire clay refractories. Glass: Definition, type and properties of glasses. Manufacture of glass, annealing of glass. Optical fibre grade glass.

Suggested Readings:

1. Engineering Chemistry by Monica Jain and P C Jain, Dhanpat Rai Publishing Company (P) Ltd, New Delhi.
2. Engineering Chemistry Wiley, India.
3. The Chemistry and Technology of Coal, by J G Speigh, CRC Press.
4. The Chemistry and Technology of Petroleum, by J G Speigh, CRC Press.
5. Polymer Chemistry: An Introduction, Malcolm P. Stevens, Oxford University Press.
6. Lubricants and Lubrications, Theo Mang, Wilfeied, Wiley-VCH.
7. Chemistry of water treatment, Samuel Faust & Osman M Aly, CRC Press.
8. Boilers water treatment. Principles and Practice, Colin Frayne, CRC Press.
9. Corrosion Understanding the Basic, by Joseph R Davis, ASM International.
10. Engineering Chemistry, by O.G. Palanna, McGraw Hill Education, India.

BT-204 COMPUTER PROGRAMMING-II

Unit-I

Computer System Fundamentals: System software, firmware, freeware/open-source, loader, compiler, peripherals.

Unit-II

Computer Programming: one-dimensional arrays, multi-dimensional arrays, character arrays and strings,

Unit-III

Pointers ,Pointers arithmetic, Dynamic memory allocation: functions like malloc, calloc, free.

Unit-IV

Preprocessor, command line arguments, difference between macro and inline function. Structure & Union, typedef.

Unit-V

File operations and multi-file handling, sscanf()/sprintf(). Graphics using C.

Suggested Readings:

1. Programming in ANSI C by E Baluguamsamy, TaTa McGraw-Hill Education
2. Programming in C by Thareja, Oxford University Press.
3. The C Programming Language by Brian W. Kernighan and Dennis M. Ritchie, PHI.

4. C: The Complete Reference by Herbert Schildt, McGraw-Hill Education.
5. Graphics Under C by Yashavant P. Kanetkar, bpb publications.

BT 205.A BASIC ELECTRICAL AND ELECTRONICSENGINEERING

Unit-I

Basic Concepts of Electrical Engineering: Electric Current, Electromotive force, Electric Power, Ohm's Law, Basic Circuit Components, Faraday's Law of Electromagnetic Induction, Lenz's Law, Kirchhoff's laws, Network Sources, Resistive Networks, Series- Parallel Circuits, Node Voltage Method, Mesh Current Method, Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems.

Unit-II

Transformers: Construction, EMF equation, ratings, phasor diagram on no load and full load, equivalent circuit, regulation and efficiency calculations, open and short circuit tests, auto-transformers

Unit-III

Alternating Quantities: Introduction, Generation of AC Voltages, Root Mean Square and Average Value of Alternating Currents and Voltages, Form Factor and Peak Factor, Phasor Representation of Alternating Quantities, Single Phase RLC Circuits, Introduction to 3- Phase AC System.

Unit-IV

Rotating Electrical Machines; DC Machines: Principle of Operation of DC Machine as Motor and Generator, EMF Equation, Applications of DC Machines. AC Machines: Principle of Operation of 3-Phase Induction Motor, 3-Phase Synchronous Motor and 3- Phase Synchronous Generator (Alternator), Applications of AC Machines.

Unit-V

Basic Electronics: Conduction in Semiconductors, Conduction Properties of Semiconductor Diodes, Behaviour of the PN Junction, PN Junction Diode, Zener Diode, Photovoltaic Cell, Rectifiers, Bipolar Junction Transistor, Field Effect Transistor, Transistor as an Amplifier. Digital Electronics: Boolean algebra, Binary System, Logic Gates and Their Truth Tables. Electrical Measuring Instruments:

DC PMMC instruments, shunt and multipliers, multimeters, Moving iron ammeters and voltmeters, dynamometer, wattmeter, AC watthour meter, extension of instrument ranges.

Suggested Readings:

1. Basic Electrical and Electronics Engineering by Sukhija and Nagsarkar, Oxford Publication
2. Basic Electrical & Electronics Engineering by Kothari, Nagrath, TMH
3. Basic Electrical & Electronics Engineering by V. Jagathesan, K. Vinod Kumar & R. Saravan Kumar, WileyIndia.
4. Basic Electrical & Electronics Engineering by Van Valkenburge, Cengage learning Indian Edition
5. Basic Electrical and Electronics Engineering by Muthusubrmaniam, TMH
6. Fundamentals of Electrical and Electronics Engineering by Ghosh, Smarajit, PHI India
7. Basic Electrical & Electronics Engineering by Ravish Singh, TMH
8. Basic Electronics Engineering by Vijay Baru et al, Dream Tech, New Delhi

BT-205.B BASIC CIVIL ENGINEERING

Unit-I

Introduction: Specialization of Civil Engineering, scope of Civil Engineering, Role of civil Engineer in Society, Impact of infrastructural development on economy of country.

Surveying: Object & principles of Surveying, plans and maps, Scales, Unit of measurement.

Unit-II

Linear measurements: Direct measurements- Tape & Chain, Ranging out survey lines, taking measurements of sloping ground.

Tape correction, conventional symbols. Introduction to Compass Surveying & Leveling. Introduction to totalstation.

Unit-III

Building & Building materials:

Construction materials: Stone, Brick, Cement, Mortar, Concrete, Steel – their properties & uses.

Unit-IV

Selection of site for Buildings, types of buildings, plinth area, carpet area, floor space index, Introduction to building byelaws, concept of sun light and ventilation.

Components of Buildings & their functions, Basic concept of R.C.C., Introduction to types of foundation.

Unit-V

Transportation, Traffic and Road Safety: Types and characteristics of various modes of transportation, various road traffic signs, causes of accidents and road safety measures.

Suggested Readings:

1. Palancharmy, Basic Civil Engineering, McGraw Hill publishers.
2. Satheesh Gopi, Basic Civil Engineering, Pearson Publishers.
3. Ketki Ranwala Dalal, Essentials of Civil Engineering, Charotar Publishing House.

BT-205.C BASIC MECHANICAL ENGINEERING

Unit-I

Fundamentals: Introduction to mechanical engineering, concepts of thermal engineering, mechanical machine design, industrial engineering and manufacturing technology. Steam Boilers, Steam Turbines and Power Plants: Introduction, classification and types of steam boilers and steam turbines. Discuss working of steam boilers and steam turbines.
Introduction and Classification of power plants.

Unit-II

Pumps and IC Engines: Applications and working of Reciprocating and Centrifugal pumps. Introduction, Classification of IC Engines, Main Components of IC Engines, Working of IC Engines and its components.

Unit-III

Refrigeration and Air Conditioning: Introduction, classification and types of refrigeration systems and air-conditioning. Applications of refrigeration an Air-conditioning.

Transmission of Power: Introduction and types of Belt and Rope Drives. Introduction to Gears and Gear Trains.

Unit-IV

Primary Manufacturing Processes:
Metal Casting Process: Introduction to Casting Process, Patterns, Molding, Furnaces. Metal Forming Processes: Introduction to Forging, Rolling, Extrusion, Drawing.

Metal Joining Processes: Introduction to various types of Welding, Gas Cutting, Brazing, and Soldering.

Metal Removal or Machining Processes: Introduction to machining process and various machine tools.

Unit-V

Engineering Materials and Heat Treatment of Steel:Introduction to various engineering materials and their properties. Introduction to Heat Treatment and types of Heat Treatment Processes.

Introduction to CAD, CAM, FMS, MEMS and CIM:Introduction to modern manufacturing systems and their applications.

Suggested Readings:

1. G. Shanmugam and S Ravindran, Basic Mechanical Engieering, Mc Graw hill, fourth edition.
2. K Venu Gopal and Prabhu Raja V, Basic Mechanical Engineering, Anuradha agencies pub,Chennai.

BT-205.D ENGINEERING MECHANICS

Unit-I

Statics of particles and rigid bodies: Fundamental laws of mechanics, Principle of transmissibility, System of forces, Resultant force, Resolution of force, Moment and Couples, Resolution of a force into a force and a couple, Free body diagram, Equilibrium, Conditions for equilibrium, Lami's theorem.

Centroid & Moment of inertia (M.I): Location of centroid, Moment of inertia (mass and area), Parallel axis and perpendicular axis theorems, M.I of composite section, M.I. of solid bodies, Polar moment of inertia.

Unit-II

Virtual work: Principle of Virtual Work, Active forces and active force diagram, Stability of equilibrium.

Friction: Types of Friction, Laws of friction, Angle of friction, Angle of repose, Ladder, Wedge, Belt Friction.

Unit-III

Kinematics of particles and rigid bodies: Velocity, Acceleration, Types of Motion, Equations of Motion, Rectangular components of velocity and acceleration, Angular velocity and Angular acceleration, Radial and transverse velocities and accelerations, Projectiles motion on plane and Inclined Plane, Relative Motion.

Kinetics of particles and rigid bodies: Newton's second law, Equation of motion in rectangular coordinate, Equation of motion in radial and transverse components, Equation of motion in plane for a rigid body, D'Alembert principle.

Unit-IV

Work, Energy and Power: Work of a force, weight, spring force and couple, Power, Efficiency, Energy, Kinetic energy of rigid body, Principle of work and energy, Conservative and Non-conservative Force, Conservation of energy.

Unit-V

Impulse and Momentum: Linear and angular momentum, Linear and angular impulse, Principle of momentum for a particle and rigid body, Principle of linear impulse and momentum for a particle and rigid body, Principle of angular momentum and Impulse, Conservation of angular momentum, Angular momentum of rigid body, Principle of impulse and momentum for a rigid body, Central impact, System of variable mass.

Suggested Readings:

1. Engineering Mechanics, Sharma, Pearson Education.
2. Engineering Mechanics, Beer and Johnston, Tata McGraw-Hill.
3. Engineering Mechanics, Basudeb Bhattacharya, Oxford University Press
4. Engineering Mechanics, Hibbeler, Pearson Education.
5. Engineering Mechanics, Meriam and Kraige, John Wiley & Sons.
6. Engineering Mechanics, Timoshenko and Young, Tata McGraw-Hill.
7. Engineering Mechanics, Shames, Pearson Education.

BT- 206 HUMAN VALUES: ACTIVITIES

PS 1:

Introduce yourself in detail. What are the goals in your life? How do you set your goals in your life? How do you diffierentiate between right and wrong? What have been your salient achievements and shortcomings in your life ? Observe and analyze them.

PS 2:

Now-a-days, there is a lot of talk about many technogenic maladies such as energy and material resource depletion, environemental pollution, global warming, ozone depletion, deforestation, soil degradation, etc. - all these seem to be manmade problems, threatening the survival of life Earth - What is the root cause of these maladies & what is the way out in opininon?

On the other hand, there is rapidly growing danger because of nuclear proliferation, arms race, terrorism, breakdown of relationships, generation gap, depression & suicidal attempts etc. - what do you think, is the root cause of these threats threats to human happiness and peace - what could be the way out in your opinion?

PS 3:

1. Observe that each of us has the faculty of 'Natural Acceptance', based on which one can verify what is right or not right for him. (As such we are not properly trained to listen to our 'Natural Acceptance' and may a time it is also clouded by our strong per-conditioning and sensory attractions).

Explore the following:

(i) What is Naturally Acceptable' to you in relationship the feeling of respect or disrespect for yourself and for others?

(ii) What is 'naturally Acceptable' to you - to nurture or to exploit others?

Is your living in accordance with your natural acceptance or different from it?

2. Out of the three basic requirements for fulfillment of your aspirations - right understanding, relationship and physical facilities - observe how the problems in your family are related to each. Also observe how much time & effort you devote for each in your dailyroutine.

PS 4:

list down all your important desires. Observe whether the desire is related to Self (I) or the Body. If it appears to be related to both, visualize which part of it is related to Self
(I) and which part is related to Body.

1. a. Observe that any physical facility you use, follows the given sequence with time:

Necessary and tasteful - unnecessary but still tasteful - unnecessary and tasteless - intolerable

b. In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If not acceptable, you want it continuously and if not acceptable, you do not want it any moment!

2. List down all your important activities. Observe whether the activity is of 'I' or of Body or with the participation of both or with the participation of both 'I' and Body.

3. Observe the activities within 'i'. Identify the object of your attention for different moments (over a period of sy 5 to 10 minutes) and draw a line diagram connecting these points. Try observe the link between any two nodes.

PS 6:

1. Chalk out some programs towards ensuring your harmony with the body - in tearms of nurturing, protection and right utilisation of the body.
2. Find out the plants and shrubs growing in and around your campus, which can be useful in curing common diseases.

PS 7:

Form small groups in the class and make them carry out a dialogue focusing on the following eight questions related to 'TRUST';

1a. Do I want to make myself

happy? 2a. Do I want to make the

other happy?

3a. Does the other want to make himself/herself

happy? 4a. Does the other want to make me happy?

What is the answer?

Intention (NaturalAcceptance)

1b. Am I able to always make myself

happy? 2b. Am I able to always make the

other happy?

3b. Is the other able to always make himself/herself happy?

What is theanswer?

Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate yourself and others on the basis of intention/competence.

PS 8:

1. Observe, on how many occasions, you are able to respect your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under-evaluation, over-evaluation or otherwise evaluation.
2. Also, observe whether your feeling of respect is based on treating the other as you would treat youself or on differentiations based on body, physical facilities or belieds.

PS 9:

1. Write a narration in the form of a story, poem, skit or essay to clarify a salient Human Value to the children.
2. Recollect and narrate an incident in your life where you were able to exhibit willful adherence to balues in a difficult situation.

PS 10:

List down some common units (things) of Nature which you come across in your daily life and classify them in the four orders of Nature. Analysis and explain the aspect of mutual fulfillment of each unit with other orders.

PS 11:

Make a chart to show the whole existence as co-existence. With the help of this chart try to identify the role and the scope of some of the courses of your study. Also indicate the areas which are being either over-emphasized or ignored in the present context.

PS 12:

Identify any two important problems being faced by the society today and analyze the root cause of these problems. Can these be solved on the basic of natural acceptance of human values. If so, how should one proceed in this direction from the present situation?

PS 13:

1. Suggest ways in which you can use your knowledge of Science/Technology/Management etc. for moving towards a universal human order.
2. Propose a broad outline for humanistic Constitution at the level of Nation.

PS 14:

The course is going to be over now. It is time to evaluate what difference in your thinking it has made. Summarize the core massage of this course grasped by you. How has this affected you in terms of;

a. Thought
b. Behavior
c. Work and
d. Relization

3. **What practical steps are you able to visualize for the transition of the society from its present state.**
4.
5.
6. **Project:**
7.
8. **Every student required to take-up a social project e.g. educating children in needy/weaker section, services in hospitals, NGO's and other such work**

BT-207 ENGINEERING CHEMISTRY LAB

1. To determine the hardness of water by HCL method.
2. To determine the hardness of water by EDTA method
3. Measurement of conductivity of a given sample by conductivity meter.
4. Study of BombCalorimeter.
5. To determine the strength of Ferrous Ammonium sulphate solution with the help of $K_2Cr_2O_7$ solution.
6. To determine the strength of $CuSO_4$ solution with the help of hypo solution.
7. To determine the strength of NaOH and Na_2CO_3 in a given alkali mixture.
8. To determine the flash and fire point of a given lubricating oil.
9. To determine the viscosity of a given lubricating oil by Redwood viscometer.
10. To determine cloud and pour point of lubricating oil.

BT 208 COMPUTER PROGRAMMING-II LAB

The programs shall be developed in C language related with the following concepts:

1. Input roll numbers of your friends in an array & print in reverse order.
2. Input names of your friends in an array & print in reverse order.
3. Input two matrices and output third matrix after performing add/subtract the corresponding elements.
4. Four programs using malloc, calloc, free & sscanf()/sprintf() functions.

5. Two programs using macro and online functions.
6. Two programs using structure & union.
7. Two programs using pointers.
8. Three programs belonging to file operations and multi-file handling.
9. Three programs belonging to graphics using C.

BT 209: COMPUTERS AIDED MACHINE DRAWING

1.Introduction: Principles of drawing, conventional representation of machine components and materials, lines, types of lines, dimensioning types, rules of dimensioning.

2.Conversion of pictorial views into orthographic views: (1 drawing sheet) Introduction to orthographic projection, concept of first angle and third angle projection, drawing of simple machine elements in first angle projection, missing view problems.

3.Sectional view : (1 drawing sheet) Introduction, cutting plane line, type of sectional views-full section, half section, partial or broken section, revolved section, removed section, offset section, sectioning conventions-spokes, web, rib, shaft, pipes, different types of holes, conventions of section lines for different metals and materials.

4.Fasteners: (1 drawing sheet) Temporary and permanent fasteners, thread nomenclature and forms, thread series, designation, representation of threads, bolted joints, locking arrangement of nuts, screws, washers, foundation bolts etc., keys, types of keys, cotter and knuckle joints. Riveted joints, rivets and riveting, types of rivets, types of riveted joints etc.

5.Assembly drawing: (1 drawing sheet) Introduction to assembly drawing, assembly drawing of simple machine elements; like rigid or flexible coupling, muff coupling, plummer block, footstep bearing, bracket etc.

6.Free hand sketching: Need for free hand sketching, Free hand sketching of conventional representation of materials, screw fasteners, foundation bolts, studs.

7.Bearing: Ball, roller, needle, foot step bearing.

8.Coupling: Protected type, flange, and pin type flexible coupling.

9.Other components: Welded joints, belts and pulleys, pipes and pipe joints, valves etc.

10.Computer aided drafting: Concepts of computer aided 2D drafting using any drafting software like AutoCAD/ Solid works/Creo/Catia etc., basic drawing and modify commands, making 2D drawings of simple machine parts.

Suggested Readings:

1. Laxminarayan and M.L. Mathur, Machine Drawing, Jain Brothers
2. Gill P S, Machine Drawing, Kataria & Sons 2009
3. Basudeb Bhattacharya, Machine Drawing, Oxford University Press 2011
4. Dhawan, R.K., A Text Book of Machine Drawing, S. Chand & Company, 1996
5. Ostrowsky, O., Engineering Drawing with CAD Applications, ELBS, 1995
6. Siddeshswar N., P Kannaiah, VVS Shastry, Machine Drawing,Tata McGraw Hill

BACHELOR OF TECHNOLOGY								
MECHANICAL ENGINEERING								
THIRD SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	L	T	P	IA	EA	Total	Credits
BTME301	Advance Engineering Mathematics-I	3	0	0	30	70	100	3
BTME302	MEFA	3	0	0	30	70	100	3
BTME303	Engineering Mechanics	3	1	0	30	70	100	4
BTME304	Engineering Thermodynamics	3	0	0	30	70	100	3
BTME305	Materials Science and Engineering	3	0	0	30	70	100	3
BTME306	Mechanics of Solids	3	1	0	30	70	100	4
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTME307	Machine drawing practice	-	-	2	30	20	50	1
BTME308	Materials Testing Lab	-	-	2	30	20	50	1
BTME309	Basic Mechanical Engineering Lab	-	-	2	30	20	50	1
BTME310	Programming using MATLAB	-	-	2	30	20	50	1
BTME311	Mini Project	-	-	-	30	20	50	1
TOTAL		**18**	**2**	**8**	**330**	**520**	**850**	**25**

BTME301: ADVANCE ENGINEERING MATHEMATICS-I

UNIT 1 Numerical Methods –

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

UNIT 2 Numerical Methods – 2:

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

UNIT 3 Laplace Transform:

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

UNIT 4 Fourier Transform:

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

UNIT 5 Z-Transform:

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

BTME 302: MANAGERIAL ECONOMICS AND FINANCIAL ACCOUNTING

UNIT 1: Basic economic concepts-Meaning, nature and scope of economics, deductive vs inductive methods, static and dynamics, Economic problems: scarcity and choice, circular flow of economic activity, national income-concepts and measurement.

UNIT 2: **Demand and Supply analysis**-Demand-types of demand, determinants of demand, demand function, elasticity of demand, demand forecasting – purpose, determinants and methods, Supply-determinants of supply, supply function, elasticity of supply.

UNIT 3: **Production and Cost analysis**-Theory of production- production function, law of variable proportions, laws of returns to scale, production optimization, least cost combination of inputs, isoquants. Cost concepts explicit and implicit cost, fixed and variable cost, opportunity cost, sunk costs, cost function, cost curves, cost and output decisions, cost estimation

UNIT 4: **Market structure and pricing theory**-Perfect competition, Monopoly, Monopolistic competition, Oligopoly.

UNIT 5: **Financial statement analysis**-Balance sheet and related concepts, profit and loss statement and related concepts, financial ratio analysis, cash flow analysis, funds-flow analysis, comparative financial statement, analysis and interpretation of financial statements, capital budgeting techniques.

BTME303: ENGINEERING MECHANICS

UNIT 1 Statics of particles and rigid bodies: Fundamental laws of mechanics, Principle of transmissibility, System of forces, Resultant force, Resolution of force, Moment and Couples, Varignon's theorem, Resolution of a force into a force and a couple, Free body diagram, Equilibrium, Conditions for equilibrium, Lami's theorem.

UNIT Plane trusses: Types of structures, Trusses, Support Conditions, Types of Loadings, Classification of trusses, Determinacy of trusses, Basic assumptions of truss analysis, Method of joints, Method of sections.Virtual work: Principle of Virtual Work, Active forces and active force diagram, Stability of equilibrium.

UNIT 2 Centroid & Moment of inertia: Location of centroid and center of gravity, Moment of inertia, Parallel axis and perpendicular axis theorem, Radius of gyration, M.I of composite section, Polar moment of inertia, M.I of solid bodies.

UNIT Lifting machines: Mechanical advantage, Velocity Ratio, Efficiency of machine, Ideal machine, Ideal effort and ideal load, Reversibility of machine, Law of machine, Lifting machines; System of pulleys, Simple wheel and axle, Wheel and differential axle, Weston's differential pulley block, Worm and worm wheel, Single purchase winch crab, Double purchase winch crab, Screw jack, Differential screw jack.

UNIT 3 Friction: Types of Friction, Laws of friction, Angle of friction, Angle of repose, Ladder, Wedge, Belt Friction.

Belt and Rope drive: Types of belts, Types of belt drives, Velocity ratio, Effect of slip on Velocity ratio, Crowing of pulleys, Length of belt, Ratio of tensions in flat belt drive, Power transmission by belt drives, Advantage and disadvantages of V-Belt over Flat Belt.

UNIT 4 Kinematics: Fundamentals of rectilinear motion and curvilinear motion, applications of general equations, Projectiles motion on plane and on inclined plane, Concept of Relative motion.

Dynamics: Principles of dynamics, D'Alembert's principle, conservation of momentum and energy, Work and Energy and impulse momentum methods, central impact, oblique impact, system of variable mass.

UNIT 5 Vibrations: Introduction to vibrations, Free vibrations of particles, Simple, compound and torsional pendulum, Energy Method.

BTME304 : ENGINEERING THERMODYNAMICS

UNIT 1 Basic Concepts and definitions of Thermodynamics: System, Surroundings, Property, Energy, Thermodynamic Equilibrium, Process, work and modes of work.

Zeroth and First Law of Thermodynamics: Zeroth of Thermodynamics**,** Temperature scale, First law of thermodynamics, First law analysis of some elementary processes. Steady and

unsteady flow energy equations.

UNIT 2 Second Law of Thermodynamics: Heat engine, Heat pump and refrigerator, Second law of thermodynamics, Equivalence of the Kelvin-Plank and Clausius statements. Reversible and Irreversible Processes, Carnot engine, Efficiency of a Carnot engine, Carnot principle, thermodynamic temperature scale, Clausis Inequality.

Entropy: Entropy, Calculation of Entropy change, Principle of entropy increase. Temperature-Entropy diagram, Second law analysis of a control volume.

Availability: Available energy, Loss in available energy, Availability Function, Irreversibility.

UNIT 3 Thermodynamic Properties of Fluids: Pure substance, Concept of Phase, Graphical representation of p-v-T data, Properties of steam. Steam tables, Mollier chart

Ideal Gas and Real Gas: Ideal gas, Real gas, Internal energy, enthalpy and specific heats of an ideal gas, equations of state, Dalton's law of partial pressures, Gibbs Dalton law, Thermodynamic properties of gas mixtures.

UNIT 4 Thermodynamic Relations: Thermodynamic variables, Independent and dependent variables, Maxwell's thermodynamic relations, Thermodynamic relations involving entropy,

Thermodynamic relations involving enthalpy and internal energy, Joule-Thomson coefficient, Clapeyron equation.

Power Cycles: Otto cycle, Diesel cycle, Dual cycle, Brayton cycle and Ericsson cycle.

UNIT 5 Vapour power cycle: Rankine cycle, effect of operating conditions on its efficiency, properties of ideal working fluid in vapour power cycle Reheat cycle, regenerative cycle, bleeding extraction cycle, feed water heating co-generation cycle.

BTME305 : MATERIAL SCIENCE AND ENGINEERING

UNIT 1 Crystal structure – BCC, FCC and HCP, unit cell, crystallographic planes and directions, miller indices. Crystal imperfections, point, line, surface and volume defects.

Frank Reed source of dislocation, Elastic & plastic modes of deformation, Bauschinger's effect, slip & twinning, strain hardening, cold/hot working recovery, re-crystallization and grain growth.

UNIT 2 Classification of Engineering Materials: Solidification of metals and of some typical alloys, mechanism of crystallization (I) nuclear formation (ii) crystal growth, general principles of phase transformation in alloys, phase rule and equilibrium diagrams, equilibrium diagram of binary system having complete mutual solubility in liquid state and limited solubility in solid state, binary isomorphous alloy system, Hume- Rothery rule , binary system with limited solid solubility of terminal phase and in which solubility decreases with temperature and also alloy with a peritectic transformation, equilibrium diagram of a system whose components are subject to allotropic change.

Iron carbon equilibrium diagram, phase transformation in the iron carbon diagram, eutectic, peritectic, eutectoid and peritectoid reactions and microstructures.

UNIT 3 Isothermal transformation diagrams –cooling curves superimposed on Isothermal Transformation diagram, critical cooling rate. (i) Formation of Austenite from Pearlite (ii) Transformation of Austenite into Pearlite.

Full annealing, stress relief, spheroidizing – normalizing, hardening and tempering of steel. Hardenability, Jominey end quench test – Austempering, martempering. Case hardening, carburising, nitriding, cyaniding, carbonitriding. Flame and Induction hardening.

UNIT 4 Non-Metallic Materials- Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO,PPS, PEEK, PTFE Polymers. Urea and Phenol formaldehydes.

Constitution of alloys: Solid solutions - substitutional and interstitial. Ferrous and Non Ferrous Metals- Effect of alloying additions on steel (Mn, Si, Cr, Mo, V, Ti & W) - stainless and tool steels – HSLA steel.

UNIT 5 Mechanical Properties and Testing: Types of fracture, testing of materials under tension, compression and shear loads – hardness tests (Brinell, Vickers and Rockwell) Impact test Izod and charpy,fatigue and creep test.

Classification of steels and cast iron constitution and properties. BIS standards. Engineering Ceramics – Properties and applications of Al2O3, SiC, Si3N4, PSZ etc. Fiber and particulate reinforced composites and resin plastics. Introduction to Nano materials- Nano structured materials. Nano clusters & Nano crystals.

BTME306 : MECHANICS OF SOLIDS

UNIT 1 Stress and Strain: Elementary definition of stress and strain, stressstrain relationship, elastic, plastic and visco-elastic behavior of common materials in tension and compression test, stress-strain curves, Hooke's law, Poisson's ratio, elastic constants and their relations for an isotropic hookean material, anisotropic and orthotropic materials.

Tension, compression, shearing stress and strain, thermal stresses, composite bars, equations of static equilibrium, concept of free body diagram. Strain energy due to axial loading.

UNIT 2 Members Subjected to Flexural Loads: Theory of simple bending, bending moment and shear force diagrams for different types of static loading and support conditions on beams. bending stresses, section modulus and transverse shear stress distribution in circular, hollow circular, I, Box, T, angle sections etc. Strain energy due to bending.

UNIT 3 Principal Planes, Stresses and Strains: Members subjected to combined axial, bending and torsional loads, maximum normal and shear stresses, concept of equivalent bending and equivalent twisting moments, Mohr's circle of stress and strain.

Theories of Elastic Failures: The necessity for a theory, different theories, significance and comparison, applications.

UNIT 4 Torsion: Torsional shear stress in solid, hollow and stepped circular shafts, angular deflection and power transmission capacity. Strain energy due to torsional loads.

Stability of Equilibrium: Instability and elastic stability, long and short columns, ideal strut, Euler's formula for crippling load for columns of different ends, concept of equivalent length, eccentricloading, Rankine formulae and other empirical relations.

UNIT 5 Transverse Deflection of Beams: Relation between deflection, bending moment, shear force and load, transverse deflection of beams and shaft under static loading, area moment method, direct integration method.

Thin-walled Pressure Vessels: Stresses in cylindrical and spherical vessels

BTME307: MACHINE DRAWING PRACTICE

CONTENTS

1. Assembly drawing with sectioning and bill of materials of the following: Lathe tail stock, shaper tool head, swivel machine vice etc (1 drawing sheet of any assembly)

2. Detailed part drawings from assembly drawing indicating fits, tolerances and surface finish symbols by referring BIS codes: Check-valve, Junction Valve etc (1 drawing sheet)

3. Computer Aided Drafting: Introduction to different features of the CAD Software (AutoCAD/ProE/ Creo/Solidworks). At least one drawing problem related to

a. 2-D Drafting.

b. 3-D Modeling.

c. 3-D Advanced Modeling.

d. Assembly modeling.

e. Feature Modification and Manipulation

f. Detailing.

g. Surface Modeling

BTME308 : MATERIALS TESTING LAB

1 (a) Study of various crystals structures through models BCC, FCC, HCP, tetrahedral and octahedral voids. Material identification of, say, 50 common items kept in a box.

2 Specimen preparation for metallographic examination /micro structural examination-cutting, grinding, polishing, etching.

3 Comparative study of microstructures of different given specimens (mild steel,gray C.I., brass, copper etc.)

4 Heat treatment experiments such as annealing, normalizing, quenching, case hardening and comparison of hardness before and after.

5 Study of Microstructure and hardness of steel at different rates of cooling. Microstructure examination of white cast iron.

6 To perform Tensile/Compressive/Shear/torsion test on a given material and to determine its various mechanical properties under tensile/compression/Shear/torsional loading

7 To determine Rockwell/ Vickers/Brinell hardness of a given material

8 To perform Impact test on a given material and to determine its resilience.

9 To study and perform Fatigue test on a given material and to determine fatigue strength of the material

10 To perform Bending test and to determine the Young's Modulus of Elasticity via deflection of beam.

11 Creep testing on creep testing machine

BTME 309 : BASIC MECHANICAL ENGINEERING LAB

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

machines/systems including specifications formulation; visits to industries.

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

BTME310: PROGRAMMING USING MATLAB

1 1. Basics of MATLAB computer programming

2. Use of formulae and inbuilt functions

3. MATLAB scripts and functions (m-files)

4. Loops and nested loops

5. Array, vector and matrices

6. Plotting functions and vector plots

7. Solving differential equations using MATLAB

8. Reading and writing data, file handling

9. Using MATLAB toolboxes

10. MATLAB graphic functions

BACHELOR OF TECHNOLOGY								
MECHANICAL ENGINEERING								
FOURTH SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	**L**	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTME401	Data Analytics	3	-	-	30	70	100	3
BTME402	Technical Communications	3	-	-	30	70	100	3
BTME403	Digital Electronics	3	-	-	30	70	100	3
BTME404	Fluid Mechanics & Fluid Machines	3	1	-	30	70	100	4
BTME405	Manufacturing Processes	3	1	-	30	70	100	4
BTME406	Theory Of Machines	3	1	-	30	70	100	4
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTME407	Digital Electronics Lab	-	-	2	30	20	50	1
BTME408	Fluid Mechanics Lab	-	-	2	30	20	50	1
BTME409	Production Practice Lab	-	-	2	30	20	50	1
BTME410	Theory Of Machine Lab	-	-	2	30	20	50	1
BTME411	Social Outreach, Discipline & Extra Curricular Activates	-	-	-	-	-	50	1
TOTAL		18	**3**	**8**	**330**	**520**	**850**	26

BTME401: DATA ANALYTICS

Unit 1 Introduction: Objective, scope and outcome of the course. Introduction to Multivariate Statistics-Degree of Relationship among Variables-Review of Univariate and Bivariate Statistics-Screening Data Prior to Analysis-Missing Data, Outliers, Normality, Linearity, and Homoscedasticity.

Unit 2 Multiple Regression- Linear and Nonlinear techniques- Backward Forward-Stepwise-Hierarchical regression-Testing interactions (2way interaction) Analysis of Variance and Covariance (ANOVA & ANCOVA)-Multivariate Analysis of Variance and Covariance (MANOVA & MANCOVA).

Unit 3 Logistic regression: Regression with binary dependent variable - Simple Discriminant Analysis-Multiple Discriminate analysis Assessing classification accuracy- Conjoint analysis(Fullprofile method).

Unit 4 Principal Component Analysis- Factor Analysis- Orthogonal and Oblique Rotation-Factor Score Estimation-Multidimensional Scaling- Perceptual Map-Cluster Analysis (Hierarchical Vs Nonhierarchical Clustering).

Unit 5 Latent Variable Models an Introduction to Factor, Path, and Structural Equation Analysis- Time series data analysis (ARIMA model) – Decision tree analysis (CHAID, CART) - Introduction to Big Data Management.

BTME402: TECHNICAL COMMUNICATION

Unit1: Introduction- Objective, scope and outcome of the course. Introduction to Technical Communication- Definition of technical communication,

Unit 2: Aspects of technical communication, formsof technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.

Unit 3 Comprehension of Technical Materials/Texts and Information Design & development- Reading of technical texts, Reading and comprehending instructions and technical manuals, Interpreting and summarizing technical texts, Note-making. Introduction of different kinds of technical documents, Information collection, factors affecting information and document design, Strategies for organization, Information design and writing for print and online media.

Unit 4 Technical Writing, Grammar and Editing- Technical writing process, forms of technical discourse, Writing, drafts and revising, Basics of grammar, common error in writing and speaking, Study of advanced grammar, Editing strategies to achieve appropriate technical style, Introduction to advanced technical communication. Planning, drafting and writing Official Notes, Letters, E-mail, Resume, Job Application, Minutes of Meetings.

Unit 5 Advanced Technical Writing- Technical Reports, types of technical reports, Characteristics and formats and structure of technical reports. Technical Project Proposals, types of technical proposals, Characteristics and formats and structure of technical proposals. Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.

BTME403: Digital Electronics

Unit 1 Introduction: Objective, scope and outcome of the course. Semiconductor Devicesand Applications: Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave

rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.

Unit 2 Operational amplifier and its applications: Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.

Unit 3 Timing Circuits and Oscillators: RC-timing circuits, IC 555 and its applications as astable and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator.

Unit 4 Digital Electronics Fundamentals: Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- map, Logic ICs, half and full adder/subtractor, multiplexers, de- multiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications.

Unit 5 Electronic Communication Systems: The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.

BTME404: Fluid Mechanics And Fluid Machines

Unit 1 Introduction: Objective, scope and outcome of the course. Fluid Properties: Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Fluid Statics and Flow Characteristics: Basic equation of fluid statics, Manometers, Force on plane areas and curved surfaces, center of pressure, Buoyant force, Stability of floating and submerged bodies. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

Unit 2Flow Through Circular Conduits: Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram-minor losses – Flow through pipes in series and parallel.

Unit 3 Dimensional Analysis: Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude – Dimensionless parameters- application of dimensionless parameters – Model analysis.

Unit 4 Pumps: Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps –classification.

Unit 5 Turbines: Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

BTME405: Manufacturing Processes

Unit 1 Introduction: Objective, scope and outcome of the course. General Classification and Introduction to Manufacturing processes. Foundry Technology: Casting: Definition and major classification; Casting materials, Patterns: types, material and pattern allowances. Moulding sands; composition, preparation, properties and testing; Grain fineness; moisture content, clay content and permeability test. Core & core prints; Gating system: types, pouring basin, sprue, runner and risers; Melting, pouring and solidification. Principles and method of floor mould casting, shell mould casting, pit mould and loam mould casting; centrifugal casting, investment casting; Permanent mould casting. Die casting; Slush casting. Casting defects; types, causes and remedy

Unit 2 Forming Processes: Classification; Hot working and cold working; principle, advantages, disadvantages and applications. Forging: Classification, drop forging and press forging methods and use; Forging dies; types, materials. Rolling: Characteristics and applications of hot rolling and cold rolling;

Unit 3 Extrusion; Work materials and products; Press tool works; Basic principles, system, perations and applications. Shearing; Parting, notching, trimming, nibbling, blanking and piercing, Drawing: wire drawing, tube drawing and deep drawing.

Unit 4 Metal Joining Processes: Welding, Brazing and soldering, classification of weldingprocess,Principle, characteristics and applications of gas welding, thermit welding, electrical arc welding; Submerged arc welding; TIG and MIG welding; Resistance welding; Spot welding; Butt welding; Seam welding; Projection welding. Principles and process details of Forge welding; Friction welding; Diffusion welding; Ultrasonic welding. Explosive welding. Welding defects; Types, causes, effects and remedy. Electrodes and Electrode Coatings

Unit 5 Powder Metallurgy: Properties of Powder processed materials, Powder manufacturing, mechanical pulverization, sintering, Electrolytic Process, chemical reduction, atomization, properties of metal powders, compacting of powders sintering, advantages and applications of Powder metallurgy.

BTME406: Theory of Machines

Unit 1 Introduction: Objective, scope and outcome of the course. Introduction to mechanism: Basic concept of machines, links, kinematic pair, kinematic chain and mechanism. Inversions of kinematic chains : four bar chain mechanisms, quick return mechanisms, inversions of double slider crank mechanisms. Velocity and acceleration in mechanism: Velocity and acceleration polygons, relative velocity and instantaneous centre method

Unit 2 Friction devices: Types and laws of friction. Pivots and collars. Power screws such as lead screw of the lathe. Clutches: Single and multi-plate clutches. Brakes: Band, block and band and block brakes.

Unit 3 Gears: Laws of gearing, gears terminology; tooth form; interference, undercutting and minimum number of teeth on pinion. Rack and pinion, Spur, helical, basic introduction of bevel, worm and worm gears. Gear Trains: Simple, compound and epicyclic gear trains.

Unit 4 Cams: Type of cams; displacement, velocity and acceleration curves for different cam followers; consideration of pressure angle and wear. Gyroscope: Principles of gyroscopic couple, effect of gyroscopic couple and centrifugal force on vehicles taking a turn, stabilization of ship.

Unit 5 Balancing: Balancing of rotating masses in same and different planes, balancing of reciprocating masses, swaying couple, hammer blow and tractive effort.

BTME407: Digital Electronics Lab

1 To verify the truth tables of basic logic gates: AND, OR, NOR, NAND, NOR. Also to verify the truth table of Ex-OR, Ex-NOR (For 2, 3 & 4 inputs using gates with 2, 3, & 4 inputs).

2 To verify the truth table of OR, AND, NOR, Ex-OR. Ex-NOR realized using NAND & NOR gates.

3 To realize an SOP and POS expression.

4 To realize Half adder/ Subtractor & Full Adder/ Subtractor using NAND & NOR gates and to verify their truth tables.

5 To realize a 4-bit ripple adder/ Subtractor using basic half adder/ Subtractor & basic Full Adder/ Subtractor.

6 To verify the truth table of 4-to-l multiplexer and l-to-4 demultiplexer. Realize the multiplexer using basic gates only. Also to construct and 8-to-1 multiplexer and l-to-8 demultiplexer using blocks of 4-to-1 multiplexer and 1-to-4 demulriplexer.

7 Design & Realize a combinational circuit that will accept a 2421 BCD code and drive a TIL -3 I 2 seven-segment display.

8 Using basic logic gates, realize the R-S, J-K and D-flip flops with and without clock signal and verify their truth table.

9 Construct a divide by 2, 4 & 8 asynchronous counter. Construct a 4-bit binary counter and ring counter for a particular output pattern using D flip flop.

10 Perform input/output operations on parallel in/parallel out and Serial in/Serial out registers using clock. Also exercise loading only one of multiple values into the register using multiplexer.

BTME408 Fluid Mechanics Lab

1 Determination of Meta-centric height of a given body.

2 Determination of Cd, Cv & Cc for given orifice.

3 Calibration of contracted Rectangular Notch and / Triangular Notch and determination of flow rate.

4 Determination of velocity of water by Pitot tube.

5 Verification of Bernoulli's theorem.

6 Calibration and flow rate determination using Venturimeter & Orifice meter and Nozzle meter

7 Determination of head loss in given length of pipe.

8 Determination of the Reynold's number for laminar, turbulent and transient flow in pipe.

9 Determination of Coefficient for minor losses in pipes.

10 To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.

11To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.

12 Conducting experiments and drawing the characteristic curves of centrifugal

pump/submergible pump.

13 Conducting experiments and drawing the characteristic curves of reciprocating pump.

14 Conducting experiments and drawing the characteristic curves of Pelton wheel.

15 Conducting experiments and drawing the characteristics curves of Francis turbine.

16 Conducting experiments and drawing the characteristic curves of Kaplan turbine.

BTME409 Production Practice Lab

Turning Shop

1 To study lathe machine construction and various parts including attachments, lathe tools cutting speed, feed and depth of cut.

2 To perform step turning, knurling and chamfering on lathe machine as per drawing.

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

4 Boring using a boring bar in a centre lathe and cut BSW/Metric internal threads on lathe machine.

5To perform taper turning using compound rest.

Machine shop

1 To study the milling machine, milling cutters, indexing heads and indexing methods and to prepare a gear on milling machine.

2 To machine a hexagonal /octagonal nut using indexing head on milling machine.

3 To study of single point cutting tool geometry and to grind the tool as per given tool geometry.

4 To study shaper machine, its mechanism and calculate quick return ratio. To prepare a job on shaper from given mild steel rod.

5 Cylindrical grinding using grinding attachment in a centre lathe

Demonstration and study

1 Demonstration for job by eccentric turning on lathe machine.

2 Study of capstan lathe and its tooling and prepare a tool layout & job as per given drawing.

3 Demonstration on milling machine for generation of plane surfaces and use of end milling cutters.

4 Grinding of milling cutters and drills.

Foundry Shop

1 To prepare mould of a given pattern requiring core and to cast it in aluminium.

2 To perform moisture test and clay content test.

3 To perform permeability test

4 A.F.S. Sieve analysis test.

5Strength Test (compressive, Tensile, Shear Transverse etc. in green and dry conditions) and Hardness Test (Mould and Core).

Welding Shop

1 Hands-on practice on spot welding.

BTME410 Theory of Machines Lab

1 To study inversions of four bar chain and slider crank mechanism and their practical applications.

2 To study Steering Mechanisms: Davis and Ackerman.

3 Study of quick return mechanism and its practical applications.

4Study of inversion of Double slider chain: Oldham Coupling, Scotch Yoke and Elliptical Trammel.

5 Study of various cam-follower arrangements. To plot displacement v/s angle of rotation curve for various cams

6 To determine co-efficient of friction using two roller oscillating arrangement.

7 Study of various types of dynamometers, Brakes and Clutches.

8 Study of differential gear box.

9 To verify the torque relation for gyroscope.

10 To perform wheel balancing. To perform static and dynamic balancing on balancing set up.

11 Study of a lathe gear box, sliding mesh automobile gear box, planetary gear box.

BACHELOR OF TECHNOLOGY								
MECHANICAL ENGINEERING								
FIFTH SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	L	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTME501	Mechatronics Systems	3	-	-	30	70	100	3
BTME502	Heat Transfer	3	1	-	30	70	100	4
BTME503	Manufacturing Technology	3	-	-	30	70	100	3
BTME504	Design Of Machine Elements I	3	1	-	30	70	100	4
BTME505	Principles Of Management	3	-	-	30	70	100	3
BTME506.A	Steam Engineering	3	-	-	30	70	100	3
BTME506.B	Automobile Engineering	3	-	-	30	70	100	3
BTME506.C	Non Destructive Evaluation & Testing	3	-	-	30	70	100	3

PRACTICALS/VIVA-VOCE		No. of Teaching Hours			Sessional	Practical	Total	Credits
BTME507	Mechatronics Lab	-	-	2	30	20	50	1
BTME508	Heat Transfer Lab	-	-	2	30	20	50	1
BTME509	Production Engineering Lab	-	-	2	30	20	50	1
BTME510	Machine Design Practice Lab	-	-	2	30	20	50	1
BTME511	Industrial Training/ Seminar	-	-	2	30	20	50	1
BTME512	Social Outreach, Discipline & Extra Curricular Activates	-	-	-	-	-	50	1
TOTAL		18	**1**	**10**	**330**	**520**	**900**	26

BTME501: MECHATRONIC SYSTEMS

Unit 1.

Introduction: Objective, scope and outcome of the course. Overview of Mechatronics: Historical perspective, Definition, Applications, Block diagram of Mechatronic system, Functions of Mechatronics Systems, Systems Engineering, Verification Vs Validation, Benefits of mechatronics in manufacturing. Electrical and Electronic Systems: Electrical circuits and Kirchhoff's laws, Network Theorems and AC circuit Analysis, Transformers, Analog Devices, Signal Conditioning, Digital Electronics, Data Acquisition systems.

Unit2.

Modeling, Analysis and Control of Physical Systems: Basics of System Modeling: LTI and LTV systems, Need for modeling, Types of modeling, Steps in modeling, Building blocks of models, Modelling of one and two degrees of freedom systems, Modeling of Electromechanical systems, Mechanical Systems, Fluid systems, Thermal systems; Dynamic Responses, System Transfer Functions, State Space Analysis and System Properties, Stability Analysis using Root Locus Method, Stability Analysis using Bode Plots, PID Controllers (with and without Time Delay)

Unit 3.

Sensors and Actuators: Static characteristics of sensors and actuators, Position, Displacement and Proximity Sensors, Force and torque sensors, Pressure sensors, Flow sensors, Temperature sensors, Acceleration sensors, Level sensors, Light sensors, Smart material sensors, Micro and Nano sensors, Selection criteria for sensors, Actuators: Electrical Actuators (Solenoids, Relays, Diodes, Thyristors, Triacs, BJT, FET, DC motor, Servo motor, BLDC motor, AC motor, Stepper motors), Hydraulic and

Pneumatic actuators, Design of Hydraulic and Pneumatic circuits, Piezoelectric actuators, Shape memory alloys.

Unit 4.

Microprocessors, Microcontrollers and Programmable Logic Controllers: Logic Concepts and Design, System Interfaces, Communication and Computer Networks, Fault Analysis in Mechatronic Systems, Synchronous and Asynchronous Sequential Systems, Architecture, Microcontrollers.

Unit 5.

Programmable Logic Controllers (PLCs): Architecture, Number Systems Basics of PLC Programming, Logics, Timers and Counters, Application on real time industrial automation systems.Case Studies: Design of pick and place robot, Car engine management system, Automated manufacturing system, Automatic camera, Automatic parking system, Safety devices and systems.

BTME502: HEAT TRANSFER

Unit1. Introduction: Objective, scope and outcome of the course. Introduction: Heat transfer processes, conduction and radiation. Fourier's law of heat conduction, thermal conductivity, thermal conductivity of solids, liquids and gases, effect of temperature on thermal conductivity. Newton's law of cooling, definition of overall heat transfer coefficient. General parameters influence the value of heat transfer coefficient. Conduction: General 3-Dimensoinal conduction equation in Cartesian, cylindrical and spherical coordinates; different kinds of boundary conditions; nature of differential equations; one dimensional heat conduction with and without heat generation; electrical analogy; heat conduction through composite walls; critical thickness of insulation.

Unit 2. Heat transfer from extended surfaces: Governing differential equation of fin, fin efficiency and effectiveness for different boundary conditions. Unsteady state heat conduction for slab, cylinder and sphere, Heisler chart. Convection: Review of Navier – Stokes and energy equation, hydrodynamic and thermal boundary layers; laminar boundary layer equations; forced convection appropriate non dimensional members; effect of Prandtl number; empirical relations for flow over a flat plate and flow through pipes.

Unit 3. Natural convection: Dimensional analysis, Grashoff number, boundary layers in external flows (flow over a flat plate only), boundary layer equations and their solutions, heat transfer correlations.Heat transfer with change of phase: Nature of vaporization phenomena; different regimes of boiling heat transfer; correlations for saturated liquid vaporization; condensation on flat plates; correlation of experimental results, drop wise condensation.

Unit 4. Heat exchanger: Types of heat exchangers, arithmetic and logarithmic mean temperature differences, heat transfer coefficient for parallel, counter and cross flow type heat exchanger; effectiveness of heat exchanger, N.T.U. method, fouling factor. Constructional and manufacturing aspects of Heat Exchangers.

Unit 5. Thermal Radiation: Plank distribution law, Krichoff's law; radiation properties, diffuse radiations; Lambert's law. Radiation intensity, heat exchange between two black bodies heat exchanger between gray bodies. Shape factor; electrical analogy; reradiating surfaces heat transfer in presence of reradiating surfaces.

BTME503: MANUFACTURING TECHNOLOGY

Unit1. Introduction: Objective, scope and outcome of the course. Classification of metal removal process and machines: Geometry of single point cutting tool and tool angles, tool nomenclature in ASA, ORS. Concept of orthogonal and oblique cutting. Type of chips, Mechanics of metal cutting; interrelationships between cutting force, shear angle, strain and strain rate. Thermal aspects of machining and measurement of chip tool interface temperature.

Unit 2. Concept of machinability, machinability index, factors affecting machinability, Different mechanism of tool wear. Types of tool wear (crater, flank etc), Concept of tool life. Taylor's tool life equation. Introduction to economics of machining. Cutting fluids: Types, properties, selection and application methods

Unit 3. Basic machine tools: Constructional configuration, estimation of machining time on lathe, drilling, shaping, milling, grinding, Gear cutting on milling, Gear hobbling. Special Purpose Machine Tools: Automatic lathes, capstan and turret lathe machines, operational planning and turret tool layout, sequence of operations.

Unit 4 Introduction to Grinding and different methods of grinding, Abrasives; natural and synthetic, manufacturing and selection of grinding wheels, Wheel specifications. Honing, lapping, superfinishing.

Unit 5 High Velocity Forming Methods: Definition; Hydraulic forming, Explosive forming, Electro-hydraulic forming, Magnetic pulse forming.

BTME504: DESIGN OF MACHINE ELEMENTS – I

Unit 1 Introduction: Objective, scope and outcome of the course. Materials: Mechanical Properties and IS coding of various materials, Selection of material from properties and economic aspects.

Unit 2 Manufacturing Considerations in Design: Standardization, Interchangeability, limits, fits tolerances and surface roughness, BIS codes, Design consideration for cast, forged and machined parts. Design for assembly. Design for Strength: Modes of failure, Strength and Stiffness considerations, Allowable stresses, factor of safety, Stress concentration: causes and mitigation, fatigue failures.

Unit 3 Design of Members subjected to direct stress: pin, cotter and keyed joints. Design of Members in Bending: Beams, levers and laminated springs. Design for stiffness of beam: Use of maximum deflection formula for various end conditions for beam design

Unit 4 Design of Members in Torsion Shaft and Keys: Design for strength, rigidity. Solid and hollow shafts. Shafts under combined loading. Sunk keys. Couplings: Design of muff coupling, flanged couplings: rigid and flexible

Unit 5 Design of Threaded fasteners: Bolt of uniform strength, Preloading of bolts: Effect of initial tension and applied loads, Eccentric loading Power screws like lead screw, screw jack Design of members which are curved like crane hook, body of Cclamp, machine frame etc.

BTME505: PRINCIPLES OF MANAGEMENT

Unit 1 Introduction: Objective, scope and outcome of the course. Basic concepts of management: Definition – Need and Scope – Different schools of management thought – Behavioural, Scientific, Systems, and Contingency Contribution of Management Thinkers: Kautilya, Taylor, Fayol, Peter Drucker and C.K. Prahlad.

Unit 2 Functions of Management: Planning: Essentials of Planning and Managing by Objectives; Strategies, Policies and Planning Premises; Decision making.Organizing The Nature of organizing, Entrepreneuring, and Reengineering; Organizational Structure, Departmentation; Line/staff authority, empowerment, and decentralization; Effective organizing and organization culture;

Unit 3 Staffing Human resource Management and Selection; Performance Appraisal and Career Strategy; managing change through Manager and Organization Development.

Unit 4Leading Human Factors and Motivation; Leadership: Committees, Terms, and Group Decision making; Communication. Controlling The system and process of controlling; Control Techniques and Information Technology; Productivity, Operations Management and Total Quality Management.

Unit 5 Management practices of: Dhirubhai Ambani, Narayan Murthy, Premji, Ratan Tata, Steve Jobs, Bill Gates. Studying organizational structures of any 10 companies and classifying them into different types of organizations which are studied above and justifying why such structures are chosen by those organizations. Preparing the leadership profiles of any 5 business leaders and studying their leadership qualities.

BTME506.A: STEAM ENGINEERING

Unit 1 Introduction: Objective, scope and outcome of the course. Steam generators: Classification of Boilers, water and fire tube boilers, High pressure boilers, Advantages of high pressure Boilers, Natural and forced circulation boilers, Water wall. Steam drum internal, steam super heaters, Economizers, air preheater, induced, forced and balanced draught boilers, Fluidized bed boilers

Unit 2 Definition and type of nozzle and diffuser equation of continuity, sonic velocity, mach no. and stagnation properties, the steady flow energy equation for nozzles, momentum energy equation for flow through steam nozzles nozzle efficiency, effect of friction, nozzle for uniform pressure drop, throat pressure for maximum discharge or chock flow, critical pressure ratio, design of nozzle and diffuser.

Unit 3 Steam Turbines: Principle and working of steam turbines, type of turbines, compounding for pressure and velocity. Overview and difference of various type of turbine, different types of governing of turbines. Impulse turbine: The effect of blade friction on velocity diagram. Force, work and power, Blade or diagram efficiency, Gross stage efficiency, steam speed to blade, speed ratio for optimum performance, turbine performance at various loads

Unit 4 Impulse reaction turbine: Velocity diagram and work done, degree of reaction, Parson turbine, blade efficiency, gross stage efficiency comparison of enthalpy drop in various stages, size of blades in impulse reaction turbines for various stages of impulse reaction and impulse turbine. Regenerative Feed Heating Cycles: Introduction, Ideal regenerative feed heating cycle, Regenerative heating cycles and their representation on T-s and h-s Diagram, Representation of actual process on T-s and h-s Diagram Regenerative cycles, types of feed heating arrangements, Optimum feed water temperature and saving in Heat Rate. direct contact and surface heaters.

Unit 5 Reheating of steam: Practical reheating and Non- reheating cycles, advantage and disadvantages of reheating, reheat regenerative cycle, regenerative water extraction cycles. Process heat and by product power cycle, pass out turbine, Binary vapour cycle. Condensers.

BTME506.B: AUTOMOBILE ENGINEERING

Unit 1 Introduction: Objective, scope and outcome of the course. Frame & Body: Layout of chassis, types of chassis frames and bodies, their constructional features and materials. Clutches: single plate, multi-plate, cone clutch, semi centrifugal, electromagnetic, vacuum and hydraulic clutches. Fluid coupling. Brakes: Classification and function; Mechanical, hydraulic, vacuum air and self engineering brakes; Brake shoes and lining materials.

Unit 2 Gear Boxes: Sliding mesh, constant mesh, synchromesh and epicyclic gear boxes, Automatic transmission system; Hydraulic torque converter; Drives: Overdrive, Propeller shaft, Universal joints, Differential; Rear axle drives. Hotchkiss and torque tube drives; Rear axle types; Front wheel and All wheel drive.

Unit 3 Wheels and Tyres: Tyre types, Tyre construction; Tyre inflation pressure, Tyre wear and their causes; Re-treading of the tyre, Steering system: steering gear boxes, Steering linkages, Steering mechanism, Under and Over steering. Steering Geometry, Effect of camber, caster, king pin inclination, toe in and toe out; Power steering; Integral and linkage types , Suspension system: objective and requirements, Suspension spring, front and rear suspension systems, Independent suspension system Shock absorbers.

Unit 4 Automotive Electrical System: Battery construction, Charging and testing, battery types, Starting and Battery Charging System: Starter motor construction, types of drive, Alternator construction, regulation and rectification. Ignition System: Magneto and coil ignition systems, System components and requirements, Automotive lighting: Wiring systems Electrical instruments; head lamp, electric horn, fuel level indicator.

Unit 5 Automotive Air Conditioning: Introduction, Loads, Air conditioning system Components, Refrigerants, Fault Diagnosis. Automotive Safety: Safety requirements, Safety Devices, Air bags, belts, radio ranging, NVS (Night Vision System) GPS (Global Positioning System)

BTME506.C: NON DESTRUCTIVE EVALUATION AND TESTING

Unit 1 Introduction: Objective, scope and outcome of the course. ACOUSTICAL METHODS: Ultrasonic testing- Generation of ultrasonic waves, Horizontal and shear waves, Near field and far field acoustic wave description, Ultrasonic probes- Straight beam, direct contact type, Angle beam, Transmission/reflection type, and delay line transducers, acoustic coupling and media. ULTRASONIC TESTS: Transmission and pulse echo methods, A-scan, B-scan, C-scan, F- scan and P-scan modes, Flaw sizing in ultrasonic inspection: AVG, Amplitude, Transmission, TOFD, Satellite pulse, Multi-modal transducer, zonal method using focused beam. Flow location methods, Signal processing in Ultrasonic NDT; Mimics, spurious echo's and noise. Ultrasonic flaw evaluation.

Unit 2 ELECTRO-MAGNETIC METHODS- magnetic particle inspectionintroduction to electrical impedance, principles of eddy current testing, flaw detection using eddy currents

Unit 3 RADIOGRAPHIC METHODS: Introduction to x-ray radiography, the radiographic process, X-ray and Gamma ray sources, Geometric principles, Factors governing exposure, radio graphic screens,scattered radiation, arithmetic of exposure, radiographic image quality and detail visibility, industrial X-ray films.X-RAY RADIOGRAPHY PROCESES: Fundamentals of processing techniques, process control, the processing room, special processing techniques, paper radiography, sensitometric characteristics of X-ray films, film graininess signal to noise ratio in radiographs. The photographic latent image, radiation protection.

Unit 4 OPTICAL METHODS: holography- Principles and practices of Optical holography, acoustical, microwave, x-ray and electron beam holography techniques.

Unit 5 APPLICATIONS: NDT in flaw analysis of Pressure vessels, piping NDT in Castings, Welded constructions, etc., Case studies.

BTME507: MECHATRONICS LAB.

NAME OF EXPERIMENT

1 Using Transducers Kit :-

- Characteristics of LVDT
- Principle & Characteristics of Strain Gauge
- Characteristics of Summing Amplifier
- Characteristics of Reflective Opto Transducer

2 Mobile Robot

- Program for Operating Buzzer Beep
- Program for Operating Motion control

- Program for Operating Direction control
- Program for Operating White line follower for the given arena

3 PLC PROGRAMMING

- Ladder programming on Logic gates ,Timers & counters
- Ladder Programming for digital & Analogy sensors
- Ladder programming for Traffic Light control, Water level control and Lift control Modules

4 MATLAB Programming

- Sample programmes on Mat lab
- Simulation and analysis of PID controller using SIMULINK

Important Note:

It is mandatory for every student to undertake a Mini project. Mini project shall be a group activity. A group shall consist of maximum five students. Final evaluation of sessional component shall include 30% weight age to mini project.

Mini project can be integration of sensor, actuator and transduction units for various home and office applications.

BTME508: HEAT TRANSFER LAB.

NAME OF EXPERIMENT

1 To Determine Thermal Conductivity of Insulating Powders.

2 To Determine Thermal Conductivity of a Good Conductor of Heat (Metal Rod).

3 To determine the transfer Rate and Temperature Distribution for a Pin Fin.

4 To Measure the Emissivity of the Test plate Surface.

5 To Determine Stefan Boltzmann Constant of Radiation Heat Transfer.

6 To Determine the Surface Heat Transfer Coefficient For Heated Vertical Cylinder in Natural Convection.

7 Determination of Heat Transfer Coefficient in Drop Wise and Film Wise condensation.

8 To Determine Critical Heat Flux in Saturated Pool Boiling.

9 To Study and Compare LMTD and Effectiveness in Parallel and Counter Flow Heat Exchangers.

10 To Find the Heat transfer Coefficient in Forced Convection in a tube.

11 To study the rates of heat transfer for different materials and geometries

12 To understand the importance and validity of engineering assumptions through the lumped heat capacity method.

Important Note:

It is mandatory for every student to undertake a Mini project. Mini project shall be a group activity. A group shall consist of maximum five students. Final evaluation sessional component shall include 30%

weight age to mini project.

Heat exchanger design for different applications, designing for thermal insulation, Use of relevant BIS codes for designing

BTME509: PRODUCTION ENGINEERING LAB.

NAME OF EXPERIMENT

1 Study of various measuring tools like dial gauge, micrometer, vernier caliper and telescopic gauges.

2 Measurement of angle and width of a V-groove by using bevel protector..

3 (a) To measure a gap by using slip gauges

(b) To compare & access the method of small-bore measurement with the aid of spheres.

4 Measurement of angle by using sine bar.

5 (a) Measurement of gear tooth thickness by using gear tooth vernier caliper.

(b) To check accuracy of gear profile with the help of profile projector.

6 To determine the effective diameter of external thread by using three- wire method.

7 To measure flatness and surface defects in the given test piece with the help of monochromatic check light and optical flat.

8 To check the accuracy of a ground, machined and lapped surface - (a) Flat surface (b) Cylindrical surface.

9 Find out Chip reduction co-efficient (reciprocal of chip thickness ratio) during single point turning.

10 Forces measurements during orthogonal turning.

11 Torque and Thrust measurement during drilling.

12 Forces measurement during plain milling operation.

13 Measurement of Chip tool Interface temperature during turning using thermocouple technique.

Important Note:

It is mandatory for every student to undertake a Mini project. Mini project shall be a group activity. A group shall consist of maximum five students. Final evaluation shall include 30% weight age to mini project.

Fabrication of an assembly in which parts shall be machined and standard parts shall be procured.

BTME510: MACHINE DESIGN PRACTICE - I

Sessional Work

1 Material selection and relevant BIS nomenclature

2 Selecting fit and assigning tolerances

3 Examples of Production considerations

4 Problems on:

(a) Knuckle & Cotter joints

(b) Torque: Keyed joints and shaft couplings

(c) Design of screw fastening

(d) Bending: Beams, Levers etc.

(e) Combined stresses: Shafts, brackets, eccentric loading.

BACHELOR OF TECHNOLOGY								
MECHANICAL ENGINEERING								
SIXTH SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	L	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTME601	Measurement & Metrology	3	-	-	30	70	100	3
BTME602	Computer Integrated Manufacturing Systems	3	-	-	30	70	100	3
BTME603	Mechanical Vibrations	3	1	-	30	70	100	4
BTME604	Design of Machine Elements II	3	1	-	30	70	100	4
BTME605	Quality Management	3	-	-	30	70	100	3
BTME606.A	Refrigeration & Air Conditioning	3	-	-	30	70	100	3
BTME606.B	Non Conventional Machining Methods	3	-	-	30	70	100	3
BTME606.C	Micro electro and mechanical systems (MEMS) and Microsystems	3	-	-	30	70	100	3
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTME607	CIMS Lab	-	-	2	30	20	50	1
BTME608	Vibration Lab	-	-	2	30	20	50	1
BTME609	Machine Design Practice II Lab	-	-	2	30	20	50	1
BTME610	Thermal Engineering Lab	-	-	2	30	20	50	1
BTME611	Industrial Training/ Seminar	-	-	2	30	20	50	1
BTME612	Social Outreach, Discipline & Extra Curricular Activates	-	-	-	-	-	50	1
TOTAL		18	**2**	**10**	**330**	**520**	**900**	26

BTME601: Measurement & Metrology

Unit 1: Introduction: Objective, scope and outcome of the course. Concept of measurement: General concept of measurement, Need for measurement, Generalized measuring system, Units, Standards, Sensitivity, Readability, Range of accuracy, Precision, Accuracy Vs precision, Uncertainty. Repeatability and reproducibility, Errors in measurement, Types of error, Systematic and random error, Calibration, Interchangeability.

Unit 2: Linear and angular measurements: Linear measuring instruments: Vernier caliper, Micrometer, Interval measurements:- Slip gauges, Checking of slip gauges for surface quality, Optical flat, Application of limit gauges Comparators:- Mechanical comparators, Electrical comparator, Optical comparator, Pneumatic comparator; 2 Sine bar, Use of sine bar, Limitations of sine bars, Sources of error in sine bars, Bevel protractor, Applications of bevel protractor.

Unit 3: Form measurement: Introduction, Screw thread measurement, Thread gauges, Measurement of gears: Gear errors. Surface finish measurement:-Introduction, Elements of surface texture, Analysis of surface finish, Methods of measuring surface finish, Straightness measurement, Flatness testing, Roundness measurements

Unit 4: Coordinate measuring machine (CMM):-Types of CMM, Features of CMM, Computer based inspection, 2 Measurement of power, flow and temperature related properties Measurement of force, Accelerometer, Load cells, Bourdon tube. Torque measurement: Torque measurement using strain gauges, Torque measurement using torsion bars, Mechanical dynamometers.

Unit 5: Measurement of flow: Variable area meters – Rotameter, Hot wire anemometer, Pitot tube. Temperature measurement, Bimetallic strip, Thermocouples (Thermo electric effects), Thermistors, Pyrometers

BTME602: Computer Integrated Manufacturing Systems

Unit 1: Introduction: Objective, scope and outcome of the course. Introduction to CIM:Overview of Production Systems, the product cycle, Automation in Production Systems, computer's role in manufacturing, sources and types of data used in manufacturing. The Beginning of CAM: Historical Background, Numerical Control (NC): Basic components of an NC system, coordinate system and motions control systems. Computer Numerical Control (CNC): features of CNC, machine control unit, CNC software. Direct Numerical Control and Distributed Numerical Control. Applications, advantages and disadvantages of NC. Adaptive control of machining system.

Unit 2: NC Part programming: Manual and computer assisted part programming, Part programming with APT. NC part programming using CAD/CAM software. NC cutter path verification.

Unit 3: Computer Aided Process Planning: Traditional Process Planning, Retrieval process planning system, Generative Process Planning, Machinability data systems, computer generated time standards.

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

Unit 4: Computer Aided Production Management Systems: Introduction to computer aided PPC, Introduction to computer aided inventory management, manufacturing resource planning (MRPII), computer process monitoring and shop floor control, and computer process control. Computer Aided Quality Control; Computer in quality control, contact inspection methods, Non contact inspection methods, optical and non optical computer aided testing.

Unit 5: Computer Aided Material Handling; Computer control on material handling, conveying, picking. Ware house control, computerized material handling for automated inspection and assembly. Computer Integrated Manufacturing Systems: Introduction, type's special manufacturing systems, flexible manufacturing systems (FMS). Collaborative Engineering; Introduction, Faster Design throughput, Web based design, Changing design approaches, extended enterprises, concurrent engineering, Agile and lean manufacturing.

BTME603: Mechanical Vibrations

Unit 1: Introduction: Objective, scope and outcome of the course. Introduction to Sound: Frequency dependent human response to sound, Sound pressure dependent human response, Relationship among sound power, sound intensity and sound pressure level. Introduction to Noise: Auditory and Non auditory effects of Noise, Major sources of the noise, Industrial noise sources, Industrial noise control strategies. Introduction to Vibration: Importance and scope of vibrations, terminology and classification, Concept of Degrees of freedom, Harmonic motion, vectorial representation, complex number representation, addition.

Unit 2: Undamped Single Degree of Freedom System: Derivation of equation of motion for one dimensional longitudinal, transverse and Torsional vibrations without damping using Newton's second law, D' Alembert's principle and Principle of conservation of energy, Compound pendulum and centre of percussion. Damped vibrations of single degree of freedom systems: Viscous damping, under-damped, critically damped and over-damped systems, Logarithmic decrement. Vibration characteristics of Coulomb damped system and Vibration characteristics of Hysteretic damped systems.

Unit 3: Forced Vibrations of Single Degree of Freedom Systems: Forced vibration with constant harmonic excitation, Steady state and transient parts, Frequency response curves and phase angle plot, Forced vibration due to excitation of support. Vibration Isolation and Transmissibility: Force transmissibility, Motion transmissibility, Forced vibration with rotating and reciprocating unbalance, Materials used in vibration isolation.

Unit 4: System with Two Degrees of Freedom: principle mode of vibration, Mode shapes, Undamped forced vibrations of two degrees of freedom system with harmonic excitation, Vibration Absorber, Undamped dynamic vibration absorber and centrifugal pendulum absorber Critical Speed of Shaft: Critical speed of a light shaft without damping, critical speed of shaft having multiple discs, secondary critical speed.

Unit 5: Many Degrees of Freedom Systems (Exact analysis): Equation of Motion, The matrix method, Eigen Values and Eigen Vectors, Method of influence Coefficients and Maxwell's reciprocal theorem. Torsional vibrations of multi rotor system, vibrations of geared system, Generalized coordinates and coordinate coupling Many Degrees of Freedom Systems (approximate methods): Rayleigh's, Dunkerley's, Stodola's and Holzer's methods Vibrations of continuous systems: Transverse vibration of a string, Longitudinal vibration of a bar, Torsional vibration of a shaft.

BTME604: Design of Machine Elements II

Unit 1 : Introduction: Objective, scope and outcome of the course. Fatigue Considerations in Design: Variable load, loading pattern, endurance stresses, Influence of size, surface finish, notch sensitivity and stress concentration.

Unit 2: Goodman line, Soderberg line, Design of machine members subjected to combined, steady and alternating stresses. Design for finite life, Design of Shafts under Variable Stresses, Bolts subjected to variable stresses.

Unit 3: Design of IC Engine components: Piston, Cylinder, Connecting Rod and Crank Shaft. Design of helical compression, tension, torsional springs, springs under variable stresses.

Unit 4: Design of belt, rope and pulley drive system, Design of gear teeth: Lewis and Buckingham equations, wear and dynamic load considerations. Design and force analysis of spur, helical, bevel and worm gears, Bearing reactions due to gear tooth forces.

Unit 5: Design of Sliding and Journal Bearing: Methods of lubrication, hydrodynamic, hydrostatic, boundary etc. Minimum film thickness and thermal equilibrium. Selection of anti-friction bearings for different loads and load cycles, Mounting of the bearings, Method of lubrication.

BTME605: Quality Management

Unit 1 : Introduction: Objective, scope and outcome of the course. The meaning of Quality and quality improvement dimensions of quality, history of quality methodology, quality control, Quality of design and quality of conformance, Quality policy and objectives, Economics of quality. Modeling process quality: Describing variation, frequency distribution, continuous and discrete, probability distributions, pattern of variation, Inferences about process quality: sampling distributions and estimation of process parameters. Analysis of variance.

Unit 2 : Statistical Quality Control: Concept of SQC, Chance and assignable causes of variation, statistical basis of control chart, basic principles, choice of control limits, sample size and sampling frequency, analysis of patterns on control charts. The magnificent seven.

Unit 3 : Control chart for variables,: X-bar and R charts, X-bar and S charts, control chart for individual measurement. Application of variable control charts. Control chart for attributes: control chart for fraction non conforming P- chart, np-chart, c-chart and u-chart. Demerit systems, choice between attribute and variable control chart. SPC for short production runs. Process capability analysis using histogram and probability plot, capability ratios and concept of six sigma.

Unit 4 : Quality Assurance: Concept, advantages, field complaints, quality rating, quality audit. Acceptance Sampling: Fundamental concepts in acceptance sampling, operating characteristics curve. Acceptance sampling plans, single, double and multiple sampling plans, LTPD, AOQL, AOQ. Introduction to Quality systems like ISO 9000 and ISO 14000.

Unit 5 : Reliability and Life Testing- Failure models of components, definition of reliability, MTBF, Failure rate, common failure rate curve, types of failure, reliability evaluation in simple cases of exponential failures in series, paralleled and series-parallel device configurations, Redundancy and improvement factors evaluations. Introduction to Availability and Maintainability Introduction to Taguchi Method of Design of Experiments, Quality loss function.

BTME606.A: Refrigeration and Air Conditioning

Unit1: **Introduction:** Refrigeration and second law of Thermodynamics, Refrigeration effect and unit of Refrigeration, Heat pump, reversed Carnot cycle.

Vapour Compression Refrigeration System: Analysis of simple vapour compression Refrigeration cycle by p-h and T-S diagram. Effect of operating conditions

Multiple Evaporator and compressor system: Application, air compressor system, Individual compressor, compound compression, cascade system. Application, air compressor systems, individual compressor, compound compression, cascade system.

Unit 2:

Gas Cycle Refrigeration: Limitation of Carnot cycle with gas, reversed Brayton cycle, Brayton cycle with regenerative heat exchanger. Air cycle for air craft: Necessity of cooling of air craft, Basic cycle, boot

strap, regenerative type air craft refrigeration cycle.

Unit 3:

Other refrigeration systems (description only): Vapour absorption refrigeration system, Electrolux refrigerator, Lithium Bromide – Water system, Water vapour refrigeration system, Vortex tube refrigeration

system, thermo electric refrigeration system.

Refrigerants: Classification, Nomenclature, selection of Refrigerants,

global warming potential of CFC Refrigerants. Refrigeration Equipments: Compressor, condenser, evaporator,

expansion devices, types & working.

Unit 4:

Psychrometry: Psychrometric properties, psychometric relations, pyschrormetric charts, psychrometric processes, cooling coils, By-pass factor, Apparatus Dew point temperature and air washers.

Human Comfort: Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart.

Unit 5:

Cooling load calculations: Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychrometric calculation for cooling.

Selection of air conditioning: Apparatus for cooling and dehumidification, Air conditioning system, year round air conditioning.

TEXT BOOK

1 Arora, C.P., Refrigeration and Air Conditioning, Tata McGraw Hill

REFERENCE BOOKS

1 Stoecker W.F., "Refrigeration & Air Conditioning" McGraw Hill Publication. **2000**

2 Andrew D. Althouse., "Modern Refrigeration & Air Conditioning" GoodHeart-Willcox Co.**2002**

3 Jorden & Priester, Refrigeration & Air Conditioning, Prentice Hall of India. **2003**

4 Roy J. Dossat, Principal of Refrigeration, Pearson Education, New Delhi. **2014**

5 Edward G. Pita, Air Conditioning Principles and Systems, Pearson Education, New Delhi.**2003**

6 Jain V.K., Refrigeration & Air Conditioning, Tata McGraw Hill New Delhi. 2004

BTME606.B: NONCONVENTIONALMACHINING METHODS

Unit1: Introduction and classification of advanced machining process, consideration in process selection, difference between traditional and non-traditional process, Hybrid process. Abrasivefinishingprocesses:AFM,MAF(forPlainandcylindricalsurfaces).

Unit2: Mechanical advanced machining process: Introduction, Mechanics of metal removal, process principle, Advantages, disadvantages and applications of AJM, USM,WJC.

Unit3: Thermoelectric advanced machining process: Introduction, Principle ,process parameters ,advantages, disadvantages and applications about EDM,EDG, LBM,PAM,EBM

Unit4: Electrochemical and chemical advanced machining process: ECM, ECG, ESD, Chemical machining, Anode shape prediction and tool design for ECM process. Tool (cathode) design for ECM Process.

Unit5: Introduction to Micro and nano machining

BTME606.C: MICRO ELECTRO AND MECHANICAL SYSTEMS (MEMS) and MICROSYSTEMS

Unit 1: Over view of MEMS and Microsystems: Micro electromechanical Systems(MEMS) and Microsystems, Typical MEMS and Micro system products, Evaluation of Micro fabrication, Micro system and microelectronics, the multidisciplinary nature of micro system design and manufacture, Microsystems and miniaturization, Application of Microsystems in the automotive industry, applications of Microsystems in other industries. Working Principles of Microsystems: Introduction, Micro sensors, Micro actuation, MEMS with Microactuators, Micro accelerometers, Micro fluidics.

Unit2: Engineering Science for Micro system Design and Fabrication: Introduction, atomic structure of matter, ions and ionization, molecule theory of matter and intermolecular forces,

doping of semiconductors, the diffusion process, plasma physics, electrochemistry, quantum physics. Engineering Mechanics for Micro system design: Introduction, static bending of thin plates, mechanical vibration, thermo mechanics, fracture mechanics, thin-film mechanics, overview of finite element stress analysis.

Unit3: Thermo fluid Engineering and Micro system design: Introduction, overview of the basics of fluid mechanics in Macro and mesoscales, Basic equations in continuum fluid dynamics, laminar fluid flow in circular conduits, computational fluid dynamics, Incompressible fluid flow in micro conduits, fluid flow in sub micrometer and nano scale, overview of heat conduction in solids, heat conduction in multilayered thin films, heat conduction in solids in sub micrometer scale. Scaling laws in Miniaturization: Introduction to scaling, scaling in geometry, scaling in rigid-body dynamics, scaling in electrostatic forces, scaling in electromagnetic forces, scaling in electricity, scaling in fluid mechanics, scaling in heat transfer.

Unit4: Materials for MEMS and Microsystems: Introduction, substrate and wafers, active substrate materials, silicon as a substrate material, silicon compounds, silicon piezo resistors, gallium arsenide, quartz, piezo electric crystals, polymers, packaging materials.5Microsystem Fabrication Processes: Introduction, Photolithography, Ion implantation, diffusion, oxidation, chemical vapor deposition, physical vapor deposition-sputtering, deposition by epitaxy, etching.

Unit5: Overview of Micro manufacturing: Introduction, bulk micro manufacturing, surface micro machining, LIGA. Micro system Design: Introduction, design consideration, process design, mechanical design, mechanical design using finite element method, design of silicon die for a micro pressure sensor, design of micro fluidic network systems, design case: capillary electrophoresis network system.

BTME607: CIMS Lab

List of Experiments

1. To prepare part programming for plain turning operation.

2. To prepare part program for turning operations using turning cycle.

3. To prepare part program for threading operation.

4. To prepare part program for gear cutting using mill cycle.

5. To prepare part program for multiple drilling in X and Z axis using drilling cycle.

Important Note: It is mandatory for every student to undertake a Mini project. Mini project shall be a group activity. A group shall consist of maximum five students. Final evaluation shall include 30% weight age to mini project.

- Engraving of students' name, manufacturing of a part.

BTME608: Vibration Lab

List of Experiments

1. To verify relation T = 2π√(l/g) for a simple pendulum.

2. To determine radius of gyration of compound pendulum.

3. To determine the radius of gyration of given bar by using bifilar suspension.

4. To determine natural frequency of a spring mass system.

5. Equivalent spring mass system.

6. To determine natural frequency of free torsional vibrations of single rotor system.

i. Horizontal rotor

ii. Vertical rotor

7. To verify the Dunkerley's rule.

8. Performing the experiment to find out damping co-efficient in case of free damped torsional vibration

9. To conduct experiment of trifler suspension.

10. Harmonic excitation of cantilever beam using electro-dynamic shaker and determination of resonant frequencies.

11. Study of Vibration measuring instruments.

12. Perform study of the following using Virtual Lab http://www.vlab.co.in/

13. Forced Vibration of a Cantilever Beam with a Lumped Mass at Free End: To calculate the natural freq and damping ratio for forced vibration of a single DOF cantilever beam system, experimentally; and compare the results with theoretical values.

14. Harmonically Excited Forced Vibration of a Single DOF System: To analyze the forced vibration response of a single DOF system at diff damping ratio and frequency ratio.

15. Perform study of the following using Virtual Lab http://www.vlab.co.in/

16. Forced Vibration of a Cantilever Beam with a Lumped Mass at Free End: To calculate the natural freq and damping ratio for forced vibration of a single DOF cantilever beam system, experimentally; and compare the results with theoretical values.

17. Harmonically Excited Forced Vibration of a Single DOF System: To analyze the forced vibration response of a single DOF system at diff damping ratio and frequency ratio.

Important Note: It is mandatory for every student to undertake a Mini project. Mini project shall be a group activity. A group shall consist of maximum five students. Final evaluation shall include 30% weight age to mini project.

- Design of vibration system, measurement of vibration, FFT analysis using MATLAB

BTME609: Machine Design Practice II Lab

Problems on:

Use data hand book by Mahadevan and Reddy

1. Fatigue loading.

2. Helical compression, tension and torsional springs design.

3. Curved Beams.

4. Preloaded bolts and bolts subjected to variable stresses.

5. Belt, Rope and Chain drive system.

6. Gear Design.

7. Sliding contact bearing design.

8. Anti-friction bearing selection

Important Note: It is mandatory for every student to undertake a Mini project. Mini project shall be a group activity. A group shall consist of maximum five students. Final evaluation shall include 30% weight age to mini project.

- Design of assembly (mechanical systems) using various BIS codes/databook

BTME610:Thermal Engineering Lab

List of Experiments

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

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

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

4. Study of various types of boilers.

5. Study of various types of mountings and accessories.

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

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

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

Important Note:

- Study also includes Assembly and disassembly of above systems
- It is mandatory for every student to present a term paper. Term paper shall be a group activity. A group shall consist of maximum two students. Final evaluation shall include 30% weight age to term paper. Term paper shall cover study or survey of new technologies in above systems.

BACHELOR OF TECHNOLOGY								
MECHANICAL ENGINEERING								
SEVENTH SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	**L**	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTME701.A	**I.C. Engines**	3	0	0	30	70	100	3
BTME701.B	Operation Research	3	0	0	30	70	100	3
BTME701.C	Turbomachines	3	0	0	30	70	100	3
Open Elective – I (Choose Any One Subject)								
BTME702.A	**Non Destructive System**	3	0	0	30	70	100	3
BTME702.B	Environmental Engineering and Disaster Management	3	0	0	30	70	100	3
BTME702.C	Power Generation Sources	3	0	0	30	70	100	3
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTME703	FEA Lab	0	0	3	30	20	50	1
BTME704	Thermal Engineering Lab-II	0	0	3	30	20	50	1
BTME705	Quality Control Lab	0	0	2	30	20	50	1
BTME706	Industrial Training	1	0	0	60	40	100	2
BTME707	Seminar	2	0	0	60	40	100	2
BTME708	Social Outreach, Discipline & Extra Curricular Activity	-	-	-	-	-	50	1
TOTAL		9	**0**	**8**	**270**	**280**	**600**	14

BTME701.A: INTERNAL COMBUSTION ENGINE

Unit-I

Introduction: Objective, scope and outcome of the course.

History of IC engines: Nomenclature, Classification & Comparison, SI & CI, 4stroke- 2 stroke, First Law analysis, Energy Balance. Fuel air cycles, Actual cycles.

Testing & Performance: Performance parameters, Measurement of operating parameters e.g. speed, fuel & air consumption, Powers, IHP, BHP, FHP, Efficiencies Thermal, Mechanical, Volumetric, Emission Measurement, Indian & International standards of Testing, Emission.

Unit-II

Fuel & Combustion: Combustion in CI & SI engines, Ignition Limits, Stages of combustion, Combustion parameters. Delay period and Ignition Lag, Turbulence and Swirl, Effects of engine variables on combustion parameters, abnormal combustion in CI & SI engines, Detonation & knocking, Theories of detonation, Control of abnormal combustion, Combustion chamber design principles, Types of combustion chamber.

Unit-III

Alternative Fuels: Methanol, Ethanol, Comparison with gasoline, Manufacturing, Engine performance with pure Methanol, Ethanol & blends, Alcohols with diesel engine, Vegetable oils, Bio gas.

Engine Systems & Components: Fuel System (SI Engine), Carburetion & Injection, process & parameters, properties of A/F mixture, Requirements of A/F ratios as per different operating conditions, Carburettors, types, Aircraft carburettor, comparison of carburetion & injection, F/A ratio calculations.

Unit-IV

CI engine: Mixture requirements & constraints, Method of injection, Injection systems, CRDI etc. system components, pumps injectors.

Ignition system: Conventional & Modern ignition systems Magneto v/s Battery, CB point v/s Electronic ignition, Fuel Ignition Energy requirements. Spark advance, centrifugal, vacuum Firing order, spark plugs.

Unit-V

Engine Friction & Lubrication: Determination of friction, Lubrication principles, Types of lubrication, Places of lubrication Bearings and piston rings etc., Functions of Lubrication, Properties, Rating and Classification of lubricating oil, Additives, Lubrication systems. Engine Cooling: Requirements of cooling, Areas of heat flow, High temperature regions of combustion chamber. Heat Balance, Cooling Systems, Air, Water Cooling, Cooling system components.

BTME701.B: Operation Research

Unit 1:Introduction: Objective, scope and outcome of the course.

Overview of Operations Research

Linear Programming: Applications and model formulation, Graphical method, Simplex method, duality and Sensitivity analysis.

Transportation Model and Assignment Model including travelling salesman problem.

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

programming.

Unit 2:Replacement Models: Capital equipment replacement with time, group replacement of items subjected to total failure.

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

queue with infinite customer population,

Unit 3:Competitive Situations and Solutions: Game theory, two person zero sum game, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy, approximate solution, and simplified analysis for

other competitive situations. Application of linear programming

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

Unit 4:Deterministic Inventory control models: functional role of inventory, inventory costs, model building, Single item inventory control model without shortages, with shortage and quantity discount. Inventory control model with uncertain demand, service

level, safety stock, P and Q systems, two bin system. Single period model. Selective Inventory control techniques.

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

Unit 5: Simulation: Need of simulation, advantages and disadvantages of simulation method of simulation. Generation of Random numbers, Generation of Normal Random numbers. Use of random numbers for system simulation. , Monte Carlo simulation, simulation language ARENA, Application of simulation for solving queuing Inventory Maintenance, Scheduling and other industrial problems

BTME701.C: Turbomachines

Unit 1: Introduction: Objective, scope and outcome of the course.

Basic Concepts of Turbo Machines: Definition & classification of Turbo machine, Basic laws and governing equations: continuity equation, steady flow energy equation(1st law of thermodynamics),2nd law of thermodynamics applied to turbo
machines, Newton's 2nd law of motion applied to turbomachines - Euler's pump equation and Euler's turbine equation

Dimensional analysis applied to hydraulic machines, power coefficient, flow coefficient, head coefficient, non-dimensional specific speed, Range of specific speeds for various turbo machines, Dimensional analysis applied to compressible flow machines, pressure ratio as a Function of temperature ratio, mass flow rate
parameter and speed parameter

Unit 2: Centrifugal Compressors and Fans: Components and description, velocity iagrams, slip factor, energy transfer, power input factor, stage pressure rise and loading coefficient, pressure coefficient, degree of reaction, Centrifugal compressor characteristic, surging,
rotating Stall and Choking

Unit 3: Axial Flow Compressors and Fans: Basic constructional features, Advantages of axial flow compressors, working principle, velocity triangle, elementary theory, stage work, work done factor, stage loading, degree of reaction; vortex theory, simple design calculations,
introduction to blade design, cascade test, compressibility effects, operating characteristics

Unit 4: Reciprocating Compressors: Basic constructional features, working principle, work done calculation, single and double acting compressors

Unit : Centrifugal Pumps: Main parts, work done and velocity triangles, slip and slip factor, pump losses and efficiencies, minimum starting
speed, net positive suction head, performance curve.

Unit 5 : Axial Flow Pumps: Description, velocity triangles, work done on the fluid, energy transfer, axial pump characteristics, cavitation.

Reciprocating Pumps: Classification, component and working, single acting and double acting, discharge, work done and power required, coefficient of discharge, indicator diagram, slip, effect of
friction and acceleration, theory of air vessels.

BTME702.A: Non Destructive System

Unit-I

Introduction: Objective, scope and outcome of the course

Overview of NDT: NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterization. Relative

merits and limitations, Various physical characteristics of materials and their applications in NDT, Visual inspection, Unaided and aided.

Unit-II

Surface Non Destructive Evaluation (NDE) Methods: Liquid Penetrant Testing, Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods. Testing Procedure, Magnetic Particle Testing, Theory of magnetism, inspection materials. Magnetisation methods, Interpretation and evaluation, Principles and methods of demagnetization, Residual magnetism.

Unit-III

Thermography and Eddy Current Testing (ET): Thermography, Principles, Contact and non contact inspection methods, Advantages and limitation, Instrumentations and methods, applications. Eddy Current Testing, Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.
Ultrasonic Testing (UT) and Acoustic Emission (AE): Ultrasonic Testing, Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A-Scan, B-scan, C-scan. Acoustic Emission Technique, Principle, AE parameters, Applications.

Unit-IV

Radiography (RT): Principle, Interaction of X-Ray with matter, imaging, film and film less techniques, Types and use of filters and screens, Geometric factors, Inverse square, law, characteristics of films, Interpretation/ Evaluation, Fluoroscopy, Xero Radiography, Computed Radiography, Computed Tomography.

Unit-V

Special Techniques and Applications: Phased array ultrasonic time of flight diffractions, Automated and remote ultrasonic testing, Acoustic pulse reflectometry, Alternative current field method, Case studies on NDT techniques used in aircrafts.

BTME702.B: Engineering and Disaster Management

Unit-I

Introduction: Objective, scope and outcome of the course. (This compulsory for all course)

Unit-II

Importance of safe water supply system. Domestic water requirements for urban and rural areas. Sources of Water supply. Intakes and transportation of water.

Unit-III

Drinking water quality. Indian Standards of drinking water. Introduction to water treatment for safe drinking, Importance of sanitation.

Unit-IV

Domestic waste water: quantity, characteristics, disposal in urban and rural areas. Sewer: types, design discharge and hydraulic design. Introduction to domestic wastewater treatment.

Unit-V

Solid waste: quantity, characteristics and disposal for urban and rural areas. Introduction to air pollution. Types of pollutants, properties and their effects on living beings. BIS standards for pollutants in air and their abetments. Introduction to various disaster, Importance of disaster management.

BTME702.C: Power Generation Sources

Unit-I

INTRODUCTION: World energy status, Current energy scenario in India, Environmental aspects of energy utilization, Environment - Economy - Energy and Sustainable Development, Energy planning.

Conventional Energy Generation Methods: Thermal Power plants: Basic schemes and working principle. Gas Power Plants: open cycle and closed cycle gas turbine plants, combined gas & steam plants-basic schemes. Hydro Power Plants: Classification of hydroelectric plants. Basic schemes of hydroelectric and pumped storage plants. Nuclear Power Plants: Nuclear fission and nuclear fusion. Fissile and fertile materials. Basic plant schemes with boiling water reactor, heavy water reactor and fast breeder reactor. Efficiencies of various power plants.

Unit-III

SOLAR ENERGY: Basic concepts, Solar radiation – Measurement, Solar thermal systems – Flat plate and concentrating collectors, Solar passive space - Solar heating and cooling techniques – Solar desalination – Solar Pond - Solar cooker - Solar dryers-Solar furnaces - Solar pumping,

Solar green house- Solar thermal electric power plant – Solar photo voltaic conversion – Solar cells – PV applications, Hybrid systems.

Unit-IV

WIND ENERGY: Introduction-Availability- Wind power plants , Power from the wind, Wind energy conversion systems, site characteristics, Wind turbines types – Horizontal and vertical axis-design principles of wind turbine – Blade element theory, Magnus effect- Performance. Wind energy Applications – Hybrid systems, Wind energy storage, Safety and environmental aspects.

Unit-V

BIOMASS ENERGY: Biomass – usable forms- composition- fuel properties – applications, Biomass resources, Biomass conversion technologies - direction combustion - pyrolysis – gasification -anaerobic digestion, Bioethanol and Biodiesel Production - Economics - Recent developments. Energy farming, Biogas technology - Family biogas plants, Community and institutional biogas plants – design consideration – applications.

OTHER RENEWABLE ENERGY SOURCES: Tidal energy – Wave energy – Open and closed OTEC Cycles – Small hydro – Geothermal energy – Social and environmental aspects.Fuel cell technology - types, principle of operation – applications. Hydrogen energy production - Storage – transportation – utilization.

BTME703: FEA Lab

1. Laboratory work for the solution of solid mechanics problems, heat transfer problems, and free vibration problems A: by using FE packages such as NASTRAN/ANSYS/SIMULIA/ABAQUS
2. Introduction of GUI of the software in the above mentioned areas' realistic problems.
3. Analysis of beams and frames (bending and torsion problems)
4. Plane stress and plane strain analysis problems
5. Problems leading to analysis of axisymmetric solids
6. Problems leading to analysis of three dimensional solids (a) Heat transfer problems (b) Modal analysis problem B: by writing own code for finite element analysis using MATLAB for:

7. Plane stress and plane strain analysis problems 8 Modal Analysis problem.

BTME704: Thermal Engineering Lab-II

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

BTME705: Quality Control Lab

1. Case study on X bar chart and R chart of an industrial process output and process capability analysis of the process. The charts are to be drawn and calculations of process capability analysis to be reported.

2. P Chart:
   (a) To verify the Binomial Distribution of the number of defective balls by treating the balls with a red colour to be defective.
   (b) To plot a p -chart by taking a sample of n=20 and establish control limits.

3. Case study on C-chart of a product and establish control limits .

4. Operating Characteristics Curve:
   (a) To plot the operating characteristics curve for single sampling attribute plan for n = 20; c = 1, 2, 3. Designate the red ball as defective.
   (b) To compare the actual O.C. curve with theoretical O.C. curve using approximation for the nature of distribution.

5. Distribution Verification:
   (a) To verify Normal Distribution using the experimental setup.

(b) To find the distribution of numbered cardboard chips by random drawing one at a time with replacement. Make 25 subgroups in size 5 and 10 find the type of distribution of sample average in each case. Comment on your observations.

6. To carry out verification of Poisson distribution using experimental set up.

7. Central Limit Theorem:
   (a) To show that a sample means for a normal universe follow a normal distribution
   (b) To show that the sample means for a non normal universe also follow a normal Distribution.

8. Solve quality control problems using SPC software like STATGRAPHICS/MINITAB/SIGMA XL /SYSTAT/EXCEL etc.

Important Note:
It is mandatory for every student to undertake a Case Study. The case study shall be of real problem involving quality issues preferably from local industry whose quality issues shall be solved using seven magnificent tools of SQC and other techniques of quality control. Case study shall be a group activity. A group shall consist of maximum five students. Final evaluation shall include 30% weight age to case study.

BACHELOR OF TECHNOLOGY								
MECHANICAL ENGINEERING								
EIGHTH SEMESTER								
THEORY PAPERS		**No. of Teaching Hours**			**Marks Allocation**			
Code	**Subject/Paper**	**L**	**T**	**P**	**IA**	**EA**	**Total**	**Credits**
BTME801.A	Hybrid and Electric Vehicles	3	0	0	30	70	100	3
BTME801.B	Supply and Operations Management	3	0	0	30	70	100	3
BTME801.C	**Additive Manufacturing**	3	0	0	30	70	100	3
Open Elective – II (Choose Any One Subject)								
BTME802.A	Finite Elements Methods	3	0	0	30	70	100	3
BTME802.B	**Energy Management**	3	0	0	30	70	100	3
BTME802.C	Waste and By-product Utilization	3	0	0	30	70	100	3
PRACTICALS/VIVA-VOCE		**No. of Teaching Hours**			**Sessional**	**Practical**	**Total**	**Credits**
BTME803	Industrial Engineering Lab	0	0	2	30	20	50	1
BTME804	Metrology Lab	0	0	2	30	20	50	1
BTME805	Project	3	0	0	150	100	250	5
BTME807	Social Outreach, Discipline & Extra Curricular Activity	0	0	0	0	0	50	1
TOTAL		9	**0**	**4**	**270**	**280**	**600**	14

BTME801.A: Hybrid and Electric Vehicles

Unit 1:

Introduction: Objective, scope and outcome of the course.

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

Unit 2:

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance.

Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Unit 3:

Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electricdrive-train topologies, fuel efficiency analysis.

Unit 4:

Electric Propulsion unit: Introduction to electric components used inhybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives

Unit 5:

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices.

Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology

BTME801.B: Supply and Operations Management

Unit 1:

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

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

Unit 2:

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

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

Unit 3:

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

Unit 4:

Techniques of production control in job shop production, batch production and mass production systems. sequencing: priority rules,
sequencing jobs through two work centers, scheduling services

Introduction to Just-in-time (JIT) and Lean Operations: JIT production, JIT scheduling, synchronous production, Lean operations system

Unit 5:

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

BTME801.C: Additive Manufacturing

Unit-I

Introduction: Objective, scope and outcome of the course.
Overview of Rapid Product Development (RPD): Need for the compression in product development, history of RP systems, Definition of RPD; Components of RPD. Rapid Prototyping (RP); Principle of RP; Technologies and their classifications.

Unit-II

Stereo Lithography Systems: Principle, Process parameter, Process details, Data preparation, data files and machine details, Application.
Selective Laser Sintering& Fusion Deposition Modelling: Selective Laser Sintering: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications. Fusion Deposition Modeling: Principle, Process parameter, Path generation, Applications.

Unit-III

Solid Ground Curing: Principle of operation, Machine details, Applications. Laminated Object Manufacturing: Principle of operation, LOM materials. Process details, application.
Selection of RP process; Issues in RP; Emerging trends. **Rapid Tooling (RT):** Introduction to RT, Indirect RT process- Silicon rubber molding, Epoxy tooling, Spray metal tooling and Investment Casting, Cast kirksite, 3Q keltool, etc.

Unit-IV
Direct RT processes: Laminated Tooling, Powder Metallurgy based technologies, Welding based technologies, Direct pattern making (Quick Cast, Full Mold Casting),
Emerging Trends in RT, Reverse Engineering: Geometric data acquisition, 3D reconstruction, Applications and Case Studies, Engineering applications, Medical applications.

Unit-V
Processing Polyhedral Data: Polyhedral B-Rep modeling, STL format, Defects and repair of STL files,
Introduction to software for RP : Brief overview of Solid view, magics etc.

BTME802.A: Finite Elements Methods

Unit-I
Introduction: Objective, scope and outcome of the course.
Introduction to FEM, Application of FEM, Advantages of FEM, FEA Software.
Steps of FEM: Discretization, Local stiffness matrix, coordinate transformation, Assembly, Global stiffness matrix, imposition of Boundary conditions, Properties of stiffness matrix, Banded symmetric matrix and bandwidth.

Unit-II
One-dimensional Finite Element Analysis: Basics of structural mechanics, stress and strain tensor, constitutive relation, Principle of minimum Potential, Finite element model concept, Derivation of finite elements equations using potential energy approach for linear and quadratic 1-D bar element.
Shape functions and their properties, Assembly, Boundary conditions, Computation of stress and strain, Problems on 1-D structural analysis.

Unit-III
Two Dimensional Finite Element Analysis: Finite element formulation using three nodded triangular (CST) element , Plane stress and Plane strain problems,
Shape functions, node numbering and connectivity, Assembly, Boundary conditions, Problems on 2-D structural analysis.

Unit-IV
Finite Element Formulation from Governing Differential Equation: Galerkin FEM method.

Application to one dimensional structural problems, one-dimensional heat transfer problems, etc., Introduction to variational formulation (Ritz Method.)

Unit-V
Higher Order Elements: Lagrange's interpolation formula for shape functions, Convergence of solution, static condensation, p and h methods of mesh refinement, Aspect ratio.

BTME802.B: Energy Management

Unit-I
Introduction: Objective, scope and outcome of the course.(This compulsory for all course)

Unit-II
Energy Basics; Energy Demand Management, Conservation & Resource Development, Energy for Sustainable Development.

Unit-III
Need for Energy Management by Sector- Industry, Buildings & Houses, Transport, Electric Power.

Unit-IV
Need for Energy Management by Sector- Agriculture, Domestic; Energy forecasting techniques; Energy Integration, Energy Matrix.

Unit-V
Energy Auditing; Energy management for cleaner production, application of renewable energy, appropriate technologies.

BTME802.C: Waste and By-product Utilization

Unit-I
Introduction: Objective, scope and outcome of the course. (This compulsory for all course)

Unit-II
Types and formation of byproducts and waste; magnitude of waste generation in different agro-processing industries; concept scope and maintenance of waste management and effluent treatment, basics pf Waste Recycling & Resources Recovery System (WRRRS), Temperature, pH, Oxygen demands (BOD, COD), fat, oil and grease content, metal content, forms of

phosphorous and sulphur in waste waters, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues.

Unit-III
Waste utilization in various industries, furnaces and boilers run on agricultural wastes and byproducts, briquetting of biomass as fuel, production of charcoal briquette, generation of electricity using surplus biomass, producer gas generation and utilization.

Unit-IV
Waste treatment and disposal, design, construction, operation and management of institutional community and family size biogas plants, concept of vermi-composting, Pre-treatment of waste: sedimentation, coagulation, flocculation and floatation, Secondary treatments: Biological and chemical oxygen demand for different food plant waste– trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons.

Unit-V
Tertiary treatments: Advanced waste water treatment process-sand, coal and activated carbon filters, phosphorous, sulphur, nitrogen and heavy metals removal, Assessment, treatment and disposal of solid waste.

BTME803: Industrial Engineering Lab

1. Determination of time standard for a given job using stopwatch time-study.
2. Preparation of flow process chart, operation process chart and man-machine charts for an existing setup and development of an improved process.
3. Study of existing layout of a workstation with respect to controls and displays and suggesting improved design from ergonomic viewpoint.
4. To perform ABC analysis for the given set of inventory data.
5. To develop Bill of Materials/Product structure tree and calculate planned order release (POR) using MRP format
6. To solve the operations research problems on Linear programming/Transportation/Assignment etc. using OR software's like TORA/LINGO/LINDO/SAS/EXCEL SOLVER etc.
7. Simulation of inventory system/Queuing system/production system using Monte-Carlo method.

8. To perform case study on sales forecasting.

9. To perform case study on project management using PERT/CPM.
10. To perform a case study on plant location and layout planning.

11. To perform a case study on capacity planning.

Important Note:
It is mandatory for every student to undertake a Mini project. The mini project shall involve a detailed project report of establishing a factory in which plant location, plant layout, capacity planning, selection of processes, ergonomically designing of equipments and other facilities are to be installed. Mini project shall be a group activity. A group shall consist of maximum five students. Final evaluation shall include 30% weight age to mini project.

BTME804: Metrology Lab

1. Study of various measuring tools like dial gauge, micrometer, vernier caliper and telescopic gauges.
2. Measurement of angle and width of a V-groove by using bevel protector..
3. To measure a gap by using slip gauges
4. Measurement of angle by using sine bar.

5. Study and use of surface roughness instrument (Taylor Hobson make) Inspection of various elements of screw thread by Tool makers microscope and optical projector.
6. Measurement of gear tooth thickness by using gear tooth vernier caliper.

7. To check accuracy of gear profile with the help of profile projector.
8. To determine the effective diameter of external thread by using three-wire method.
9. To measure flatness and surface defects in the given test piece with the help of monochromatic check light and optical flat.
10. To plot the composite errors of a given set of gears using composite gear tester.
11. Measurement of coating thickness on electroplated part and paint coating on steel and non-ferrous material using coating thickness gauge.
12. Study and use of hardness tester for rubber and plastics.
13. To check the accuracy of a ground, machined and lapped surface - (a) Flat surface (b) Cylindrical surface.
14. To compare & access the method of small-bore measurement with the aid of

spheres.