



Faculty of Engineering & Technology

B.Tech (Mechanical Engg.)

Scheme of Examination & Detailed Syllabi

University Campus

NH-12, Chaksu Bypass, Tonk Road, Jaipur-303901

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Plot No.-IP-2 & 3, Phase-IV, Sitapura Industrial Area, Jaipur-202022

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** Approved by AC vide resolution no. dated*

B.TECH. (MECHANICAL ENGINEERING)

CORE COURSES:

- Engineering Physics I (BT101)
- Introduction to Computers Fundamental and IT* (BT102)
- Applied Mathematics I (BT103)
- Introduction to Electrical & Electronic Engineering (BT104)
- Engineering Chemistry (BT106)
- Engineering Physics II (BT201)
- Introduction to Computer Programming * (BT202)
- Engineering Mechanics (BT203)
- Digital Electronics (BT204)
- Applied Mathematics II (BT205)
- Numerical Analysis and Statistical Techniques (BTME301)
- Thermodynamics (BTME302)
- Electronics Measurement and Instrumentation (BTME303)
- Mechanics of Solids (BTME304)
- Production Technology (BTME305)
- Material Science & Engineering (BTME306)
- Fluid Mechanics and Hydraulics (BTME401)
- Automobile Engineering (BTME402)
- Kinematics of Machines (BTME403)
- Industrial Engineering (BTME404)
- Manufacturing Processes (BTME405)
- Design Of Machine Elements-1 (BTME406)
- Design Of Machine Elements- II (BTME501)
- Management of Manufacturing system (BTME502)
- Heat and Mass Transfer (BTME503)
- Dynamics Of Machines (BTME504)
- I.C. Engines (BTME505)
- Air Conditioning & Refrigeration (BTME601)
- Steam & Gas Turbine (BTME602)
- Hydraulic Machines (BTME603)
- Noise,Vibration & Harshness (BTME604)
- Operation Research (BTME605)
- Project/ Industrial Training (BTME701)
- Fundamentals of Aerodynamics (BTME801)
- Quality Control and Quality Assurance (BTME802)
- Mechatronics & Robotics (BTME803)
- Product Design & Development(BTME804)
- Non Conventional Energy (BTME805)
- Advance Manufacturing Methods (BTME806)
- Project/Seminar(BTME810)

ELECTIVE COURSES (Discipline Centric)

- ABILITY**
- Principle of Turbo Machines (BTME506A)
 - Fundamental of Aerodynamics (BTME506B)
 - Object Oriented Programming in C++ (BTME506C)
 - Electrical Machines (BTME506D)
 - Control System (BTME506E)
 - CAD-CAM (BTME606A)
 - Non Destructive Evaluation and Testing (BTME606B)
 - Design and Manufacture of Plastic products (BTME606C)
 - Maintenance Management (BTME606D)
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ENHANCEMENT COMPULSARY COURSES (AECC)

- English & Communication Skills (BT105)
- Environmental Sciences (BT206)

SKILL ENHANCEMENT COURSES

- Communication Skill Lab
- French
- Project Management

**MECHANICAL ENGINEERING
BACHELOR OF TECHNOLOGY
COMMON TO ALL BRANCHES
FIRST SEMESTER**

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			
Code	Subject/Paper	L	T	P	IA	EA	Total	Credits
BT 101	Engineering Physics-I	3	1	-	30	70	100	4
BT 102	Introduction to Computers Fundamental and IT*	3	-	-	30	70	100	3
BT 103	Applied Mathematics-I	3	1	-	30	70	100	4
BT 104	Introduction to Electrical & Electronic Engineering	3	-	-	30	70	100	3
BT 105	English & Communication Skills	3	-	-	30	70	100	3
BT 106	Engineering Chemistry	3	-	-	30	70	100	3

PRACTICALS/VIVA-VOCE		No. of Teaching Hours			Sessional	Practical	Total	Credits
BT 107	Electrical & Electronics Lab-I	-	-	2	30	20	50	1
BT 108	Engineering Physics Lab-I	-	-	2	30	20	50	1
BT 109	IT Fundamental Lab*	-	-	2	30	20	50	1
BT 110	Engineering Chemistry Lab	-	-	2	30	20	50	1
BT 111	Engineering Workshop	-	-	2	30	20	50	1
TOTAL		18	2	10	330	520	850	25

**MECHANICAL ENGINEERING
BACHELOR OF TECHNOLOGY
COMMON TO ALL BRANCHES
SECOND SEMESTER**

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			
Code	Subject/Paper	L	T	P	IA	EA	Total	Credits
BT 201	Engineering Physics-II	3	1	-	30	70	100	4
BT 202	Introduction to Computer Programming *	3	-	-	30	70	100	3
BT 203	Engineering Mechanics*	3	1	-	30	70	100	4
BT 204	Digital Electronics	3	-	-	30	70	100	3
BT 205	Applied Mathematics-II	3	-	-	30	70	100	3
BT 206	Environmental Sciences	3	-	-	30	70	100	3
PRACTICALS/VIVA-VOCE								
		No. of Teaching Hours			Sessional	Practical	Total	Credits
BT 207	Electrical & Electronic Lab-II	-	-	2	30	20	50	1
BT 208	Engineering Physics-II	-	-	2	30	20	50	1
BT 209	Computer Programming Lab*	-	-	2	30	20	50	1
BT 210	Engineering Drawing	-	-	2	30	20	50	1
BT 211	Communication Skill Lab*	-	-	2	30	20	50	1
TOTAL		18	2	10	330	520	850	25

**BACHELOR OF TECHNOLOGY
MECHANICAL ENGINEERING
THIRD SEMESTER**

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			Credits
Code	Subject/Paper	L	T	P	IA	EA	Total	
BTME 301	Numerical Analysis and Statistical Techniques	3	-	-	30	70	100	3
BTME302	Thermodynamics	3	1	-	30	70	100	4
BTME303	Electronics Measurement and Instrumentation	3	-	-	30	70	100	3
BTME304	Mechanics of solids	3	1	-	30	70	100	4
BTME305	Production Technology	3	-	-	30	70	100	3
BTME306	Material Science & Engineering	3	-	-	30	70	100	3
PRACTICALS/VIVA-VOCE		No. of Teaching Hours			Sessional	Practical	Total	Credits
BTME307	EMI Lab	-	-	2	30	20	50	1
BTME308	Strength of Material Lab	-	-	2	30	20	50	1
BTME309	Production Technology Lab	-	-	2	30	20	50	1
BTME310	Material Science Lab	-	-	2	30	20	50	1
BTME311	Machine drawing lab	-	-	2	30	20	50	1
TOTAL		18	2	10	330	520	850	25

**BACHELOR OF TECHNOLOGY
MECHANICAL ENGINEERING
FOURTH SEMESTER**

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			Credits
Code	Subject/Paper	L	T	P	IA	EA	Total	
BTME401	Fluid Mechanics and Hydraulics	3	1	-	30	70	100	4
BTME402	Automobile Engineering	3	-	-	30	70	100	3
BTME403	Kinematics of Machines	3	1	-	30	70	100	4
BTME404	Industrial Engineering	3	-	-	30	70	100	3
BTME405	Manufacturing Processes	3	-	-	30	70	100	3
BTME406	Design Of Machine Elements-1	3	-	-	30	70	100	3
PRACTICALS/VIVA-VOCE		No. of Teaching Hours			Sessional	Practical	Total	Credits
BTME407	Fluid Mechanics and hydraulics Lab	-	-	2	30	20	50	1
BTME408	Automobile Engineering Lab	-	-	2	30	20	50	1
BTME409	KOM Lab	-	-	2	30	20	50	1
BTME410	Production Engineering practice lab	-	-	2	30	20	50	1
BTME4111	Machine Design Lab -I	-	-	2	30	20	50	1
TOTAL		18	2	10	330	520	850	25
4-6 weeks training will be held after fourth semester,viva will be conducted in fifth sem.								

**BACHELOR OF TECHNOLOGY
MECHANICAL ENGINEERING
FIFTH SEMESTER**

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			Credits
Code	Subject/Paper	L	T	P	IA	EA	Total	
BTME501	Design Of Machine Elements- II	3		-	30	70	100	3
BTME502	Management of Manufacturing system	3		-	30	70	100	3
BTME503	Heat and Mass Transfer	3	1	-	30	70	100	4
BTME504	Dynamics Of Machines	3	1	-	30	70	100	4
BTME505	I.C. Engines	3		-	30	70	100	3
	Elective (any one)							
BTME506A	Principle of Turbo Machines	3	-	-	30	70	100	3
BTME506B	Fundamental of Aerodynamics	3	-	-	30	70	100	3
BTME506C	Object Oriented Programming in C++	3	-	-	30	70	100	3
BTME506D	Electrical Machines	3	-	-	30	70	100	3
BTME506E	Control system	3	-	-	30	70	100	3

PRACTICALS/VIVA-VOCE		No. of Teaching Hours			Sessional	Practical	Total	Credits
BTME 507	Heat Transfer Lab	-	-	2	30	20	50	1
BTME 508	Dynamics of Machines Lab	-	-	2	30	20	50	1
BTME 509	I.C. Engine Lab	-	-	2	30	20	50	1
BTME 510	Manufacturing Technology Lab	-	-	2	30	20	50	1
BTME 511	Machine Design Lab-II	-	-	2	30	20	50	1
BTME512	TRAINING VIVA	-	-	0	30	20	50	2
TOTAL		18	2	10	360	540	900	27

**BACHELOR OF TECHNOLOGY
MECHANICAL ENGINEERING
SIXTH SEMESTER**

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			Credits
Code	Subject/Paper	L	T	P	IA	EA	Total	
BTME 601	Air Conditioning & Refrigeration	3	1	-	30	70	100	4
BTME 602	Steam & Gas Turbines	3	-	-	30	70	100	3
BTME 603	Hydraulic Machines	3	1	-	30	70	100	4
BTME 604	Noise, Vibration & Harshness	3	-	-	30	70	100	3
BTME 605	Operation Research	3	1	-	30	70	100	4
Elective (any one)								
BTME606A	CAD-CAM	3	-	-	30	70	100	3
BTME606B	Non Destructive Evaluation and Testing	3	-	-	30	70	100	3
BTME606C	Design and Manufacture of Plastic products	3	-	-	30	70	100	3
BTME606D	Maintenance Management	3	-	-	30	70	100	3
PRACTICALS/VIVA-VOCE		No. of Teaching Hours			Sessional	Practical	Total	Credits
BTME 607	Air Conditioning & Refrigeration Lab	-	-	2	30	20	50	1
BTME 608	CAD lab	-	-	2	30	20	50	1
BTME 609	Vibration Lab	-	-	2	30	20	50	1
BTME 610	Hydraulic Machines Lab	-	-	2	30	20	50	1
BTME 611	Industrial tour/ In house workshop	-	-	0	30	20	50	2
BTME 612	Technical Seminar	-	-	1	30	20	50	1
TOTAL		18	3	9	360	540	900	28

4 -6 weeks training will be held after sixth semester,viva will be conducted in seventh sem.

**BACHELOR OF TECHNOLOGY
MECHANICAL ENGINEERING**

Semester – VII

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			Credits
Code	Subject/Paper	L	T	P	IA	EA	Total	
BTME 701	PROJECT/INDUSTRIAL TRAINING	-	-	-	540	360	900	28
TOTAL					540	360	900	28

**BACHELOR OF TECHNOLOGY
MECHANICAL ENGINEERING**

Semester – VIII

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			Credits
Code	Subject/Paper	L	T	P	IA	EA	Total	
BTME 801	Fundamentals of Aerodynamics	3	1	-	30	70	100	4
BTME 802	Quality Control & Quality Assurance	3	1	-	30	70	100	4
BTME 803	Mechatronics & Robotics	3	1	-	30	70	100	4
BTME 804	Production Design & Development	3	-	-	30	70	100	3
BTME 805	Non Conventional Energy	3	-	-	30	70	100	3
BTME 806	Advanced Manufacturing Methods	3	1	-	30	70	100	4
<i>PRACTICALS/VIVA-VOCE</i>		No. of Teaching Hours			Sessional	Practical	Total	Credits
BTM807	CAM & Robotics Lab	-	-	2	30	20	50	1
BTME808	MAT Lab	-	-	2	30	20	50	1
BTME809	NCE Lab	-	-	2	30	20	50	1
BTME810	Project/Seminar	-	-	2	90	60	150	2
TOTAL		18	4	8	360	540	900	27

Grand Total of Marks and Credits	126	16	63	3030	4180	7000	210
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MECHANICAL ENGINEERING

L=LECTURER, T= TUTORIAL, P=PRACTICAL, IA=INTERNAL ASSESSMENT, EA=EXTERNAL ASSESSMENT

The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format, thereafter he/she will have to present the progress of the work through seminars and progress reports. Seminar related to the project should be delivered one after starting of semester .The progress will be monitored through seminars and progress reports.

Note;--

1. The total number of the credits of (Mechanical) Programme are = 210.
2. Each student shall be required to appear for examinations in all courses. However, for the award of the degree a student shall be required to earn minimum of 200 credits.

For lateral entry students in Third SEMESTER ::--

- 1.The total number of credits of the B. Tech (Mechanical)Programme = 160
- 2.Each student shall be required to appear for examination for all courses third semester onwards .However, for the award of the degree a student shall be required to earn the minimum of 150 credits .

BACHELOR OF TECHNOLOGY COMMON TO ALL BRANCHES FIRST SEMESTER

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			
Code	Subject/Paper	L	T	P	IA	EA	Total	Credit
BT 101	Engineering Physics-I	3	1	-	30	70	100	4
BT 102	Introduction to Computers Fundamental and IT*	3	-	-	30	70	100	3
BT 103	Applied Mathematics-I	3	1	-	30	70	100	4
BT 104	Introduction to Electrical & Electronic Engineering	3	-	-	30	70	100	3
BT 105	English & Communication Skills	3	-	-	30	70	100	3
BT 106	Engineering Chemistry	3	-	-	30	70	100	3
PRACTICALS/VIVA-VOCE		No. of Teaching Hours			Sectionals	Practical	Total	Credits
BT 107	Electrical & Electronics Lab-I	-	-	2	30	20	50	1
BT 108	Engineering Physics Lab-I	-	-	2	30	20	50	1
BT 109	IT Fundamental Lab*	-	-	2	30	20	50	1
BT 110	Engineering Chemistry Lab	-	-	2	30	20	50	1
BT 111	Engineering Workshop	-	-	2	30	20	50	1
TOTAL		18	2	10	330	520	850	25

Note:

1. Semester I and II common for all Branches of Engineering.

2. Half the students will study Environmental Science in 1st Semester and rest will study Engineering Chemistry and Chemistry Lab. The students shall interchange the subjects and vice-versa In 2nd Semester.

BT101: Engineering Physics I

UNIT-I

Atomic Structure and Solid State: Atomic energy levels and electronic configuration, Intermolecular forces and binding, phases of matter, crystal structure simple cubic, body centered cubic and face centered cubic structures, energy bands in solids, band structure of metals, semiconductors and insulators.

UNIT-II

Semiconductor Physics: Extrinsic and intrinsic semiconductors, Fermi levels of undoped and doped semiconductors, p-n junction, depletion region, forward and reverse biased p-n junction, volt-Ampere characteristics of a diode, effect of temperature on diode characteristics, Zener diode, tunnel diode, photodiode and LEDs, their structure and characteristics.

UNIT-III

Theory of Relativity: Absolute and relative frames of reference, Galilean transformations, importance of Michelson-Morley experiment, postulates of special theory of relativity, Lorentz transformations, time dilation and length contraction, velocity addition, mass-energy relationship, elementary ideas about general theory of relativity.

UNIT-IV

Elementary Quantum Mechanics: Wave particle duality, deBroglie waves, experimental evidence of wave nature of matter, Schrodinger wave equation in One dimension, eigen values and eigen functions, physical interpretation of wave function, Heisenberg uncertainty principle, tunneling phenomenon.

UNIT-5

Oscillation & Waves: Simple harmonic oscillator with example, energy of oscillator, Damping oscillator, viscous & solid friction damping, Quality factor, Resonance standing waves, elastic waves,

Recommended reference books:

1. Conceptual Physics, P. Hewitt, Pearson, India
2. Physics for Scientists and Engineers, R. Serway
3. Fundamental University Physics, Alonso & Finn.
4. Physics Vol I and II, Resnick and Halliday
5. Berkley Physics Course Vol 1 & Vol. 3
6. Modern Physics , A . Beiser

BT102 - INTRODUCTION TO COMPUTER FUNDAMENTAL AND IT

UNIT-I

Computer System: Basics of computer systems, history, types and Generation of computer, capability and limitations of computer systems. Hardware organization: Anatomy of a digital computer, CPU. Internal architecture of CPU. Memory Units: Memory Hierarchy, Primary Memory, Secondary Memory, cache memory. Storage Devices, Input and Output Devices.

UNIT-II

Operating Systems: DOS Internal, External commands, Windows (2000 and NT) , Overview of architecture of Windows, tools and system utilities including registry , partitioning of hard disk , Overview of Linux architecture , File system , file and permissions , concept of user and group , installation of rpm and deb based packages.

UNIT-III

Number system & Conversions: decimal, binary, octal and hexadecimal number systems and their inter conversions, 1's and 2's complement representation, negative numbers and their representation, BCD, EBCDIC , ASCII and Unicode. Binary Arithmetic operations: addition, subtraction, multiplication, division.

UNIT-IV

Networking Basics - Uses of a Network and Common types of Networks, Network topologies and protocols, Network media and hardware, Overview of Database Management System.

UNIT-IV

Data Processing: Introduction to MS office, MS-Power Point and MS-Excel, Introduction to Electronic Spreadsheets, Applications of Electronic Spreadsheets, Types of Spreadsheets, Features of MS-Excel, Starting MS-Excel, Contents of the MS-Excel window, Cell Referencing, Ranges and Functions, Formatting Worksheets and Creating Charts, Data Forms and Printing

Introduction to MS-PowerPoint : Introduction to MS-PowerPoint, What is a Presentations?, Slides, Working with Slides, Slides Show and Printing Presentation

Text/Reference Books:

1. Peter Norton, Introduction to computers, Sixth Edition Tata McGraw Hill (2007).
2. Pradeep K. Sinha, PritiSinha, Computer Fundamentals, BPB Publications.
3. Andrews Jean, A+Guide to Managing & Maintaining Your PC, Cengage Publication 6/e
4. Anita Goel, Computer Fundamentals, Pearson Education.

BT103- Applied Mathematics I

UNIT-I

Functions of variables: Geometric representation, limit, continuity and differentiability of functions of several variables , partial and full derivatives, derivatives of composite functions, Euler's theorem on homogeneous functions, harmonic functions, directional derivatives, Taylor's formula, maxima and minima of functions, Lagrange's multipliers.

UNIT-II

Asymptotes and curvature: Rolle's Theorem, Cauchy's mean value theorem, Taylor and Maclaurin theorems, concavity and convexity of a curve, points of inflexion, asymptotes and curvature.

UNIT-III

Analytical functions: Limit, continuity and differentiability of analytic functions, Cauchy-Reimann equations, complex functions, line integrals, Cauchy's integral theorem, Cauchy's integral formula, power series, zeroes and singularity, residue theorem.

UNIT-IV

Integral calculus: Definite integral as limit of sum, properties of definite integrals, mean value theorem, fundamental theorem, evaluation of definite integrals, reduction formula.

UNIT-V

Differential equations: Order and degree of a differential equation, general and particular solutions, solution of differential equations by separation of variables method, integrating factor method, homogeneous differential equations of first order and their solutions, solution of linear differential equation $dy/dx+f(x)y=Q(x)$ and their application in electrical, nuclear and mechanical systems.

Recommended reference books:

1. Kreszig, Advanced Engineering Mathematics, Wiley Eastern Ltd
2. Grewal B. S., Higher Engineering mathematics, Khanna Publishers
3. Sastri S S., Engineering Mathematics, Vol. 1 & 2, PHI
4. Gangadharan A, Engineering Mathematics Vol 1 & 2, PHI
5. Dass H.K., Advanced Engineering Mathematics, S. Chand, Delhi

BT104 : Introduction to Electrical and Electronic Engineering

UNIT-I

Basic Electrical Quantities: Electromotive force, Electric Power, Charge, current, voltage, Energy, Electric potential and field, magnetic flux, resistance, capacitance and inductance. Ohm's law, Voltage and current sources.

UNIT-II

Network analysis: Circuit principles, Kirchoff's Laws, Node Voltage and Mesh Current Analysis; Delta-Star and Star-Delta Transformation, Source Conversion. Classification of Network Elements, Superposition Theorem, Thevenin's Theorem, Norton Theorem, Maximum Power Transfer Theorems.

UNIT-III

AC circuits: 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. Power in a circuit, reactive power, power factor, impedance in ac circuit, series and parallel resonance, Q factor, Introduction to 3-Phase AC System.

UNIT-IV

Transformers: Faraday's Law of Electromagnetic Induction Basic principle of operation of transformer, construction, working, voltage and current relations, Phasor Diagram of Ideal Transformer.open circuit and short circuit test, transformer losses and efficiency, ferrite core transformers.**Electrical DC Machine:** Principle of DC Machines, Types, Different Parts ofDC Machines

UNIT-V

Power Supplies: Half wave, full wave and bridge rectifiers, ripple factor and reduction by use of inductor,capacitor, L and pie section filters, voltage regulation using Zener diode.

Recommended reference books:

1. Millman and Halkias; Integrated Electronics, Tata-McGraw Hill , New Delhi
2. E. Hughes; Electrical and Electronic Technology, Pearson Limited.
3. R.P. Punagin, Basic Electronics, Tata McGraw Hill.
4. J.Millman and C. Halkias: Electronic Devices and Circuits, Tata McGraw Hill Publishing Company Ltd., 2000.
- 5 .Donald A. Neamen, Semiconductor Physics and Devices, McGraw Hill, 1997.
6. Vicent Del Toro, Electrical Engineering Fundamentals, Prentice Hall India.

BT105- English and Communication Skills

UNIT –I

Grammar and Vocabulary: Basic sentence pattern, use of tense, modals, active and passive voice, Direct and Indirect Speech, One word substitution, Synonyms and Antonyms and Common Erros in English.

UNIT-II

Phonetics: IPA symbols, Correct pronunciation of commonly used words, sounds (vowel and consonants)

UNIT-III

Literature : Poetry : where the mind is without fear – Rabindra Nath Tagore, Mending wall – Robert Frost, Night of Scorpion – Nissim Ezekiel

Essays: of studies: Francis Bascon, what is science? George Orwell.

UNIT-IV

Writing skills : Paragraph writing, Letter writing, covering letter and C.V., Writing E-mails.

UNIT-V

Fundamentals of Communication: (A) Communication: definition and meaning of communication, functions of communication, process of communication.

(B) Types of communication: Verbal and Non verbal communication, Formal and informal communication.

(C) Barriers to communication, qualities of good communication, the art of listening.

Recommended reference books:

1. English for competitive examinations, Prof. R. P. Bhatnagar, Macmillan Publications.
2. “Current English Grammar and usage with composition” by R. P. Sinha, Oxford University Press (New Delhi).
3. Effective Technical Communication by M. Ashraf Rizvi Tata Mcgraw-Hill Companies, New Delhi.
4. Communication skills by Sanjay Kumar & Pushp Lata. Oxford University Press (New Delhi)

BT106- Engineering Chemistry

UNIT -I

Water:

The sources of water, common Impurities, soft and hard water, Hardness of water, degrees of hardness and its effects, determination of hardness by various techniques, Municipal Water supply, requisites of drinking water, purification of water by sedimentation, filtration, reverse osmosis (RO), sterilization, chlorination. Water for boilers, corrosion,

sludge and scale formation, caustic embitterment, treatment by preheating, lime-soda process, permutit de-ionizer or demineralization.

UNIT- II

Electrochemistry: Redox reactions; conductance in electrolytic solutions, specific and molar conductivity variations of conductivity with concentration, Kohlrausch's Law, electrolysis and laws of electrolysis (elementary idea), dry cell – electrolytic cells and Galvanic cells; lead accumulator, EMF of a cell, standard electrode potential, Nernst equation and its application to chemical cells. Relation between Gibbs energy change and EMF of a cell, fuel cells; corrosion.

Analysis: Volumetric Analysis, Types of titrations, Theory of indicators.

Spectral Analysis: Electromagnetic radiation, Lambert-Beer's Law, UV-VIS, IR, NMR instrumentation & applications.

Thermal Methods of Analysis: principle, working and applications of Thermogravimetry, Differential thermal analysis and Differential scanning calorimetry.

UNIT- III

Fuels: The need of fuel, origin and classification of fuels, Solid fuels, coal and its constituents, calorific value and its determination, coke: carbonization process, various types of coke ovens.

Liquid Fuels: advantages, petroleum and its refining, synthetic petrol, reforming of gasoline, knocking, octane number and anti knocking agents, cracking. Gaseous Fuels advantages, composition and calorific value of coal gas and oil gas and its determination.

Lubricants: Need of Classification, types of lubricants, their properties and uses, lubricants, viscosity and viscosity index and flash points, cloud and pour point, emulsification

UNIT- IV

Phase Rule: Statement, definition of terms involved, application to one component system (water-sulphur system), two component systems (Ag-Pb systems).

Polymers: Plastics, preparation, properties and uses of polyethylene, bakelite, terylene and nylon, Rubber; natural rubber, synthetic rubber such as butyl and neoprene rubbers, vulcanization process and its advantages.

Corrosion: its significance, theories of corrosion, Galvanic cell and concentration cell,

pitting and stress corrosion, protection techniques.

UNIT-V

Explosives: Introduction, classification of explosives, preparation of commercially important explosives, blasting fuses, uses and abuses of explosives.

Cement: properties, Portland cement and its manufacture, chemistry of setting and hardening of cement, RCC structures.

Refractories: definition, classification, properties of silica and fireclay refractories, **Glass:** preparation, properties and uses.

Recommended reference books:

1. Morrison R.T & Boyn R. N ; Organic Chemistry; Prentice Hall of India 1999
2. Lee J. D. ; Inorganic Chemistry ;Blackwell Science
3. Gopalan R., Venkappayya D., Nagarajan S. “Engineering Chemistry” Vikas Publishing House Pvt Ltd 2000.
4. Jain & Jain “ Engineering Chemistry” Dhanpat Rai publishing company
5. Dara S. S. , “ A Text Book of Engineering Chemistry” S. Chand and Company Ltd, 2008
6. Keeler J and Wolhess P, Why Chemical Reaction Happen Oxford Press.

BT107- Electrical and Electronics Lab-I

List of Experiments

1. Identification, Study & Testing of various electronic components:
(a) Resistances-Variety types, Colour coding (b) Capacitors-Variety types, Coding, (c) Inductors
(d) Diodes (e) Transistors (f) SCRs (g) ICs (h) Photo diode (i) Photo transistor (j) LED (k) LDR
(l) Potentiometers.
2. Study of symbols for various Electrical & Electronic Components, Devices, Circuit functions etc.
3. Study of Analog & digital multi-meters.
4. Study of Function/ Signal generators.
5. Study of Regulated d. c. power supplies (constant voltage and constant current operations).
6. Study of analog CRO, measurement of time period, amplitude and frequency.

7. Perform half wave rectifier experiment and effect of filters on output.
8. Perform bridge rectifier experiment and measure the effect of filter output.
9. Application of diode as clipper and clamper.
10. Soldering & desoldering practice.

BT108- Engineering Physics Lab-I

List of Experiments

1. To study the charging of a condenser to plot a graph of voltage (V) across it against time (T) and to determine the time constant from this graph
2. To study the discharging of a condenser to plot a graph of voltage (V) across it against time (T) and to determine the time constant from this graph.
3. To determine the specific resistance of a material and difference between two small resistances using “Carey Foster’s Bridge “.
4. To determine band gap of a semiconductor- diode.
5. To study the Zener diode as a constant voltage regular.
6. To verify Malus Law (Cosine square law) for plane polarized light with the help of a Photo voltaic cell.
7. To determine the transmission coefficient by using Lummer Brodhum Photometer.
8. To determine minimum deviation angle for different light using prism and spectrometer.
9. To determine the profile of He -Ne Laser beam.
10. To study the variation of thermo e.m.f. of iron copper thermo couple with temperature.
11. To determine the wavelength of sodium light using Michelson Interferometer.
12. To determine the curie temperature of Monel metal
13. The determination of viscosity.

BT109 – IT FUNDAMENTAL LAB

LIST OF EXPERIMENTS

1. Dismantling a PC Part -1.
2. Dismantling a PC Part -2.
3. Internal and External commands of DOS.
4. System utilities of windows.
5. Understanding and Working knowledge of Linux/Unix OS.
6. Understanding of File system of Linux.

7. Creating user and group.
8. Understanding and Working knowledge of MS Office, Power Point and Excel: Editing and Reviewing, Drawing, Tables, Graphs, Templates.

BT110- Engineering Chemistry Lab

List of Experiments

1. To determine the strength of a given unknown copper sulphate solution (Iodometrically) with titrate Hypo (sodium thio sulphate) solution.
2. To determine the strength of a given unknown FAS solution with titrate potassium dichromate solution using N-phenyl anthranilic acid (internal indicator).
3. To determine the strength of a given unknown potassium dichromate solution (Iodometrically) with titrate Hypo (sodium thio sulphate) solution.
4. Determine the percentage of available chlorine in a given sample of bleaching powder.
5. Determine the amount of free chlorine in a given water sample.
6. To determine the viscosity and viscosity index of a given sample of lubricating oil using Redwood viscometer No.1
7. To determine the flash and fire point of a given sample of lubricating oil using Pensky Marten's apparatus.
8. Determine the cloud and pour point of a given sample of lubricating oil.
9. Determination of hardness of water by complexometric method (using EDTA).
10. Determine the pH of an acid (strength of an acid) pH – metrically.
11. Determine the strength of a given unknown HCl solution by titrating it against NaOH solution (Conductometric analysis).
12. To estimation the amount of sodium hydroxide and sodium carbonate in the given alkali mixture solution (or in water sample) by titrating against an intermediate hydrochloric acid using phenolphthalein and methyl orange indicator.

BT111- (Engineering workshop)

FITTING AND SHEET METAL SHOP

1. Finishing of two sides of a square piece by filing and to cut a Square notch using hacksaw.
2. To drill three holes and Tapping on the given specimen.
3. Tin smithy for making mechanical joint and soldering of joint

WELDING SHOP

4. To prepare Lap Joint with the help of Arc welding
5. To prepare Butt Joint with the help of arc Welding
6. Gas welding practice by students on mild steel flat

MACHINE SHOP PRACTICE

7. Job on lathe M/C with centering and one step turning
8. Job on lathe M/C with grooving and chamfering operations

BACHELOR OF TECHNOLOGY COMMON TO ALL BRANCHES SECOND SEMESTER

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			
Code	Subject/Paper	L	T	P	IA	EA	Total	Credits
BT 201	Engineering Physics-II	3	1	-	30	70	100	4
BT 202	Introduction to Computer Programming *	3	-	-	30	70	100	3
BT 203	Engineering Mechanics*	3	1	-	30	70	100	4
BT 204	Digital Electronics	3	-	-	30	70	100	3
BT 205	Applied Mathematics-II	3	-	-	30	70	100	3
BT 206	Environmental Sciences	3	-	-	30	70	100	3
PRACTICALS/VIVA-VOCE		No. of Teaching Hours			Sessional	Practical	Total	Credits
BT 207	Electrical & Electronic Lab-II	-	-	2	30	20	50	1
BT 208	Engineering Physics-II	-	-	2	30	20	50	1
BT 209	Computer Programming Lab*	-	-	2	30	20	50	1
BT 210	Engineering Drawing	-	-	2	30	20	50	1
BT 211	Communication Skill Lab*	-	-	2	30	20	50	1
TOTAL		18	2	10	330	520	850	25

Note:

1. Semester I and II common for all Branches of Engineering.
2. Half the students will study Environmental Science in 1st Semester and rest will study

Engineering Chemistry and Chemistry Lab. The students shall interchange the subjects and vice-versa In 2nd Semester.

BT201- Engineering Physics II

UNIT-I

Electric and Magnetic Fields :Coulomb's law, Gauss's law, electrostatic potential and field due to discrete and continuous charge distributions, dipole and quadrupole moments, dielectric polarization, electrostatic energy, conductors and capacitors, Biot-Savart law, Ampere's law, magnetic induction due to current carrying conductors, force on a charged particle in electric and magnetic field, Faraday's law of electromagnetic induction.

UNIT-II

Thermodynamics: Work- Thermodynamic definition of work, examples, displacement work, path dependence of displacement work, thermal equilibrium, Zeroth law , definition of temperature, heat/work interaction systems , First law and its consequences, isothermal and adiabatic processes, reversible, irreversible and quasi-static processes. Second law and entropy. Carnot engine and cycle. Absolute temperature scale.

UNIT-III

Optical phenomena : Principle of superposition, coherent and incoherent sources, temporal and spatial coherence, interference phenomena(Newton's ring and Michelson interferometer), diffraction of waves, diffraction from single and diffraction grating, polarization : types of polarization , Malus law, quarter and half wave plates, optical activity, specific rotation.

UNIT-IV

Lasers and Holography : Spontaneous and stimulated emission (Einstein A and B coefficients), population inversion, basic principles of operation of He-Ne, Ruby and semiconductor lasers. **Optical Fibers** : Types of optical fibers and their characteristics, characteristics of step, graded , mono mode and multi mode fibers, numerical aperture and its measurement, fiber optical communication. Principles and applications of holography

UNIT-V

Magnetic Materials: Magnetization- origin of magnetic moment, classification of

magnetic materials- die, Para and ferromagnetism, hysteresis curve, soft and hard magnetic materials. Superconductivity: General properties of superconductors, Meissner effect, penetration depth, type I and Type II superconductors, flux quantization, magnetic levitation, high temperature superconductors, superconducting materials, Cooper pairs and postulates of BCS theory.

Recommended reference books:

1. Fundamental University Physics, Alonso & Finn.
2. Berkley Physics Course Vol 1 & Vol. 3
3. Thermodynamics and Statistical Physics by F. Reif.
4. Thermodynamics and Statistical Physics, S. Lokanathan and D.P. Khandelwal.
5. Optics by Ajoy Ghatak
6. Conceptual Physics, Paul Hewitt
7. Introduction to Electrodynamics, D.J.Griffiths
8. Modern Physics, A. Beiser
9. Physics for Scientists and Engineers, R. Serway

BT202- INTRODUCTION TO COMPUTER PROGRAMMING

UNIT I

Concept of algorithms, Flow Charts, Overview of the compiler (preferably GCC) , Assembler, linker and loader , Structure of a simple Hello World Program in C ,Overview of compilation and execution process in an IDE (preferably Code Block)

UNIT II

Programming using C: Preprocessor Directive, C primitive input output using get char and put char , simple I/O Function calls from library , data type in C including enumeration , arithmetic, relational and logical operations, conditional executing using if, else, switch and break .Concept of loops , for, while and do-while , Storage Classes: Auto, Register, Static and Extern

UNIT III

Arrays and Strings: Declaring an array, Initializing arrays, accessing the array elements, working with multidimensional arrays, declaring and initializing string variables, arithmetic operations on characters.

Pointers: Declaring and initializing pointers, pointer expressions, pointer increment and scale factor, pointers and arrays, pointers and strings.

UNIT IV

Functions: Defining functions, passing arguments to functions, returning values from functions, reference arguments, variables and storage classes, static functions, pointers and functions.

Structures: Declaring and initializing a structure, accessing the members of a structure, nested structures, array of structures, using structures in functions, pointers and structures.

UNIT V:

File Handling in C Using File Pointers, fopen(), fclose(), Input and Output using file pointers, Character Input and Output with Files , String Input / Output Functions , Formatted Input / Output Functions, Block Input / Output Functions, Sequential Vs Random Access Files , Positioning the File Pointer.

Text/ Reference Books:

1. Kernighan & Ritchie, "C Programming Language", The (Ansi C version), PHI, 2/e
2. Yashwant Kanetkar " Test your C Skills " , BPB Publications
3. Programming in ANSI C, E. Balagurusamy; Mc Graw Hill, 6th Edition.
4. Herbert Schildt, "C: The Complete Reference", OsbourneMcgraw Hill, 4th Edition, 2002.
5. Forouzan Behrouz A. "Computer Science: A Structured Programming Approach Using C, Cengage Learning 2/e
6. K.R Venugopal, "Mastering C ", TMH
7. R.S. Salaria "Application Programming in C " Khanna Publishers4/e

BT203- ENGINEERING MECHANICS

Unit I

Force System: Introduction, force, principle of transmissibility of force, resultant of a force system, resolution of a force, moment of force about a line. Varignon's theorem, couple, resolution of force into force and a couple, properties of couple and their application to engineering problems. Lami's theorem. Force body diagram.

Unit II

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, 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, Wheel and differential axle, differential pulley Block,

Unit III

Friction: Types of Friction, Laws of friction, Angle of friction, Angle of repose, Ladder, Wedge, Belt Friction. Belt Drive: Types of belts, Types of belt drives, Velocity ratio, Effect of slip on Velocity ratio, Length of belt, Ratio of tensions and power transmission by flat belt drives.

Unit IV

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. Newton's laws, Equation of motion in rectangular Coordinate, radial and transverse components, Equation of motion in plane for a rigid body, D'Alembert principle.

Unit V

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 Nonconservative Force, Conservation of energy.

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

Suggested Readings

1. Vector Mechanics for Engineers, Beer and Johnston, Tata McGraw-Hill.
2. Engineering Mechanics, Hibbeler, Pearson Education.
3. Engineering Mechanics, Meriam and Kraige, John Wiley & Sons.
4. Engineering Mechanics, Timoshenko and Young, Tata McGraw-Hill.
5. Engineering Mechanics, Shames, Pearson Education.
6. Engineering Mechanics, Borelli and Schmidt, CL-Engineering.
7. Engineering Mechanics, Andrew Pytel & Kiusalas, Cengage Learning.

BT204- Digital Electronics

UNIT I

BASIC LOGIC GATES & BOOLEAN ALGEBRA: Features of logic algebra, postulates of Boolean algebra. Theorems of Boolean algebra. Boolean function. Derived logic gates: Exclusive-OR, NAND, NOR gates, their block diagrams and truth tables. Logic diagrams from Boolean expressions and vice-versa. Converting logic diagrams to universal logic. Positive, negative and mixed logic. Logic gate conversion.

UNIT II

DIGITAL LOGIC GATE CHARACTERISTICS: TTL logic gate characteristics. Theory &

operation of TTL NAND gate circuitry. Open collector TTL. Three state output logic. TTL subfamilies. MOS & CMOS logic families. Realization of logic gates in RTL, DTL, ECL, C-MOS & MOSFET. Interfacing logic families to one another.

UNIT III

MINIMIZATION TECHNIQUES: Minterm, Maxterm, Karnaugh Map, K map upto 4 variables. Simplification of logic functions with K-map, conversion of truth tables in POS and SOP form. Incomplete specified functions. Variable mapping. Quinn-Mc Klusky minimization techniques.

UNIT IV

COMBINATIONAL SYSTEMS: Combinational logic circuit design, half and full adder, subtractor. Binary serial and parallel adders. BCD adder. Binary multiplier. Decoder: Binary to Gray decoder, BCD to decimal, BCD to 7-segment decoder. Multiplexer, demultiplexer, encoder. Octal to binary, BCD to excess-3 encoder. Diode switching matrix. Design of logic circuits by multiplexers, encoders, decoders and demultiplexers.

UNIT V

SEQUENTIAL SYSTEMS: Latches, flip-flops, R-S, D, J-K, Master Slave flip flops. Conversions of flip-flops. Counters : Asynchronous (ripple), synchronous and synchronous decade counter, Modulus counter, skipping state counter, counter design. Ring counter. Counter applications, Registers: buffer register, shift register.

Recommended Reference Books:

1. M. Morris Mano: Digital Logic and Computer Design, PHI, India
1. Malvino and Leach: Digital Principles
2. Tocco R.J., Digital Systems- Principles & Applications, PHI 1997
3. loyd, Digital Fundamentals, PHI, 1997
4. Salivahanan A, Digital Circuit and Design, TMH

BT205- Applied Mathematics II

UNIT I

Vector spaces, linear dependence of vectors, basis and linear transformations, scalar and vector fields, level surfaces, directional derivatives, gradient, divergence and curl of fields, Green, Gauss and Stokes theorems.

UNIT II

Matrix algebra, rank of a matrix, adjoint and inverse of a matrix, Solution of algebraic

equations using matrix algebra , consistency conditions, eigenvalues and eigenvectors , Hermitian matrices.

UNIT III

Numerical solution of matrix equations using Gauss, Gauss-Seidel, LU decomposition and other iterative methods.

UNIT IV

Convergence of improper integrals, tests of convergence, elementary properties of beta and gamma functions, differentiation under integral sign, Leibnitz rule, integrals dependent on a parameter, trapezoidal and Simpson's integration rules, applications in engineering.

UNIT V

Numerical methods; round off and truncation errors, approximations, order of convergence, Newton's forward and backward interpolation formula, central difference interpolation, solutions of polynomial equations using bisection, Newton-Raphson and Regula-falsi methods.

Recommended Books:

1. H. K. Dass: Advanced Engineering Mathematics; S. Chand, Delhi
2. P. C. Bishwal: Numerical Analysis; PHI, India

BT206- Environmental Sciences

UNIT I

Ecosystem and Biodiversity: Components and types of ecosystem, Structure and functions of Ecosystem, Values, Type and levels of Biodiversity, Causes of extension, and Conservation methods of biodiversity.

UNIT II

Air Pollution: Definition, different types of Sources, effects on biotic and abiotic components and Control methods of air pollution.

UNIT III

Water pollution: Definition, different types of Sources, effects on biotic and abiotic components and treatment technologies of water pollution.

UNIT IV

Noise Pollution: Introduction of noise pollution, different Sources, effects on abiotic and biotic environment and Control measures.

UNIT V

Non Conventional energy sources: Introduction, Renewable Sources of Energy: Solar energy, wind energy, Energy from ocean, energy from biomass, geothermal energy and Nuclear Energy.

Recommended Reference Books:

1. Brunner R.C., Hazardous Waste Incineration, McGraw Hill Inc. 1989.
2. Clark R.S., Marine Pollution, Clarendon Press Oxford (TB)
3. Cunningham, W.P, Cooper, T.H. Gorhani, E & Hepworth, M.T. , Environmental Encyclopedia, Jaico Publishing House, Mumbai, 2001.
4. De. A.K., Environmental Chemistry, Wiley Eastern Ltd.
5. Down to Earth, Centre for Science and Environment (R)
6. Gleick, H.P. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press.
7. Gilpin, Alan. Environmental Impact Assessment (EIA), cutting edge for the 21th century. Cambridge university Press.

BT207- Electrical and Electronics Lab-II

List of Experiment:

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.
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 adder and Subtractor using universal gates.
5. To verify the truth table of Encoder and decoder.
6. To verify the truth table of multiplexer and demultiplexer.
7. To study and perform Various types of Flip-Flops.
8. To study and perform various types of counters.
9. To study and perform various types of shift registers.
10. To study and perform various types of Multivibrators.
11. To study and perform Schmitt Trigger.

BT208- Engineering Physics Lab-II

List of Experiments:

1. Conversion of a Galvanometer in to an ammeter and calibrate it.
2. Conversion of a Galvanometer in to voltmeter and calibrate it.
3. To determine the value of "g" by using compound pendulum.
4. To determine Plank's constant using LED.
5. To measure the Numerical Aperture (NA) of an optical fiber.
6. To determine the profile of He-Ne Laser beam.
7. To determine the wavelength of different lights using diffraction grating and spectrometer.
8. To determine the wavelength of sodium light by Newton's ring method.
9. To determine the specific rotation of glucose using Polarimeter.
10. To determine minimum deviation angle for different light using prism and spectrometer.
11. To study of detergent on surface tension of water by observing capillary rise
12. To determine the speed of sound in air at room temperature using a resonance tube by two resonance position.

BT209- COMPUTER PROGRAMMING LAB

LIST OF EXPERIMENTS

- 1 Write a program to calculate the area & perimeter of rectangle.
- 2 Write a program to calculate the area and circumference of a circle for a given radius.

- 3 Write a program to calculate simple interest for a given principal/amount.
- 4 Write a program to convert temperature given in °C to temperature in °F.
- 5 Write a program to find profit and loss (in percentage) of a given cost price and selling price.
- 6 Write a program to find out the maximum among the three given numbers.
- 7 Write a program to calculate the factorial of a given number.
- 8 Write a program to print the list of first 100 odd number.
- 9 Write a program to calculate the sum of the digits of a number and display it in reverse order.
- 10 Write a program to generate a Fibonacci series.
- 11 Write a program to generate the following series:


```

1 2
1 2 3
1 2 3 4
1 2 3 4 5

```
- 12 Write a program to generate the following series:


```

0 1
0 1 0
0 1 0 1
0 1 0 1 0

```
- 13 Write a program using a function to check whether the given number is prime or not.
- 14 Write a program to check whether the given string is a palindrome or not.
- 15 Write a program to find the length of a string, reverse the string and copy one string to another by using library function.
- 16 Write a program to swap two variables a & b using pointers.
- 17 Write a program to enter a line of text from keyboard and store it in the file. User should enter file name.
- 18 Write a recursive program for tower of Hanoi problem
- 19 Write a menu driven program for matrices to do the following operation depending on whether the operation requires one or two matrices
 - Addition of two matrices
 - Subtraction of two matrices
 - Finding upper and lower triangular matrices
 - Transpose of a matrix
 - Product of two matrices.
- 20 Write a program to copy one file to other, use command line arguments.
- 21 Write a program to perform the following operators on Strings without using String functions
 - To find the Length of String.
 - To concatenate two string.
 - To find Reverse of a string.
 - To Copy one sting to another string.
- 22 Write a Program to store records of an student in student file. The data must be stored using Binary File. Read the record stored in "Student.txt" file in Binary code. Edit the record stored in Binary File. Append a record in the Student file.
- 23 Write a programmed to count the no of Lowercase, Uppercase numbers and special Characters presents in the contents of File.

BT210- Engineering Drawing

Engineering Drawing

Sheet 1 Orthographic Projections (3 Problems)

Sheet 2 Riveted joints: Lap joints, butt joints, chain riveting, zig-zag riveting

Sheet 3 Screw fasteners, different threads, Nuts & bolts locking devices, set screws,

Sheet 4 Scale, plain scales, diagonal scales, scale of chords

Sheet 5 Conic Sections: Construction of ellipse, parabola and hyperbola

Sheet 6 Engineering Curves: Cycloid, Epicycloids, Hypo-cycloid, Involute, Archimedian and logarithmic spirals

Sheet 7 Projection of points and lines, True inclinations and true length of straight lines, Traces of straight lines

Sheet 8 Projection of planes and solids: Projection of planes, Projection of polyhedra, Pyramids.

BT211- Communication Skills Lab

1. Introducing yourself.
2. Role Plays.
3. Word Formation.
4. Listening and Speaking Skills.
5. Words often mis-spelt and Mis- Pronounced.
6. One word for many.
7. Synonyms and Antonyms.
8. Seminar Presentation.
9. Group Discussion.
10. Job Interview.

**BACHELOR OF TECHNOLOGY
MECHANICAL ENGINEERING
THIRD SEMESTER**

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			Credits
Code	Subject/Paper	L	T	P	IA	EA	Total	
BTME 301	Numerical Analysis and Statistical Techniques	3	-	-	30	70	100	3
BTME302	Thermodynamics	3	1	-	30	70	100	4
BTME303	Electronics Measurement and Instrumentation	3	-	-	30	70	100	3
BTME304	Mechanics of solids	3	1	-	30	70	100	4
BTME305	Production Technology	3	-	-	30	70	100	3
BTME306	Material Science & Engineering	3	-	-	30	70	100	3
PRACTICALS/VIVA-VOCE		No. of Teaching Hours			Sessional	Practical	Total	Credits
BTME307	EMI Lab	-	-	2	30	20	50	1
BTME308	Strength of Material Lab	-	-	2	30	20	50	1
BTME309	Production Technology Lab	-	-	2	30	20	50	1
BTME310	Material Science Lab	-	-	2	30	20	50	1
BTME311	Machine drawing lab	-	-	2	30	20	50	1
TOTAL		18	2	10	330	520	850	25

BTME301 NUMERICAL ANALYSIS & STATISTICAL TECHNIQUES

UNIT I

Probability Theory: conditional probability, Baye's theorem, Random variable: discrete probability distribution, continuous probability distribution, expectation, moments, moment generating function, skewness, kurtosis, binomial distribution, Poisson distribution, normal distribution, Curve Fitting: Principle of least square Method of least square and curve fitting for linear and parabolic curve .

UNIT II

Correlation Coefficient, Rank correlation, line of regressions and properties of regression coefficients, ANOVA, Sampling distribution: Testing of hypothesis, level of significance, sampling distribution of mean and variance, Chi-square distribution, Student's T-distribution, F- distribution, Fisher's Z- distribution.

UNIT III

Numerical Methods: Solution of algebraic and transcendental equations using bisection method, Regula-Falsi method and Newton – Raphson method. Solution of linear simultaneous equations using Gauss-Jacobi's iteration method and Gauss-Seidal's iteration methods. Finite differences: Forward differences, backward differences and Central differences.

UNIT IV

Interpolation: Newton's interpolation for equi-spaced values. Stirling's central difference interpolation formula, Divided differences and interpolation formula in terms of divided differences, Lagrange's interpolation formula for unequi-spaced values.

UNIT V

Numerical Differentiation, maxima and minima of a tabulated function. Numerical Integration: Newton-Cote's quadrature formula, Trapezoidal rule, Simpson's one-third rule and Simpson's three-eighth rule .Numerical solution of ordinary differential equations: Picard's method, Taylor's method, Euler's method, modified Euler's method, Runge-Kutta method of fourth order.

Text Books:

[T1] R.K. Jain and S.R.K. Iyengar,” Numerical methods for Scientific and Engineering Computation”, NewAge.

[T2] N.M. Kapoor, “Fundamentals of Mathematical Statistics”, Pitambar Publications

Reference Books:

[R1] E. kresyzig,” Advance Engineering Mathematics”, Wiley publications

[R2] P. B. Patil and U. P. Verma, “ Numerical Computational Methods”, Narosa

[R3] Partial Differential Equations “Schaum’s Outline Series”, McGraw Hill.

[R4] Michael Greenberg, “Advance Engineering mathematics”, Pearson.

[R5] Schaum’s Outline on Fourier Analysis with Applications to Boundary Value Problem, TMH

[R6] B.S. Grewal., “Numerical Methods in Engg. And Science”, Khanna Publications.

[R7] Miller and Freund, “Probability and statistics for Engineers”, PHI

BTME302: Thermodynamics

UNIT I

Basic Concepts of Thermodynamics: Thermodynamic systems, concept of temperature, state and processes, processes and cycle, equality of temperature, Zeroth Law of thermodynamics, temperature scale, laws of perfect gases, Pure substances, vapour-Liquid –solid-phases and equilibrium, equilibrium in pure substances, thermodynamic surfaces

UNIT II

Work and heat: Law of conservation of mass and energy, First law of thermodynamics, steady state Processes, Second law of thermodynamics, Heat engine, Carnot cycle, thermodynamic temperature scale, concepts of order and disorder and entropy, change of entropy for different processes, equivalence of Kelvin Planck and Clausius statements, Clausius inequality.

UNIT III

Energy Relations: availability of a non flow and steady flow system, Helmholtz and Gibb's functions, Thermodynamic Relations: Important mathematical relations, Maxwell relations, Joule-Thomson effect and coefficient, Clayperon relation.

UNIT IV

Air – standard power cycle, Brayton cycle, Otto cycle, diesel cycle, Dual cycle, Stirling cycle, Ericsson cycle and Atkinson cycle, Mean effective pressure and efficiencies, Four stroke petrol and diesel engine, Two stroke Petrol and diesel engine.

UNIT V

Steam - Properties of steam, phase change process, use of steam table & Molier chart. Rankine cycle, Reheat cycle, Regenerative cycle, vapour compression refrigeration cycle.

Recommended Reference Books:

1. Engineering Thermodynamics: Jones & Dugen, PHI India.
2. Thermodynamics: Gupta, Person India
3. Engineering Thermodynamics: Rogers, Person India
4. Engineering Thermodynamics: Achuthan, , PHI India

BTME 303 Electronic Measurements and Instrumentation

UNIT I

MEASUREMENTS AND ERRORS - Measurements - significance of measurements - methods of measurement – instruments and measurement systems - classification of instruments – elements of measurement system. Accuracy and precision - significant figures - types of errors - probability of errors - limiting errors. Repeatability, Systematic & random errors, modeling of errors, standard deviation, Gaussian error analysis, Combination of errors.

UNIT II

ELECTRONIC INSTRUMENTS FOR MEASUREMENTS - DC Voltmeter, DC Ammeter, Ohm meter, Multimeter, AC meters, Electrodynamometer , Watt hour meter ,digital voltmeter , component measuring system Q meter , vector impedance meter, frequency meters.RF Power & Voltage Measurements. D'Arsonval, Vibration and Ballistic galvanometers. Introduction to shielding & grounding

UNIT III

BRIDGE MEASUREMENT - Introduction, Wheatstone Bridge, Kelvin Bridge, AC Bridges, Maxwell's inductance and capacitance bridges, Hay Bridge, Schering Bridge, unbalanced conditions - Wein Bridge, Wagner ground connection. Sources and Detectors. Anderson bridge, Heaviside bridge, DeSauty bridge Sources of errors in bridge measurements and their minimization.

UNIT IV

TRANSDUCERS - Classification of transducers , Selection Criteria, Characteristics, Construction, Working Principles, selecting transducers , strain gauges , displacement transducers , capacitive and inductive transducers, LVDT , oscillation transducer - piezoelectric, potentiometer, velocity transducers temperature transducers , optical transducers, RTD, Thermocouples, Thermistors, RVDT, Bourdon Tubes, Bellows. Diaphragms, Load Cell, Ultrasonic Flow Meters.

UNIT V

SIGNAL GENERATION AND DISPLAY INSTRUMENTS - Sine wave generators, Frequency synthesized signal generators, Sweep frequency generators, Frequency - selective wave analyser,harmonic distortion analyzer, spectrum analyzer, logic analyzer,

dual trace oscilloscope, digital storage oscillator , XY plotter. CRT Construction, Basic CRO circuits, CRO Probes, Oscilloscope Techniques of Measurement of frequency, Phase Angle and Time Delay, Multi beam, multi trace, sampling Oscilloscopes.

Recommended reference books:

1. A. K. Sawhney, "A course in Electrical and Electronic Measurement and Instrumentation"
1. Kalsi G.C. , "Electronic Instrumentation"-TMH
2. Albert D. Helfrick , William d. Cooper " Modern Electronics Instrumentation and Measurement"-TMH
3. Jones L.D. and Foster Chin. A. ," Electronic Instrumentation and Measurement" ,John Wiley & Sons,Newyork

BTME304: Mechanics of Solids

UNIT I

Simple Stress & strain: Tension, compression, shearing stress & strain; Poisson's ratio: Stress-strain relationship, Hooke's law; Elastic constants and their relations for an isotropic Hookean material, anisotropy & orthotropy, thermal stresses, composite bars; simple elastic, plastic & visco-elastic behavior of common materials in tension and compression test, stress-strain curves. Concept of factor of safety & permissible stress. Conditions for equilibrium. Concept of free body diagram; Introduction to mechanics of deformable bodies.

UNIT II

Compound Stress I: Solids 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.

UNIT III

Compound Stress II: Principal planes, stresses & strains: Members subjected to combined axial, bending & Torsional loads, maximum normal & shear stresses; Concept of equivalent bending & equivalent twisting moments: Mohr's circle of stress & strain. Theories of Elastic Failures: The necessity for a theory, different theories, significance and comparison, applications.

UNIT IV

Torsion: Torsional shear stress in solid, hollow and stepped circular shafts, angular deflection and power transmission capacity. Stability of equilibrium: Instability & elastic stability. Long & short columns, ideal strut, Euler's formula for crippling load for columns of different ends, concept of equivalent length, eccentric loading, Rankine formulae and other empirical relations.

UNIT V

Bending of beams: 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: method of superposition

and conjugate beam method. Variational approach to determine deflection and stresses in beam.

Elastic strain energy: Strain energy due to axial, bending and Torsional loads; stresses due to suddenly applied loads; use of energy theorems to determine deflections of beams and twist of shafts.

Castigliano's theorem. Maxwell's theorem of reciprocal deflections.

Recommended Reference Books:

1. Material of Mechanics with program in C: Jayaram, PHI India
2. Engineering Mechanics and Strength of Materials, Paul, Roy & Mukhejee PHI India
3. Engineering Mechanics of Solids: Popov PHI India:
4. Mechanics of materials ; Popov E.P.; PHI, 1976
5. Strength of materials; Srinath I.S. , et al; Strength of Materials, McMillan India 1997
6. Elements of Strength of Materials; Timoshenko et al; Affiliated East-West , 1968

BTME 305 Production Technology

UNIT – I

Moulding: Cores, Core Prints, Core boxes, Pattern design, Pattern layout and construction, testing of moulding sand. moulding and core making machines, use of chaplets, CO₂ - Process, fluid sand process, shell moulding, cold curing process, hot-box method, high pressure and flask less moulding, Design of metal moulds, Die Design for die Casting.

UNIT – II

Casting: Directional principles, Solidification, types of gating systems, Pouring time and temperature. Design criteria of pouring basin, screw, runner, gate and riser, gating ratio, chill and its uses. Selection of melting furnaces, Crucible furnaces, Electric furnaces, Induction furnace, Control of melt and Cupola charge calculations. Foundry mechanization and lay out. Casting defects, Causes and remedies.

UNIT – III

Welding: Principle, classification, advantages, limitations and applications, Tungsten Inert Gas welding, Metal Inert Gas welding, Electro - slag welding, Electro - Gas Welding, Explosive Welding, Ultrasonic Welding, Electron Beam Welding, Laser Beam Welding, Friction Welding, Cold Welding, Thermit Welding, Codification of Electrodes, Welding Defects-causes and remedies.

UNIT – IV

Metal Forming: Introduction to Metal Forming, Hot Forming and Cold Forming, Description of Forging, Wire Drawing, Tube Drawing, Deep Drawing, Rolling Bending, Extrusion Blanking, Piercing.

UNIT V

Powder Metallurgy: Definition, advantages, limitations and applications, Powder metallurgy processes and operations, metal powders, their characteristics and manufacture.

Text Books:

[T1] Manufacturing processes Vol. 1, by H.S. Shan, Pearson Education

[T2] Manufacturing Engineering & Technology by Kalpakjian, Pearson Publication

Reference Books:

[R1] Mikell P. Groover" Principles of Modern Manufacturing, 5th Edition SI Version ,
Wiley

[R2] Jain P.L., "Principles of Foundry Technology", Tata McGraw Hill, New Delhi,
1998.

[R3] Sharma P.C., "A Text Book of Production Engineering", Vol.1, S. Chand
Publication, New Delhi, 2001.

[R4] Heine & Rosenthal, "Principle of Metal Casting", Tata McGraw Hills, New Delhi,
2003.

[R5] Little Richard L, "Welding & Welding Technology", Tata McGraw Hill, New
Delhi, 2003.

[R6] Jain, R.K., "Production Technology", Khanna Publishers, 2001.

[R7] HMT Bangalore, "Production Technology", Tata McGraw Hill, 1980.

[R8] A.K. Chakrabarti "Casting Technology and cast alloys" 2011, PHI learning

BTME306: Material Science and Engineering

UNIT I

Atomic structure of Metals: Crystal structure, crystal lattice of (i) Body centred cubic (ii) Face centred cubic (iii) Closed packed hexagonal, crystallographic Notation of atomic planes and Directions (Miller Indices), polymorphism and allotropy, Crystal imperfection.

UNIT II

Theories of plastic deformation: Phenomenon of slip, twinning and dislocation. Identification of crystallographic possible slip planes and direction in FCC, BCC, HCP. Recovery and recrystallization, preferred orientation causes and effects on the property of metals.

UNIT III

Engineering materials. Solidification of metals and of some typical alloys: Mechanism of crystallisation (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 (i) Formation of Austenite (ii) Transformation of Austenite into pearlite (iii) Martensite transformation in steel, TTT curves.

UNIT IV

Engineering properties of materials. Principles and applications of annealing, normalising, hardening, tempering. Recovery and recrystallization. Hardenability -its measures, variables, effecting Hardenability, methods, for determination of Hardenability. Over-heated and Burnt steel, its causes and remedies. Temper brittleness -its causes and remedies. Basic principles involved in heat treatment of plain carbon steel, alloy steels, cast iron and Non-ferrous metals and their alloys. Chemical Heat treatment of steels: Physical principles involved in chemical heat treatment procedure for carburizing, Nitriding, Cyaniding, carbo-nitriding of steel.

UNIT V

Alloys & Steel: Effects produced by Alloying element on the structures and properties of steel Distribution of alloying elements (Si, Mn, Ni, Cr, Mo, Co, W, Ti, Al) in steel, structural classes of steel. Classification of steels, BIS Standards. fibre reinforced plastic composites: Various fibres and matrix materials, basic composite manufacturing methods, applications of composite materials.

Recommended Reference books:

1. Engineering Materials: Polymers Ceramics and Composites, A. K. Bhargav PHI
2. Engineering Materials; properties and Selection: Bundiski & Bundiski PHI
3. Elements of Materials Science & Engineering, Van Valck, Person India

BTME 307 Electronic Measurements and Instrumentation Lab

List of Experiment

1. Measurement of strain/ force with the help of strain gauge load cell
2. Measurement of displacement with the help of LVDT
3. Plot V-I characteristics & measure open circuit voltage & short circuit current of a solar panel.
4. Measure unknown inductance capacitance resistance using following bridges
(a) Anderson Bridge (b) Maxwell Bridge
5. To measure unknown frequency & capacitance using Wein's bridge.
6. Measurement of the distance with the help of ultrasonic transmitter & receiver.
7. Draw the characteristics of the following temperature transducers:
(a) RTD (Pt-100) (b) Thermistors (c) Thermocouple
8. Study the working of Q-meter and measure Q of coils
9. Measure the speed of a Table Fan using stroboscope.
10. Study the working of DIGITAL STORAGE CRO
11. Study of Phase shift Oscillator.

BTME 308: Strength Of Material Lab

List of Experiments:

- 1 .To Study the properties of engineering materials.
2. To determine the hardness of the given specimen using Rockwell hardness test.
- 3 To determine the hardness of the given specimen using Brinell hardness test.
- 4 To determine the Impact toughness through Izod and charpy test.
- 5 To determine the tensile strength of the specimen.
- 6 To determine the compressive strength of the specimen.
- 7 To find the modulus of rigidity of the specimen through torsion testing machine.
- 8 To find the spring stiffness of the specimen through spring testing machine.
- 9 To find the bending stresses and young's modulus of the specimen.
10. To study the Fatigue testing machine

BTME309 PRODUCTION TECHNOLOGY LAB

- 1 To prepare mould of a given pattern requiring core and to cast it in aluminum.
- 2 Moisture test and clay content test.
3. To study different types of casting defects.
- 4 Strength Test (compressive, Tensile, Shear Transverse etc. in green and dry conditions) and Hardness Test (Mould and Core).
5. Permeability Test.
6. A.F.S. Sieve analysis Test.
7. Prepare a job by Arc WELDING(Single beading)
8. To study different type of welding joints
9. To study different types of welding defects.
- 10 To prepare a job by using gas welding.

BTME 310 Material Science Lab

List of Experiments

1. Material types and their characteristic properties
 - a. A comparative study – qualitative
 - b. Examples of materials and their applications
2. Common Engineering materials and properties
 - a. A comparative study - quantitative
3. Study of Metallurgical Microscope
4. Preparation of metallographic specimen
5. Study of homogeneous and heterogeneous microstructures
 - a. Study of grain size and shape in homogeneous structures
 - b. Study of heterogeneous structure – number of phases, types of distribution, size and shape of different phases
6. Space lattice and crystal structures – b.c.c., f.c.c. and h.c.p. structures, examples of metals belonging to these structures, co-relation of structure and properties.
7. To calculate the effective number of atoms, co-ordination number, packing factors, c/a ratio for hcp structures, stacking sequence in hcp and f.c.c. structures, octahedral & tetrahedral voids in f.c.c. & b.c.c. structures.
8. To study the Iron-Carbon equilibrium diagram and differentiation between steel and cast iron with the help of their microstructures.
9. Study of microstructures of hypo, hyper and eutectoid steel. Effect of carbon percentage on the hardness of steel.
10. Study of microstructure and hardness of the eutectoid steel at different rates of cooling from austenite.
11. Annealing of steel – effect of annealing temperatures and time on hardness.
12. Hardening of steel, effect of quenching medium on the hardness of the same.
13. Study of microstructures of Grey, White, Nodular and Malleable cast irons.
14. Study of dislocations through models.
15. Study of ductile and brittle fracture.

BTME 311 Machine Drawing

List of Experiments:

To prepare Drawing Sheets as mentioned below:

- (a)** Machine Tool Parts: Shaper tool head, Lathe Tail Stock

(b) IC. Engine parts: connecting rod, crank shaft, etc,

**BACHELOR OF TECHNOLOGY
MECHANICAL ENGINEERING
FOURTH SEMESTER**

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			Credits
Code	Subject/Paper	L	T	P	IA	EA	Total	
BTME401	Fluid Mechanics and Hydraulics	3	1	-	30	70	100	4
BTME402	Automobile Engineering	3	-	-	30	70	100	3
BTME403	Kinematics of Machines	3	1	-	30	70	100	4
BTME404	Industrial Engineering	3	-	-	30	70	100	3
BTME405	Manufacturing Processes	3	-	-	30	70	100	3
BTME406	Design Of Machine Elements-1	3	-	-	30	70	100	3
PRACTICALS/VIVA-VOCE		No. of Teaching Hours			Sessional	Practical	Total	Credits
BTME407	Fluid Mechanics and hydraulics Lab	-	-	2	30	20	50	1
BTME408	Automobile Engineering Lab	-	-	2	30	20	50	1
BTME409	KOM Lab	-	-	2	30	20	50	1
BTME410	Production Engineering practice lab	-	-	2	30	20	50	1
BTME4111	Machine Design Lab -I	-	-	2	30	20	50	1
TOTAL		18	2	10	330	520	850	25
4-6 weeks training will be held after fourth semester,viva will be conducted in fifth sem.								

BTME401: Fluid Mechanics and Hydraulics

UNIT I

Fluids and their properties : Definition of Fluid, Continuum Hypothesis, Difference between Solids and Fluids, Liquids and gases; definition of density, specific gravity, pressure and vapour pressure, viscosity ;ideal and real fluids, Newton's Law of Viscosity, Newtonian and Non-Newtonian Fluids, Rheological Diagram, Variation of Viscosity with Temperature and Pressure, Surface Tension and Capillarity.

UNIT II

Fluid Statics : Introduction, Pascal's Law, Hydrostatic Pressure Variation for Incompressible Fluid, Hydrostatic Pressure Variation for Compressible Fluid, Measurement of Pressure, Manometers, Static Forces on Surfaces: Plane Surfaces and Curved Surfaces.

Buoyancy and Stability, Metacentre and metacentric heights, Stability of Fully Submerged Bodies, Stability of Floating Bodies.

UNIT III

Fluid Kinematics : Introduction to kinematics of Fluid Flow, Steady and Uniform Flow, Compressible and Incompressible Flow; One, Two and Three Dimensional Flow, Velocity and Acceleration of Fluid Particle, Stream line, Stream tube, path line and Stream line flow, Conservation of Mass: Continuity Equation, Stream Function and velocity potential, Vorticity and circulation , Rotational and Irrotational Flow, Free and Forced Vortex.

UNIT IV

Dynamics of Fluid Flow : Equations of Motion , Euler's Equation, Energy Equation : Bernoulli's Equation, Applications of Bernoulli's Equation, orifices and Mouthpieces, Venturimeter and Orifice meter, Stagnation and Static Tube, Pitot Tube, Linear Momentum Equation.

UNIT V

Flow Through Closed Conduits : Energy and hydraulic gradient line, Losses in Pipe Flow: Major Loss - Darcy Weisbach Equation, Minor Losses, Pipes in Series and Parallel, flow through branched pipes, three reservoir problem, Power transmission through pipes, condition for maximum power transmission.

Recommended Reference books:

1. Hydraulics and Fluid Mechanics by R.K. Bansal
2. Introduction to Fluid Mechanics and Fluid Machines by S.K. Som and G. Biswas.
3. Hydraulics and Fluid Mechanics by Modi and Seth.
4. Fluid mechanics by Dr. A.K. Jain

BTME402 : Automobile Engineering

UNIT I

FRAME & BODY: Layout of chassis, types of chassis frames and bodies, their constructional features and materials.

TRANSMISSION SYSTEM: Clutch; single plate, multiplate, cone clutch, semi centrifugal, electromagnetic, vacuum and hydraulic clutches. Fluid coupling.

UNIT II

Gear boxes, Sliding mesh, constant mesh, synchromesh and epicyclic gear boxes, Automatic transmission system; Hydraulic torque converter; overdrive, propeller shaft, universal joints, front wheel drive, differential; Rear axle drives. Hotchkiss and torque tube drives; rear axle types; Two wheel and four wheel drive.

UNIT III

STEERING and TYRES : 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; objects and requirements, suspension spring, front and rear suspension systems, Independent suspension system shock absorber. Types of wheels and tyres. Tyre construction; tyre inflation pressure, tyre wear and their causes; re-treading of the tyre,

UNIT IV

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 V

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)

Recommended Reference Books:

1. The Motor Vehicles by Newton & Steeds
2. Automotive Mechanics by Crouse
3. Automotive Mechanics by Heitner
4. Automobile Engineering by KM Gupta
5. Automobile Engineering by Kirpal Singh Vol. I & II

BTME403: Kinematics of Machines

UNIT I

Kinematics: Elements, pairs, mechanisms, four bar chain and its inversions, velocity and acceleration, Klein's construction, coriolis component, instantaneous center method, synthesis of mechanisms,

UNIT II

Automotive vehicle mechanisms: Overhead valve mechanism, Davis and Ackerman steering mechanism, Trifler suspension and Hookes joint. Power transmission: Belts and ropes, effect of centrifugal force, creep, chain drive.

UNIT III

Friction: Laws of static, dynamic and rolling friction, dry and viscous friction, inclined plane and screw jack, pivots and friction axis, bearing, Clutches. Theory of film lubrication.

UNIT IV

Brakes and dynamometers: Band, block and band & block brakes, braking action, absorption and transmission type dynamometers, prony, rope and hydraulic dynamometers braking system of automobiles.

UNIT V

Cams: Type of cams, displacement, velocity and acceleration curves for different cam followers, consideration of pressure angle and wear, analysis of motion of followers for cams with specified contours.

Recommended Reference books:

1. Kinematics of Machines by S.S Ratan TMH Publications,
2. Kinematics of Machines by R.S.Khurmi,S.Chand Publications,
3. Kinematics of Machines by Balleney.

BTME404 INDUSTRIAL ENGINEERING

UNIT I

Management theory and Functions

Management Theory and Functions: Evolution of management, scientific management, Contribution to scientific management: Taylor, Fayol, Mayo, Levels of Management Administration and Management, functions of management.

UNIT II

Production Planning & control:

Types of production; Function of production planning and control; planning preplanning, sales forecasting short term forecasting ,long forecasting , Routing ,Scheduling ,Dispatching and control with other departments.

UNIT III

Financial Management and Depreciation :

Introduction, Needs of Finance, Kinds of Capital Sources of fixed capital, Financial ratio: Liquidity ratio, Profits investment ratio, equity ratio, inventory ratio. Depreciation: Meaning and causes. Need of Depreciation calculation, Methods of Depreciation: Straight line Methods. Sinking funds methods.

UNIT IV

Plant location and layout:

Selection of site ,layout contributing factors ,types of layout facilities available from Govt. and autonomous agencies , material management and ABC Analysis, Material handling system and equipments

UNIT V

Wage and incentives, Labour Relations and Legislation

Characteristics of a good wage or incentive system, method of wage payment, concept of wage incentive schemes: financial and non –financial. Labour relations and legislation: Profit sharing, fringe benefits etc.Trade Unions.

Methods of setting disputes (i) Collective bargaining (ii) Conciliation (iii) Mediation

(iv) Arbitration industrial disputes in India, Machinery for setting disputes. The factory Act

Recommended reference Books:

1. Industrial engineering by Hicks
2. Financial management by Prasanna Chandra
3. Motion and Time Study by Barns

4. Work Study by ILO

BTME 405 Manufacturing Processes

UNIT I

Importance of manufacturing, economic and technological definition of manufacturing, survey of manufacturing processes.

Casting practices: Fundamental of metal casting, sand casting, Shell-Mould casting, mold casting (plaster and ceramic), investment casting, vacuum casting, Permanent mould casting, slush casting, pressure casting, die casting, centrifugal casting, continuous casting, squeeze casting, casting alloys, casting defects, design of casting, gating system design, and riser design. Melting furnaces-rotary, pit electric, tilting and cupola.

UNIT II

Metal Joining Processes: Principle of welding, soldering, brazing and adhesive bonding. Survey of welding and allied processes. Arc welding: power sources and consumables. Gas welding and cutting: Processes and equipments. Resistance welding: principle and equipments. Spot, projection and seam welding process. Atomic hydrogen, ultrasonic, plasma and laser beam welding, electron beam welding, and special welding processes e.g. TIG, MIG, friction and explosive welding, welding of C.I. and Al, welding defects. Electrodes and Electrode Coatings

UNIT III

Forming and Shaping Processes: Metal working, elastic and plastic deformation, concept of strain hardening, hot and cold working, rolling, principle and operations, roll pass sequence, forging, forging operations, extrusion, wire and tube drawing processes. Forging: Method of forging, forging hammers and presses, principle of forging tool design, cold working processes-Shearing, drawing, squeezing, blanking, piercing, deep drawing, coining and embossing, metal working defects, cold heading, riveting, thread rolling bending and forming operation.

UNIT IV

Rapid Prototyping Operations: Introduction, subtractive processes, additive processes, Virtual Prototyping and applications

UNIT V

Plastic Technology: Introduction, Classification of Plastics, Ingredients of Moulding compounds, General Properties of Plastics, Plastic part manufacturing processes such as compression moulding, transfer moulding, injection moulding, extrusion moulding, blow moulding, calendaring, thermoforming, slush moulding, laminating

Recommended Reference books:

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

BTME406 Design of Machine Elements I

UNIT I

Materials: Properties and IS coding of various materials, Selection of material from properties Manufacturing aspects in Design: Selection of manufacturing processes on the basis of design and economy, standard size, Influence of limits, fits tolerances and surface finish. Design of castings, working drawing.

UNIT II

Design for strength: Allowable stresses, detailed discussion on factor of safety (factor of ignorance): Stress concentration. Causes & mitigation. Introduction of various design considerations like strength, stiffness, weight, cost, space etc. Concept of fatigue failures. Design of machine elements subjected to direct stress, Pin, cotter and keyed joints,

UNIT III

Design of members in Bending: Beams, Classification of lever, Bell crank lever , Safety valve lever, Design of laminated springs.

UNIT IV

Design of members in torsion : Shafts and shaft couplings ,Muff coupling, Split muff coupling, Flexible coupling,

UNIT V

Design of shafts, brackets under combined stresses, Calculation of transverse & torsional deflections. Design of screw fastening.

TEXT BOOK

Bhandari, V. B., Introduction to Machine Design, McGraw Hill Education(India)

REFERENCE BOOKS

- 1 Bahl and Goel, Mechanical Machine Design, Standard Publishers Distributors
- 2 Shigley, Joseph E., Mechanical Engineering Design, McGraw Hill Education (India)
- 3 Sharma and Aggarwal, Machine Design, S.K.Kataria and Sons, Delhi.
- 4 Sharma and Purohit, Design of Machine Elements, Prentice Hall India.
- 5 Jindal U C, Machine Design, Pearson Education India

BTME407 Fluid Mechanics and hydraulics Lab

List Of Experiments

1. Determine Metacentric height of a given body.
2. Determine Cd, Cv & Cc for given orifice.
3. Determine flow rate of water by V-notch.
4. Determine velocity of water by pitot tube.
5. Verify Bernoulli's theorem.
6. Determine flow rate of air by Venturi meter
7. Determine flow rate of air by orifice meter
8. Determine head loss of given length of pipe.
9. Determine flow rate of air by nozzle meter.
10. Study of Pelton, Kaplan Turbine models.

BTME 408 Automobile Engineering Lab

List of Experiments:

- 1 Comparative study of four stroke diesel and petrol engines.
2. Comparative study of two stroke petrol and diesel engines
3. Trouble shooting in cooling system of an automotive vehicle
4. Trouble shooting in the ignition system, setting of contact breaker points and spark plug gap
5. Demonstration of steering system and measurement of steering geometry angles and their impact on vehicle performance.
6. Trouble shooting in braking system with specific reference to master cylinder, brake shoes, overhauling of system and the adjusting of the system and its testing.
7. Fault diagnosis in transmission system including clutches, gear box assembly and differential.
8. Replacing of ring and studying the method of replacing piston after repair.
9. Valve re-facing and valve seat grinding and checking for leakage of valves

BTME409 KINEMATICS OF MACHINES LAB

List of Experiments:

1. Study of various links and mechanisms.
2. Study and draw various inversions of 4- bar chain and single slider crank chain.
3. Draw velocity and diagram of engine mechanism using graphical methods including Klien's construction.
4. CAM Analysis - angle Vs displacement and jump phenomenon.
5. To generate spur gear involute tooth profile using simulated gear shaping process
6. Determination of gear- train value of compound gear trains and Epicyclic gear trains.
7. To study various types of gears – Helical , cross helical worm, bevel gear.
8. Determination of moment of inertia of systems.
9. Create various types of linkage mechanism in CAD and simulate for motion outputs and study the relevant effects.

BTME410 Production Practice Lab

List of Experiments:

1. Study of lathe machine, lathe tools cutting speed, feed and depth of cut.
2. To perform step turning, knurling and chamfering on lathe machine as per drawing.
- 3 Taper turning by compound slide method as per drawing.
- 4 To cut metric thread as per drawing.
- 5 To perform square threading, drilling and taper turning by compound rest as per drawing.
- 6 To study shaper machine, its mechanism and calculate quick return ratio.
- 7.To Prepare a job by using shaper m/c.
- 8 .TO STUDY THE DIFFERENT TYPES OF INDEXING METHODS ON MILLING MACHINE.
9. TO PREPARE A JOB ON CAPSTON LATHE ,
10. TO PREPARE A JOB ON MILLING MACHINE.

BTME 411 Machine Design Lab-I

- 1 Selection of material & IS coding
- 2 Selecting fit & assigning tolerances
- 3 Knuckle & Cotter joints
- 4 Keyed joints & shaft couplings
- 5 Design of screw fastening
- 6 Bending: Beams, Levers etc.
- 7 Combined stresses: Shafts, brackets, eccentric loading.

**BACHELOR OF TECHNOLOGY
MECHANICAL ENGINEERING
FIFTH SEMESTER**

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			Credits
Code	Subject/Paper	L	T	P	IA	EA	Total	
BTME501	Design Of Machine Elements- II	3		-	30	70	100	3
BTME502	Management of Manufacturing system	3		-	30	70	100	3
BTME503	Heat and Mass Transfer	3	1	-	30	70	100	4
BTME504	Dynamics Of Machines	3	1	-	30	70	100	4
BTME505	I.C. Engines	3		-	30	70	100	3
	Elective (any one)							
BTME506A	Principle of Turbo Machines	3	-	-	30	70	100	3
BTME506B	Fundamental of Aerodynamics	3	-	-	30	70	100	3
BTME506C	Object Oriented Programming in C++	3	-	-	30	70	100	3
BTME506D	Electrical Machines	3	-	-	30	70	100	3
BTME506E	Control system	3	-	-	30	70	100	3

PRACTICALS/VIVA-VOCE		No. of Teaching Hours			Sessional	Practical	Total	Credits
BTME 507	Heat Transfer Lab	-	-	2	30	20	50	1
BTME 508	Dynamics of Machines Lab	-	-	2	30	20	50	1
BTME 509	I.C. Engine Lab	-	-	2	30	20	50	1
BTME 510	Manufacturing Technology Lab	-	-	2	30	20	50	1
BTME 511	Machine Design Lab-II	-	-	2	30	20	50	1
BTME512	TRAINING VIVA	-	-	0	30	20	50	2
TOTAL		18	2	10	360	540	900	27

BTME501 DESIGN OF MACHINE ELEMENTS- II

UNIT I

The design process, steps in design process, Fatigue Considerations in Design: Variable load, loading pattern, Design of machine members subjected to combined, steady and alternating stresses. Design for finite life. Design of Shafts under Variable Stresses.

UNIT II

SPRINGS: Stresses in helical springs. Curvature effect. Deflection of helical springs. Properties of spring materials, hot-formed springs. Extension springs, compression springs. Design of helical spring. Fatigue loading. Design of belt, rope and pulley drive system, selection of chain & sprocket drive systems.

UNIT III

Introduction to Mechanics of power screws, threaded fasteners, Bolts supporting tensile load only, static & dynamic stresses in screw fasteners. Bolts subjected to fatigue loading screwed boiler stays. Design of members which are curved like crane hook, body of C-clamp,

UNIT IV

Design of sliding & journal bearing; method 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.

UNIT V

GEAR DESIGN: Introduction to spur gears, Gear force analysis, the Lewi's formula Design calculations for helical gears: virtual number of teeth, force analysis, beam-strength & wear strength of Helical gears. Design calculation for bevel gears: Force analysis, Beam strength & wear strength of bevel gears. Selection of material and lubrication, for above type of gears..

Recommended Reference Books:

1. Shigley J.E., Mischke C.R.: Mechanical Engg. Design,
2. McGraw Hill International Black & Adams: Machine Design, McGrawHill International.
3. Sharma P.C. & Aggarwal D.K. Machine Design , Kataria & sons.
4. Bhandari V.B.: Design of machine elements , Tata McGraw Hill .
5. Machine design by Khurmi-Gupta,S.Chand Publications

BTME 502 MANAGEMENT OF MANUFACTURING SYSTEMS

UNIT I

Introduction: Production functions, Management systems, production and productivity.

Plant Organization: Principles of organization, Organization structure-line and staff organization.

UNIT II

Plant Location, Layout: Process layout, product layout and combination – methods of layout, economics of layout; group technology.

Production Planning & Control: Types of products, demand, demand forecasting, marketing strategies, scheduling and control of scheduling production control.

UNIT III

Method Study: Definition and concepts, method study procedures, symbols, advantages, Operation process chart, Flow process charts, Two hand process chart, Motion study, micro motion, SIMO charts, Systems Concepts, Classification analysis techniques, Principle of motion economics.

Work Measurement: Definition, objectives & techniques, Time study equipment, performance rating, allowances, standard time, work sampling, PMTS.

UNIT IV

Industrial Maintenance: Types, organization for maintenance department, Breakdown and preventive maintenance and corrective maintenance.

Inventory control and replacement analysis: Introduction replacement policy and method adopted, EOQ.

UNIT V

Management Concepts: Development of management principles, scientific management, human relation aspects.

Production Cost Concepts: Introduction, cost of production, cost centre and unit, Classification and analysis of cost, Break Even Analysis.

Text Books:

[T1] Ravi Shankar, “Industrial Engg. & Management”, Galgotia Publications

[T2] S.K. Sharma, “Industrial Engg. & Operation Management”, S.K. Kataria & Sons.

Reference Book:

[R1] Joseph S. Martinich, "Production & Operation Management", John Wiley & Sons.

[R2] S. N. Chary," Production and operations management, TMH 4th edition

[R3] Harold T. Amrine, John A. Ritchey, Colin L. Moodie, Joseph F. Kmec "Manufacturing organization

and Management" Pearson publication 6th edition

[R4] S. Anil Kumar, N. Suresh "Production and operations management", New age International, 2nd Ed.

[R5] M. Mahajan, "Industrial Engg. & Production Management", Dhanpat Rai & Co.

BTME 503 HEAT AND MASS TRANSFER

UNIT I

Engineering heat transfer ,Heat transfer mechanisms , Units, Dimensions and Conversion factors ,Fourier's law of heat conduction, thermal conductivity, thermal conductivity of solids, liquids and gases, effect of temperature on thermal conductivity. Conduction : General heat conduction equation. Boundary condition and initial condition. Dimensionless groups for conduction. One-dimensional steady-state conduction-simple plane walls & composite plane walls, hollow & composite cylinders & spheres. Thermal contact resistance. Critical radius of Insulation

UNIT II

Heat transfer from finned surfaces; fin efficiency and effectiveness, two dimensional steady state heat conduction using analytical and numerical methods, periodic heat conduction .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;

UNIT III

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 ,condensation on flat plates;

UNIT IV

Heat exchanger: Classification of Heat Exchangers, Overall heat transfer coefficient, The LMTD Method for Heat exchanger analysis Correction for LMTD for use with cross flow & multipass exchangers , ϵ – NTU method for heat exchanger analysis

UNIT V

Thermal Radiation: Plank distribution law, Kirchhoff'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

Recommended Reference Books:

1. Heat and Mass Transfer by D.S. Kumar
2. Heat and Mass Transfer by Arora Domkundwar
- 3 Holman J.P: Heat Transfer, McGraw-Hill

BTME 504 DYNAMICS OF MACHINES

UNIT I

GOVERNOR & FLYWHEEL: Types of governors, Characteristics of Centrifugal governors. Gravity controlled centrifugal governors (Porter and Proell governor). Spring controlled governors (Hartnell governor only). Flywheel: Need, Design and comparison of functions of flywheel and governor.

UNIT II

Gyroscope: Principle of gyroscopic couple, effect of gyroscopic couple and centrifugal force on vehicle taking a turn, stabilization of sea vessels,,

UNIT III

Gears: Law of gearing, terminology, tooth form, standard interchangeable tooth profile, minimum number of teeth on pinion in contact with gear or rack, interference and undercutting, bevel, helical and spiral gears.

UNIT IV

Gear trains: Simple, compound, reverted and epicyclic gear trains, analytical, tabular, graphical and vector methods for velocity ratio, gear boxes- sliding and constant mesh for automobiles.

UNIT V

BALANCING: Balancing of rotating masses, Two-plane balancing, Determination of balancing masses, balancing of reciprocating masses, Balancing of Locomotives & effect of partial balancing, Balancing of multi-cylinder in-line engine, V-engine ,Balancing machines.

Recommended Reference Books:

1. Ghosh A. & Mallik A.K.:THEORY OF MECHANISMS & MACHINES , EWP
- 2 Ratan S.S.:THEORY OF MACHINES, Tata McGraw Hill.
- 3 Dynamics of machine by J.L.Balleney ,TMH Publication,
- 4 Theory of Machine by Khurmi-Gupta,S.Chand Publications,

BTME505: INTERNAL COMBUSTION ENGINES

UNIT I

INTRODUCTION : Definition of Heat Engine, Classification & Basic Details of Heat Engines, Engine Components & its Nomenclature, Working principles of Engines, Comparison of S.I. and C.I. Engines, Comparison of Two Stroke & Four Stroke Engines, Classification of I.C. Engines, Applications of I.C. Engines.

UNIT II

FUEL AIR CYCLES & THEIR ANALYSIS : Introduction, Fuel Air Cycles & their significance, Variable Specific heat, Dissociation, Effect of no. of moles, Comparison of Air Standard & Fuel Air Cycles, Effect of operating Variables. 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.

UNIT III

SI Engine : Combustion & Injection, process & parameters properties of A/F mixture, Requirements of A/F per different operating conditions, Carburetion & Carburetors, types, Aircraft carburetor, comparison of carburetion & injection, F/A ratio calculations, CI engine : Mixture requirements & constraints, Method of injection, Injection systems, CRDI etc. system components, pumps injectors. Ignition systems : Conventional & Modern ignition systems Magneto v/s Battery, CB point v/s Electronic ignition, Firing order.

UNIT IV

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, High temperature regions of combustion chamber, Cooling Systems, Cooling system components, Heat Balance, Supercharging.

UNIT V

Working principles of Rotary, Stratified charge, Free piston. Diesel Power Plant: General layout, Components of Diesel power plant, Performance of diesel power plant,

fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system.

Recommended Reference Books:

1. Ganesan V: Internal Combustion Engines Tata McGraw Hill
2. Mathur M.L & Sharma R.P: A Course in Internal Combustion Dhanpat Rai & sons.
3. Vasantani & Kumar: Heat Engines Khanna Publications
4. Domkundwar V.M: I.C. Engines Dhanpat Rai & co.

BTME506A PRINCIPLES OF TURBOMACHINES

UNIT I

PRINCIPLES OF TURBOMACHINERY: The turbo machine, Positive displacement machines and turbo machines, Static and stagnation states Application of first and second laws to turbo machines, Efficiency of turbo machines. The Euler turbine equation, Fluid energy changes, Impulse and reaction, Turbines- utilization factor, Compressors and pumps

UNIT II

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 III

Axial flow pumps; Description, velocity triangles, work done on the fluid, energy transfer, axial pump characteristics, cavitation.

UNIT IV

Centrifugal compressors and fans: Components and description, velocity diagrams, 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 V

Axial flow compressors and fans: Basic constructional features; turbine v/s compressor blades; 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.

Recommended Reference Books:

- 1 DR. BANSAL R.K.: Fluid Mechanics and Hydraulic machines, Laxmi Publications
- 2.GANESHAN V. : Gas turbines , Tata Mcgraw Hill Publications
- 3YAHYA S.M. :Turbines , Fans and Compressors, Tata Mcgraw Hill Publications\
- 4.YADAV R: Steam and Gas Turbines, Central Publishing House

BTME 506B FUNDAMENTAL OF AERODYNAMICS

UNIT I

Introduction of aerodynamics

Introduction of basic Aerodynamics, Airfoil nomenclature elementary aerodynamics(lift,drag thrust moment and aerofoil stalling) critical Mach number and critical pressure coefficient drag divergent Mach number.

UNIT II

Jet propulsion system

Introduction, Review of different propulsion systems, Fundamentals of Propulsion, Fundamental gas turbine cycles and Propulsion Techniques. The propeller. The reciprocating engine, Jet propulsion – thrust equations.

UNIT III

Isentropic flow

Isentropic Flow: Velocity of sound; Mach angle; Mach number, steady isentropic flow through ducts; use of isentropic tables; condition for maximum discharge; choked flow; flow through convergent and convergent-divergent nozzle, supersaturated flow in nozzle.

UNIT IV

Adiabatic flow

Adiabatic flow and flow with Heat Transfer: Adiabatic flow; Fanno line tables; entropy change; choking due to friction; flow through long ducts; Adiabatic flow ; Rayleigh line; use of tables; change in entropy; effect of change in stagnation temperature.

UNIT V

Normal shock

Normal Shock: Plane stationary normal shock; Rankine-Hugoniot relations; increase in entropy; Prandtl's relations; change in stagnation pressure across the shock.

Recommended reference Books:

1. 1 . Aerodynamics by L.J.Clancy, Published by Sterling Book House, Indian Edition
2. Fundamentals of Aerodynamics by John D. Anderson, Jr. McGraw Hill, Inc
3. Introduction to Flight by John D. Anderson, Jr. McGraw Hill, Inc
4. Flight without Formulae by A. C. Kermode
5. Elements of Gas Turbine Propulsion by Mattingly
6. Gas Turbine by V. Ganesan, Tata-McGraw Hill Publishing Company Ltd, New Del

BTME506C Object Oriented Programming

UNIT I

Evolution of Programming Paradigms; Structured versus Object-Oriented Development; Elements of Object Oriented Programming – encapsulation, data hiding, data abstraction, inheritance, polymorphism, message communication; Popular OOP Languages, Merits and Demerits of Object Oriented Methodology.

UNIT II

Overview of C++; Class specification, class objects; Inline functions; Nesting of member functions, function overloading; Arrays within a class, arrays of objects, returning objects; Static data members, static member functions; Friend functions and friend classes; Constructors and Destructors – order of construction and destruction, parameterized constructors, constructor overloading, constructors with default arguments, copy constructor, dynamic initialization of objects

UNIT III

Operator Overloading – rules for overloading, overloading unary & binary operators, overloading binary operators using friends; Type Conversions – basic to class type, class to basic type, class to class type; Inheritance – forms of inheritance, inheritance and member accessibility, constructors and destructors in derived classes, constructor invocation and data members initialization, virtual base classes, nested and inner classes.

UNIT IV

Concept of dynamic binding; Pointers to objects; this pointer; Pointers to derived classes; Virtual functions, pure virtual functions; Object Slicing; Abstract classes, Smart pointers; Managing Console I/O Operations – C++ stream classes, unformatted I/O operations, formatted console I/O operations, managing output with manipulators; File handling – classes for file stream operations, file modes, file pointers and their manipulations, sequential and random access to a file, saving and retrieving of objects.

UNIT V

Generic programming with templates - function templates, class templates; Exception handling model and constructs; Standard Template Library(STL) overview, container classes; Namespace; Runtime typecasting.

Recommended Reference Books :

1. E. Balagurusamy, Object Oriented programming, Tata McGraw Hill.
2. K R Venugopal, Rajkumar, T Ravishankar, Mastering C++, Tata McGraw Hill.
3. C. Thomas Wu, An Introduction to OOP with Java, McGraw Hill.

4. Timothy Wood, An Introduction to Object Oriented Programming, Addison Wesley.
5. John R. Hubbard, Programming with C++, McGraw Hill International.

BTME506 D ELECTRICAL MACHINES

UNIT – I

D.C. Machines: Constructional features, Principles of operation, EMF equation Voltage build up phenomenon in a D.C. shunt generator, characteristics of different types of generators. Principle of operation of DC motor, back emf, speed and torque equation, various characteristics of different motors, starters and speed control of DC motors, applications of DC generators and motors.

UNIT – II

A.C. Machines: Constructional features, concept of revolving magnetic field, and principle of operation of Three phase induction motors, torque slip characteristics and power flow in induction motors, induction motor as a transformer, equivalent circuit, performance calculations, starting and speed control.

UNIT – III

Three Phase synchronous Machine: Constructional features EMF equation. Armature reaction of synchronous generator, voltage regulation of generators, phasor diagrams and equivalent circuits of synchronous machine,

UNIY IV

Machine Performance: computation of synchronous machine performance. Starting methods and principle of operation of synchronous motors, synchronous condenser.

UNIT –V

Single phase induction motors: double revolving field theory, different types of single phase induction motors, characteristics and typical applications. Stepper motors, hysteresis motor, Servo motors, AC series motor and Universal motor and their applications to mechanical systems.

Text Books:

[T1] Electric Machinery, A Fitzgerald, Charles Kingsley, Stephen Umans, Tata McGraw Hill Education, 6th edition, 2002

[T2] Electrical Machines, D P Kothari, I.J. Nagrath by Tata McGraw Hill Education, 2014

Reference Books:

- [R1] Electrical and Electronic Technology, Hughes Edward, Ian Mckenzie Smith, JohnHiley, Pearson Education, 10th edition, 2010
- [R2] Electrical Engineering Fundamentals, Vincent Del Toro, Prentice-Hall, 2nd edition, 1989
- [R3] Introduction to Electrical Engineering, Mulukutla S. Sarma, Oxford University Press Inc., 2001
- [R4] Problems in Electrical Engineering: Power engineering and electronics with answers Partly Solved in S.I. Units: Parker Smith , CBS Publishers, 9th edition, 2003
- [R5] Basic Electrical Engineering, C.L.Wadhwa, New Age International, 2007

BTME 506 E CONTROL SYSTEMS

UNIT I

Control Systems - - Basics Introduction to basic terms, classifications & types of Control Systems, block diagrams & signal flow graphs. Transfer function, determination of transfer function using block diagram reduction techniques and Mason's Gain formula.

UNIT II

Control System Components Control system components: Electrical/Mechanical/Electronic/A.C./D.C. Servo Motors, Stepper Motors, Tacho Generators, Synchros, Magnetic Amplifiers, Servo Amplifiers,

UNIT II

Time – Domain Analysis

Time domain performance specifications, transient response of first & second order systems, steady state errors and static error constants in unity feedback control systems, response with P, PI and PID controllers, limitations of time domain analysis.

UNIT III

Frequency Domain Analysis

Polar and inverse polar plots, frequency domain specifications and performance of LTI systems, Logarithmic plots (Bode plots), gain and phase margins, relative stability. Correlation with time domain performance closes loop frequency responses from open loop response. Limitations of frequency domain analysis, minimum/non-minimum phase systems.

UNIT IV

Stability

Concepts, absolute, asymptotic, conditional and marginal stability, Routh–Hurwitz and Nyquist stability criterion, Root locus technique and its application.

UNIT V

Compensation Techniques

Concepts of compensation, series/parallel/ series-parallel/feedback compensation, Lag/Lead/Lag-Lead networks for compensation, compensation using P, PI, PID controllers.

Text Books:

[T1] B. C. Kuo, "Automatic control system", Prentice Hall of India, 7th edition 2001.

[T2] Nagraath Gopal "Control Systems Engineering -Principles and Design" New Age Publishers

Reference Books:

[R1] Norman S. Nise, "Control systems engineering" John Wiley & Sons (Asia) Singapore.

[R2] Raymond T. Stefani, Design of Feedback Control System, Oxford University Press.

[R3] K. Ogata, "Modern control engineering", Pearson 2002.

[R4] S. P.Eugene Xavier, "Modern control systems", S. Chand & Company.

[R5] M. Gopal "Control Systems-Principles and Design" TMH 4th Edition 2012

BTME507 Heat and Mass Transfer Lab

Experiments List:

1. To Determine Thermal Conductivity of Insulating Powders.
2. To Determine Thermal Conductivity of a Good Conductor of Heat (Metal Rod).
3. To Measure the thermal Conductivity of Liquid.
4. To determine the transfer Rate & Temperature Distribution for a Pin Fin.
5. To Measure the Emissivity of the Test plate Surface.
6. To Determine Stefan Boltzman Constant of Radiation Heat Transfer.
7. To Determine the Surface Heat Transfer Coefficient For Heated Vertical Cylinder in Natural Convection.
8. Determination of Heat Transfer Coefficient in Drop Wise & Film Wise condensation.
9. To Determine Critical Heat Flux in Saturated Pool Boiling.
10. To Study Performance of Simple Heat Pipes.

BTME 508 Dynamics of Machines Lab

1. Study of various types of dynamometers, Brakes and Clutches.
2. To determine moment of inertia of the given object using of Trifler suspension
- 3 To verify the relation $T=I\omega\dot{\omega}$ for gyroscope.
4. To plot force vs. radius and lift vs. speed curves for governors.
5. To plot pressure distribution curves on a journal bearing.
- 6 To perform wheel balancing.
7. To perform static and dynamic balancing on balancing set up.
8. To determine mass moment of inertia of a flywheel. 1- Study of a lathe gear box.
9. Study of a sliding mesh automobile gear box.
10. Study of a planetary gear box.

BTME 509 I. C. Engine Lab

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.. Study of fuel supply system of a petrol engine (fuel pump and simple carburetor)
4. Study of fuel supply system of a Diesel engine (fuel pump and fuel injector)
5. Study of Ignition systems of an IC Engine (Battery and Magneto ignition system) and Electronic ignition system.
- 6 . Study of cooling systems of an IC Engine (air cooling and water cooling)
- 7 . To conduct a performance test on diesel engine to draw heat balance sheet for given load and speed
- 8 To determine friction power of diesel engine by Willan's line or fuel rate extrapolation method.
9. To calculate the indicated power, friction power and mechanical efficiency of four stroke four cylinder petrol engine at full load and rated speed by Morse test.
- 10 To draw the valve timing diagram of a Four stroke S.I. or C.I. Engine using experimental setup.
11. Analysis of engine exhaust gases using Orsat apparatus / gas analyzer.

BTME 510 Manufacturing Technology LAB

1. Study of single point cutting tool geometry & grind the tool as per given tool geometry.
2. Study the milling machine, milling cutters, indexing heads and indexing methods.
3. Prepare a gear on milling machine.
4. Prepare a hexagonal / octagonal nut using indexing head on milling m/c and to cut BSW/METRIC internal threads on lathe.
5. To cut multi-start square / metric threads.
6. To cut external metric threads & to meet it with the nut.
7. To prepare a job on shaper from given MS rod.
8. Study of capstan lathe and its tooling and prepare a tool layout & job as per given drawing.

BTME 511 Machine Design Lab-II

The Practicals will involve design of all the elements of the following systems.

1. Automotive Transmission (Gear Box)
2. Brakes
3. Clutches
4. Piston of I C Engine
5. Connecting rod of I.C. Engine
7. Hydraulic Riveter
8. Passenger Lift.
6. Mechanical Hoist

**BACHELOR OF TECHNOLOGY
MECHANICAL ENGINEERING
SIXTH SEMESTER**

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			Credits
Code	Subject/Paper	L	T	P	IA	EA	Total	
BTME 601	Air Conditioning & Refrigeration	3	1	-	30	70	100	4
BTME 602	Steam & Gas Turbines	3	-	-	30	70	100	3
BTME 603	Hydraulic Machines	3	1	-	30	70	100	4
BTME 604	Noise, Vibration & Harshness	3	-	-	30	70	100	3
BTME 605	Operation Research	3	1	-	30	70	100	4
Elective (any one)								
BTME606A	CAD-CAM	3	-	-	30	70	100	3
BTME606B	Non Destructive Evaluation and Testing	3	-	-	30	70	100	3
BTME606C	Design and Manufacture of Plastic products	3	-	-	30	70	100	3
BTME606D	Maintenance Management	3	-	-	30	70	100	3
PRACTICALS/VIVA-VOCE								
		No. of Teaching Hours			Sessional	Practical	Total	Credits
BTME 607	Air Conditioning & Refrigeration Lab	-	-	2	30	20	50	1
BTME 608	CAD lab	-	-	2	30	20	50	1
BTME 609	Vibration Lab	-	-	2	30	20	50	1
BTME 610	Hydraulic Machines Lab	-	-	2	30	20	50	1
BTME 611	Industrial tour/ In house workshop	-	-	0	30	20	50	2
BTME 612	Technical Seminar	-	-	1	30	20	50	1
TOTAL		18	3	9	360	540	900	28

4 -6 weeks training will be held after sixth semester,viva will be conducted in seventh sem.

BTME601 AIR CONDITIONING AND REFRIGERATION

UNIT I

Air Refrigeration & Heating System: Refrigeration systems ,Refrigeration effect and unit of Refrigeration, Heat pump, reversed Carnot cycle. Analysis of simple vapour compression Refrigeration cycle by p-h and T-S diagram. Effect of operating conditions, liquid vapour heat exchangers, actual refrigeration cycle. Limitation of Carnot cycle with gas, reversed Brayton cycle, Brayton cycle with regenerative.

UNIT II

Gas cycle Refrigeration

Necessity of cooling of air craft, Basic cycle, boot strap, regenerative type air craft refrigeration cycle. Application, air compressor system, Individual compressor, compound compression, cascade system. Application, air compressor systems, individual compressor, compound compression, cascade system.

UNIT III

Vapour Absorption System

Description of system components, i.e. generator, rectifier, condenser, absorber, heat exchanger and water pump., Aqua ammonia, lithium bromide-water and electrolux refrigeration systems. Classification, Nomenclature, selection of Refrigerants, Compressor, condenser, evaporator, expansion devices – types & working.

UNIT IV

Psychrometry

Psychrometric properties, psychometric relations, psychometric charts, psychometric processes, cooling coils, By-pass factor and air washers. Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart

UNIT V

Estimating Requirements: Heating, cooling, humidifying and dehumidifying requirements. Calculation of cooling, load, building transmission, infiltration, air changes, heat gain from people, light, power and duct heat gains etc. Winter and summer designs condition, air quantity and temperature requirements. Psychometric calculations for cooling.

Books for Reference:

1. C.P. Arora, "Refrigeration & Air Conditioning" Tata McGraw Hill Publishing Co. Ltd. New Delhi.
2. Roy J. Dossat: 'Principles of Refrigeration' Addison Wesley Longman Pvt. Ltd. Delhi.
Manohar Prasad 'Refrigeration & Air-conditioning' Wiley Eastern Ltd. New.
3. Dynamics of machine by J.L. Balleney, TMH Publication,
4. Theory of Machine by Khurmi-Gupta, S. Chand Publications,
5. Ganesan V: Internal Combustion Engines Tata McGraw Hill
6. Mathur M.L. & Sharma R.P: A Course in Internal Combustion Dhanpat Rai & sons.

- 7 Vasantani & Kumar: Heat Engines Khanna Publications
- 8 Domkundwar V.M: I.C. Engines Dhanpat Rai & co.
- 9 Production Engineering by P.C. Sharma
- 10 Production Engineering by Pandey Singh
- 11 Rao P. N – Manufacturing Technology –TMH.
- 12 Campbell J.S. – Principles of manufacturing materials & processes TMH

BTME 602 STEAM & GAS TURBINE

UNIT I

Steam Nozzles: Types of nozzles, velocity of steam, discharge through nozzle, critical pressure ratio and condition for maximum discharge, physical significance of critical pressure ratio, effect of friction and nozzle efficiency, general relationship between area, velocity and pressure in nozzle flow, supersaturated flow.

UNIT II

Steam turbine : Principle of operation, types of steam turbines, compounding of steam turbines, impulse turbine- velocity diagram, calculation of work, power and efficiency, condition for maximum efficiency, Reaction turbines – velocity diagram ,

UNIT III

Degree of reaction, work, power, efficiencies, blade height, condition for maximum blade efficiency for turbines, reheat factor, governing of steam turbine- throttle, nozzle and bypass governing, regenerative feed heating, reheating of steam, binary vapour cycle,

UNIT IV

Gas turbine: Classification, open and closed cycle, gas turbine fuels, actual brayton cycle, optimum pressure ratio for maximum thermal efficiency, work ratio, air rate, effect of operating variables on the thermal efficiency and work ratio, and air rate means of improving efficiency and specific output of simple cycle- open cycle turbine with regeneration, reheating and Inter cooling.

UNIT V

Velocity diagram and work done by gas turbine, turbine blade cooling, sources of losses, convection cooling, film cooling, transpiration cooling ,turbine blade material, protecting coating.

Text Books:

[T1] Arora & Domkundwar, “A course in Power Plant Engineering”, Dhanpat Rai & Sons

[T2] P.L.Balaney “Thermal Engineering”, Khanna Publishers.

Reference Books:

[R1] R.K.Rajput “Thermal Engineering”, Laxmi Publications (P) Ltd.

[R2] A.S Sarao “Thermal Engineering”, Satya Prakshan.

[R3] Shamsheer Gautam “Power Plant Engineering” Vikas Publishing House

BTME 603 HYDRAULIC MACHINES & HYDRAULIC POWER PLANT

UNIT I

Impact of Jets

Impulse momentum principle, force exerted on a stationary and moving flat plate normal, inclined to the jet and curved plate, hinged plate, jet striking a moving curved vane tangentially at one tip and leaving at the other jet propulsion of ships..

UNIT II

Hydraulic turbines

Classification of turbine, impulse turbines, Pelton wheel, Construction and working Pelton wheel turbine, Work done, head, efficiency and design aspects. Governing of turbines.

UNIT III

Reaction Turbine

Radial flow reaction turbine, Francis turbine: construction and working. Work done, Efficiency, Working proportions of a Francis turbine design aspects of Francis turbine runner.

Axial flow reaction turbine

Propeller and Kaplan turbine, bulb or tubular turbine- construction and working. Draft tube theory, governing of reaction turbine. Performance characteristics and comparison of all the turbines.

Cavitation Phenomenon in hydraulic machines

UNIT IV

Reciprocating Pumps

Classification, component and working, single acting and double acting, discharge, workdone and power required, coefficient of discharge, indicator diagram, slip, effect of friction and acceleration theory of air vessels.

Miscellaneous hydraulic machine Hydraulic accumulator, Hydraulic intensifier, Hydraulic Press, hydraulic crane, hydraulic lift, hydraulic Ram,

UNIT V

Water power Development– Advantages and disadvantages of water power, selection of site for hydroelectric power plant, hydrological cycle, hydrographs, essential elements of HEPP. Types of dams, conduits, spillways, surge tanks. Major, mini and micro power plants- present scenario in Rajasthan and India. Selection of turbine.

Recommended Reference Books:

1. Hydraulics and Fluid Mechanics by R.K. Bansal
2. Introduction to Fluid Mechanics and Fluid Machines by S.K. Som and G. Biswas.
3. Hydraulics and Fluid Mechanics by Modi and Seth

BTME 604 Noise, Vibration & Harshness

UNIT I

Noise

Noise: Effects, Ratings and Regulations; Non-auditory effects of noise on people, Auditory Effects of noise, Noise standards and limits in India. Major sources of the noise; Industrial noise sources. Industrial noise control-strategies; Noise control at the source, Noise control along the path, Acoustic barriers, Noise control at the receiver.

UNIT II

Vibration

Scope of vibration, important terminology and classification, Degrees of freedom one dimensional longitudinal, transverse and torsional vibrations with and without damping using Newton's second law, D' Alembert's principle and Principle of conservation of energy. 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 and Hysteretic damped systems.

UNIT III

Forced Vibration

Forced vibrations of single degree of freedom systems. Forced vibration with constant harmonic excitation. 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 IV

Undamped force vibration

System with two degrees of freedom; principle mode of vibration . Undamped forced vibrations of two degrees of freedom system with harmonic excitation. Vibration Absorber; Undamped dynamic vibration absorber and centrifugal pendulum absorber. Many degrees of freedom systems: exact analysis.

UNIT V

System of degree of freedom

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,

Recommended Reference Books:

1. Mechanical vibrations ;G.K. Grover,Nemi Chand & Bros.,Roorkee
2. Vibration Theory & Application ; W.T. Thomson
3. Vibration & noise for Engineers K.K. Pujra,Dhanpat Rai & Sons,Delhi

BTME 605 OPERATION RESEARCH

UNIT I

Overview of Operation Research

History of Operation Research, Linear optimization models, simplex algorithms, duality; dual linear programming, Sensitivity; Integer programming

UNIT II

Transportation

Transportation, Transshipment & Assignment problems

UNIT III

Decision and Game Theory

Decision theory under various conditions. Theory of Games. Queuing Theory

UNIT IV

Deterministic and Stochastic inventory models-

Single & multi period models with continuous & discrete demands, Service level & reorder policy

UNIT V

Simulations-Simulation V/S mathematical modeling, Monte Carlo simulation, simulation language ARENA,

Recommended Reference Books:

1. *Taha, Operations Research, PHI*
2. *S.D.Sharma, Operations Research*

Elective

BTME 606A CAD-CAM

UNIT-I

Fundamentals of CAD/CAM: Introduction to CAD and CAM, Definition of CAD and CAM tools, Applications of CAD/CAM, Design process and application of computers in design, Creating Manufacturing database, Benefits of CAD/CAM.

UNIT-II

Curves and Surfaces: Explicit and Implicit equations, parametric equations, analytical curves, Bezier and B-spline curves,. Representation of surfaces: plane, cylindrical, spherical,

UNIT-III

Fundamentals of Numerical Control: Principles of NC, Types of NC machines, Classification of NC: Motion control, control loops, power drives, positioning systems, NC, CNC, DNC, Combined CNC/DNC systems. Components of NC machines: prime movers, transducers, lead screw

UNIT-IV

Numerical Control Programming: Block format and codes, tool length and radius compensation, manual and interactive part programming, tool path simulation of lathe and milling, post processor and auxiliary statements. Types, advantages, adaptive control for proper cutting speed, feed in turning operation.

UNIT-V

Computer Integrated Manufacturing System: Types of manufacturing systems, machine tools and related equipment, material handling systems, computer control systems, human labor in manufacturing systems, CIMS benefits..automated guided vehicle (AGV), automated storage and retrieval systems (AS/RS), flexible manufacturing systems (FMS).

Recommended reference Books:

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

BTME 606B NON DESTRUCTIVE EVALUATION AND TESTING

UNIT I

Introduction: An Overview, Factors influencing the Reliability of NDE, Defects in materials, Defects in composites. NDT methods used for evaluation of materials and composites.3 Visual Inspection: Basic Principle and Applications.2 Liquid Penetrate Testing: Principle, Procedure and Test Parameters, Materials, Limitations and Applications.

UNIT II

Radiographic Inspection: Principles of X – ray radiography, equipment, Absorption, Scattering, X-rays film processing, General radiographic procedures, Reading and Interpretation of Radiographs, Industrial radiographic practice, Limitations and Applications, Welding defects detection. Gamma ray radiography.

UNIT III

Ultrasonic Testing: Principle of wave propagation, Ultrasonic equipment, Variables affecting an ultrasound test, Basic methods: Pulse Echo and Through Transmission, Types of scanning.

Applications of UT: Testing of products, Welding Inspection, Tube Inspection, Thickness Measurement, Elastic Constant Determination, Ultrasonic testing of composites.

UNIT IV

Magnetic Particle Inspection: Methods of generating magnetic field, Demagnetization of materials, Magnetic particle test: Principle, Test Equipment and Procedure, Interpretation and evaluation.5 Introduction to Acoustics Emission Testing and Thermography.

UNIT V

Eddy Current Testing: Principle of eddy current, Factors affecting eddy currents, Test system and test arrangement, Standardization and calibration, Application and effectiveness. Comparison and Selection of NDT Methods, Codes and Standards

TEXT BOOK

Baldev Raj, T. Jay Kumar, M. Thavasimuthu, Practical Non-Destructive Testing, Narosa.

REFERENCE BOOKS

1 Loius Cartz, Non Destructive Testing, ASM International

2 J PRASAD, C G K NAIR, NDT & Evaluation Of Materials, Tata McGraw Hill

3 R. Halmshaw, Introduction to the Non-Destructive Testing of Welded Joints,

4 American Metals Society, Non-Destructive Examination and Quality Control, Metals Hand Book, Vol.17, 9th Ed.

BTME 606C DESIGN AND MANUFACTURING OF PLASTIC PRODUCTS

UNIT I

Plastics Materials: An Overview, Classification, Thermoplastics, Thermosets, Crystalline, Amorphous, and Liquid, Crystalline Polymers, Copolymers, Alloys, Elastomers, Additives, Reinforcements, and Fillers, Physical Properties and Terminology.

Mechanical Properties, Thermal Properties, Electrical Properties, Environmental Considerations.

UNIT II

Design Considerations for Injection-Molded Parts: Injection Molding Process, Design Strategy, Efficient and Functional Design, Material Selection, Nominal Wall Thickness, Normal Ranges

of Wall Thickness, Structural Requirements of the Nominal Wall, Insulation Characteristics of the Nominal Wall, Impact Response of the Nominal Wall, Draft, Structural Reinforcement, Ribs, Other Geometric Reinforcement, Bosses, Coring, Fillets and Radii, Undercuts

UNIT III

Polymer processing techniques such as extrusion, compression and transfer moulding. Injection moulding, blow moldings, thermoforming, rotational Moulding, calendaring.

UNIT IV

Assembly: General Types of Assembly Systems, Molded In Assembly Systems, Snap Fit Assembly, Molded In Threads, Press Fits, Chemical Bonding Systems, Solvent Welding, Adhesive Bonding, Thermal Welding Methods. Spin Welding, Radio Frequency (RF) Welding, Electromagnetic or Induction Welding, Assembly with Fasteners, Bolted Assembly, Threaded Metal Inserts, Self Tapping Screws, Riveted Assembly, Sheet Metal Nuts, Specialty Plastic Fasteners

UNIT V

Machining of Plastics: Drilling and Reaming, Thread Tapping, Sawing, Milling, Turning, Grinding. Finishing and Decorating of Plastics: Painting, Vacuum Metalizing and Sputter Plating, Electroplating, Flame Spraying/Arc Spraying, Hot Stamping

TEXT BOOK

Design and Manufacture of Plastic Parts, R.L.E. Brown, John Wiley and Sons, New York **1980**

REFERENCE BOOKS

1 Designing with Plastics, Gerhard, Hanser Verlag

2 Handbook of Plastics Joining: a practical guide, PDL handbook series,Plastics Design Library, William Andrew

3 Modern Plastics Handbook, McGraw Hill handbooks, Modern plasticsseries, Charles A. Harper, McGraw-Hill Professional**1997**

4 Industrial Plastics: theory and applications, Erik Lokensgard and Terry L.Richardson, 4th Edition, Cengage Learning**2000**

BTME 606D MAINTENANCE MANAGEMENT

UNIT I

Introduction #Fundamentals of Maintenance Engineering. Maintenance Engineering its importance in material & energy conservation, inventory control, productivity, safety, pollution control etc. 3 Safety Regulations, pollution problems, human reliability, total quality management (TQM), total productivity maintenance (TPM), environmental issues in maintenance, ISO 9000. 4

UNIT II

Maintenance Management # types of maintenance strategies, Planned and unplanned maintenance, breakdown, preventive & predictive maintenance. Their comparison, advantages & disadvantages. Limitations. Computer aided maintenance, maintenance scheduling, spare part management, inventory control, organization of maintenance department.

UNIT III

Tribology in Maintenance, friction wear and lubrication, friction & wear mechanisms, prevention of wear, types of lubrication mechanisms, lubrication processes. 3 Lubricants # types, general and special purpose, additives, testing of lubricants, degradation of lubricants, seal & packing. 3 Repair methods for basic machine elements: Repair methods for beds, slide ways, spindles, gears, lead screws and bearings–Failure analysis–Failures and their development–Logical fault location methods–Sequential fault location.

UNIT IV

Machine Health Monitoring # Condition based maintenance, signature analysis, oil analysis, vibration, noise and thermal signatures, on line & off line techniques, Instrumentation & equipment used in machine health monitoring. Instrumentation in maintenance, signal processing, data acquisition and analysis, application of intelligent systems, data base design.

UNIT V

Reliability, availability & maintainability (RAM) Analysis # Introduction to RAM failure mechanism, failure data analysis, failure distribution, reliability of repairable and non repairable systems. Improvement in reliability, reliability testing, reliability prediction, utilization factor, system reliability by Monte Carlo Simulation Technique.

TEXT BOOK

- 1 Anthony Kelly, Strategic Maintenance Planning, Butterworth-Heinemann 2006
- 2 R. C. Mishra, K. Pathak ,Maintenance Engineering and Management, PHI Learning Pvt. Ltd 2012

REFERENCE BOOKS

- 1 Higgins L.R., “Maintenance Engineering Hand book”, McGraw Hill 1988
- 2 Maintenance & Spare parts Management Gopal Krishnan
- 3 Srivastava S.K., “Industrial Maintenance Management”, S. Chand and Co 1981
- 4 Hand book of Condition Monitoring CNR Rao
- 5 White E.N., “Maintenance Planning”, I Documentation, Gower Press 1979
- 6 Armstrong, “Condition Monitoring”, BSIRSA 1988
- 7 Davies, “Handbook of Condition Monitoring”, Chapman &Hall, 1996

BTME607 AIR CONDITIONING & LAB REFRIGERATION

List of Experiments:

1. To find out the Coefficient of performance of a Heat pump.
2. To find out the Coefficient of performance of a device, which is working on vapour absorption cycle?
3. To find out the Coefficient of performance of a refrigerator and also find the sensible heat factor.
4. To study about the evaporative cooler.
5. To perform experiment on three ton air conditioner test rig.
6. To study about the air distribution system.
7. To calculate the heat load for a given setup .
8. To study about the central air conditioning plant.
9. To study about the solar refrigeration system.

ME608 CAD LAB

List of Experiments

1. Introduction & different features of the CAD Software
2. 2-D Drafting
3. 3-D Modeling
4. 3-D Advanced Modeling
5. Assembly modeling
6. Feature Modification and Manipulation
7. Detailing
8. Sheet Metal Operations
9. Surface Modeling
10. One Dimensional problems of Finite Element Method.

(These exercises may be performed by any of the following Advanced CAD Software such as Pro E /Unigraphics/ AutoCAD Inventor)

BTME 609 VIBRATIONS LAB.

LIST OF EXPERIMENTS:

1. To determine the radius of gyration of given bar by using bifilar suspension.
2. To determine natural frequency of a spring mass system.
3. To determine natural frequency of free torsional vibrations of single Horizontal rotor system.
4. To determine natural frequency of free torsional vibrations of single Vertical rotor system.
5. Study of free damped torsional vibration to performing the experiment to find out damping co-efficient.
6. To conduct experiment of trifler suspension.
7. Harmonic excitation of cantilever beam using electro-dynamic shaker and determination of resonant frequencies.
8. Study of Vibration measuring instruments.

BTME610 HYDRAULIC MACHINES LAB

List of Experiments:

1. To verify Impulse momentum principle for impact of jet on a stationary Vane
2. To study the operation and performance of a pelton wheel turbine
3. To study the performance of a Francis wheel turbine

4. To study the operation and performance of a Kaplan wheel turbine
5. To Study the performance characteristics of a simple single stage centrifugal pump
6. To Obtain the performance characteristics of a Reciprocating pump
7. To Study the performance characteristics of the hydraulic power plant
8. To Study the performance characteristics of the Hydraulic Ram

**BACHELOR OF TECHNOLOGY
MECHANICAL ENGINEERING**

Semester - VII

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			
Code	Subject/Paper	L	T	P	IA	EA	Total	Credits
BTME 701	PROJECT/INDUSTRIAL TRAINING	-	-	-	540	360	900	28
TOTAL					540	360	900	28

**BACHELOR OF TECHNOLOGY
MECHANICAL ENGINEERING
Semester – VIII**

THEORY PAPERS		No. of Teaching Hours			Marks Allocation			Credits
Code	Subject/Paper	L	T	P	IA	EA	Total	
BTME 801	Fundamentals of Aerodynamics	3	1	-	30	70	100	4
BTME 802	Quality Control & Quality Assurance	3	1	-	30	70	100	4
BTME 803	Mechatronics & Robotics	3	1	-	30	70	100	4
BTME 804	Production Design & Development	3	-	-	30	70	100	3
BTME 805	Non Conventional Energy	3	-	-	30	70	100	3
BTME 806	Advanced Manufacturing Methods	3	1	-	30	70	100	4
PRACTICALS/VIVA-VOCE		No. of Teaching Hours			Sessional	Practical	Total	Credits
BTM807	CAM & Robotics Lab	-	-	2	30	20	50	1
BTME808	MAT Lab	-	-	2	30	20	50	1
BTME809	NCE Lab	-	-	2	30	20	50	1
BTME810	Project/Seminar	-	-	2	90	60	150	2
TOTAL		18	4	8	360	540	900	27
Grand Total of Marks and Credits		126	16	63	3030	4180	7000	210

MECHANICAL ENGINEERING

BTME801: FUNDAMENTAL OF AERODYNAMICS

UNIT 1:-Introduction of aerodynamics

Introduction of basic Aerodynamics, Airfoil nomenclature elementary aerodynamics(lift,drag thrust moment and aerofoil stalling) critical Mach number and critical pressure coefficient drag divergent Mach number.

UNIT 2:-Jet propulsion system

Introduction, Review of different propulsion systems, Fundamentals of Propulsion, Fundamental gas turbine cycles and Propulsion Techniques. The propeller. The reciprocating engine, Jet propulsion – thrust equations.

UNIT3:-Isentropic flow

Isentropic Flow: Velocity of sound; Mach angle; Mach number, steady isentropic flow through ducts; use of isentropic tables; condition for maximum discharge; choked flow; flow through convergent and convergent-divergent nozzle, supersaturated flow in nozzle.

UNIT 4:-Adiabatic flow

Adiabatic flow and flow with Heat Transfer: Adiabatic flow; Fanno line tables; entropy change; choking due to friction; flow through long ducts; Adiabatic flow ; Rayleigh line; use of tables; change in entropy; effect of change in stagnation temperature.

UNIT 5:-Normal shock

Normal Shock: Plane stationary normal shock; Rankine-Hugoniot relations; increase in entropy; Prandtl's relations; change in stagnation pressure across the shock.

Recommended reference Books:

7. 1 . Aerodynamics by L.J.Clancy, Published by Sterling Book House, Indian Edition
8. Fundamentals of Aerodynamics by John D. Anderson, Jr. McGraw Hill, Inc
9. Introduction to Flight by John D. Anderson, Jr. McGraw Hill, Inc
10. Flight without Formulae by A. C. Kermode
11. Elements of Gas Turbine Propulsion by Mattingly
12. Gas Turbine by V. Ganesan, Tata-McGraw Hill Publishing Company Ltd, New Delhi

BTME802: QUALITY CONTROL & QUALITY ASSURANCE

UNIT-I

Introduction : Definition and Need of quality, Aspects of quality, Quality characteristic, Quality specification, Quality function, Economics of quality.

Inspection: its Definition, objectives, methods and types, Inspection versus Quality Control.

Statistical Quality Control (SQC): its Tools, Advantages, limitations and Applications.

UNIT-II

Control Charts: Concept of variability, Definition and objectives of control charts, Control charts for variables such as X, R charts and control charts for attributes such as p-chart, c-chart, Variable vs Attribute charts, Construction & use of control charts, Process capability and its methods of determination.

UNIT-III

Acceptance Sampling: Principle of acceptance sampling, its advantages over 100% sampling, Methods of taking samples, Type I and Type II errors

Sampling plans: single, double & sequential sampling plans, Sampling by attributes and variables.

Quality Assurance: Need, Principles, Essentials and Advantages of Quality Assurance System, Quality Manual, Field complaints, Quality Audit & its types, Quality Assurance Methods, Quality Control vs Quality Assurance.

UNIT-IV

Reliability : Introduction to reliability & its elements, bath-tub curve, Life expectancy. Reliability based design, Series & Parallel System, Quality vs Reliability

Defect Diagnosis and prevention: Basic causes of failure, constant failure rate, control of failure.

MTBF: Maintainability, Condition monitoring and diagnostic techniques.

Value Engineering: Elements of value analysis and its Techniques.

Unit-V

Quality systems: Description of ISO: 9000 series of standards, ISO: 9001–2000 Systems, Deming award criteria.

TQM: Description and Implementation of TQM, Concept of Quality Circles, JIT System, Taguchi's Concept of Quality, Zero Defect Concept, 5S Concept, 6 Sigma Concept.

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

Text Books:

1. EL Grant & RS Leavenworth, "Statistical Quality Control", McGraw Hill & Co.
2. M. Mahajan, "Statistical Quality Control", Dhanpat Rai & Co.

3. O.P. Khanna, "Statistical Quality Control", Dhanpat Rai & Co.
4. R.C. Gupta, "Statistical Quality Control", Khanna Publishers

Reference Books:

1. Amitav Mitra, "Fundamentals of Quality Control", Pearson Education
2. Feigenbaum, "Total Quality Control", McGraw Hill & Co.
3. Suresh Dalela, "Quality Systems", Standard Publishers & Distributors
4. Montgomery DC, "Introduction to Statistical Quality Control", John Wiley & Sons Inc.
5. Stephan B. Vardeman, J Marcus Jobe, "Statistical QA Methods for Engineers", John Wiley & Sons Inc.
6. Taylor J.R., "Quality Control systems", McGraw Hill Int. Education
7. K.C. Arora, "Total Quality Management", S.K. Kataria & Sons

BTME 803: MECHATRONICS & ROBOTICS

Unit 1 Introduction about Mechatronics and NC Machine

Introduction about Mechatronics, scope of Mechatronics, Definitions of mechatronics, the mechatronic design process, mechatronic systems and components. application, process control automation and N/c Machines.

Unit II Actuation Systems

Mechanical actuators: Kinematic link, kinematic chain, gear drive, belt drive. Electrical actuators: DC motors, single phase motors, synchronous motors. Hydraulic and pneumatic actuators.

Unit III Introduction to Robotics

Evolution of Robots and Robotics, Laws of Robotics, What is and What is not a Robot,

Progressive Advancement in Robots, Robot Anatomy, Human Arm Characteristics, Design and Control Issues, Manipulation and Control, Sensors and Vision, Programming Robots, The Future Prospects, Notations.

Unit IV Robotic Sensors and Vision

The Meaning of Sensing, Sensors in Robotics, Kinds of Sensors used in Robotics, Robotic vision, Industrial Applications of Vision-Controlled Robotic Systems, Process of Imaging, Architecture of Robotic Vision Systems, Image Acquisition.

Unit V Transducers & Robot Applications

Introduction, classification, specification, characteristics of transducers, type of

transducers displacement, strain, vibration pressure, flow, temperature, force & torque,

tactile. Industrial Applications, Material Handling, Processing Applications, Assembly Applications, Inspection Application, Principles for Robot Application and Application Planning,

Recommended Reference Books:

1. Mechatronics Engineering ,Tomkinson,D.and Horne .J. Mc Graw Hill ,
2. Mechatronics ,Bolton ,W.,Longman
3. Mechatronics ,HMT Hand book
4. Deb, S R, Robotics Engineering

BTME 804: Product Design and Development

Unit I New product & Development Process.

Importance of new product for growth of enterprise. Definition of product and new product. Responsibility for new product development. Demands on product development team. Classification of products from new product development. Point of view- Need based/Market pull products, Tech. push, Platform based, Process based and customized products. New product development process and organization. Generic product development process for Market Pull Products.

Unit II Industrial product engineering design

Definition of Product design ,Principles of modern design, design theory- definition of design, industrial design and engineering design, the design process and design materials.

Unit III Preliminary & detailed design- Design Review

Preliminary design- Identification of subsystems, Subsystem specifications, Compatibility. Detailed design of subsystems, component design, Preparation of assembly drawings. Review of product design from point of view of Manufacturing, Ergonomics and aesthetics.

Unit IV concurrent Engineering

Introduction to concurrent engineering- Design for manufacturing, design for assembly, design for disassembly, design for environment, design for quality and rapid physical prototyping. Legal issues in product design and design resources.

Unit V Product Strategies and economic

Analysis of the product ,Three 5'S Standardization ,simplification. The designer and his role ,. The industrial design organization ,basic design considerations, Problem faced by Industrial Designer ,Procedure adopted by Industrial Designer ,Role of aesthetics in product design ,functional design practice , Product value ,design for safety ,for reliability and environmental consideration ,economic analysis ,profit and competitiveness

Recommended Reference Books:

1. Cross, Nigel "Engineering Design Methods" John Wiley & Sons, 1994.
2. Lindbeck, J.R. "Product Design and Manufacture" Prentice Hall, 1995.

3. Ulrich, K.T. and Eppinger, S.D., "Product Design and Development" McGraw Hill 1995.
4. Syan, C.S., and Menon, Unny "Concurrent Engineering" Chapman & Hall, 1994

BTME805: Non –Conventional Energy

Unit I Solar Energy

Introduction: Future of world energy, Form and characteristics of renewable energy sources
Different non-conventional sources of energy: their availability and future prospects in India,
Solar radiation, its measurements and prediction. Solar energy collectors, Solar energy storage,
Applications of solar energy.

Solar Photovoltaic

Principle of photovoltaic conversion of solar energy, types of solar cells and fabrication.
Photovoltaic applications: battery charger, domestic lighting, street lighting, water pumping,
power generation schemes

Unit II Wind Energy

Atmospheric circulations, classification, factors influencing wind, wind shear, turbulence, wind
speed monitoring, Betz limit, WECS: classification, characteristics, applications.

Unit III Ocean Energy

Introduction to Ocean Thermal Energy Conversion (OTEC), Principles of ocean thermal energy
conversion systems, Closed and open cycle OTEC systems, ocean thermal power plants
Prospects of OTEC in India.

Unit IV Biomass Energy

Energy from Biomass: Introduction, Biomass classification and Biomass conversion
technologies .Biogas technology: Introduction, Advantages of Biogas, Biogas production and
mechanism, Different types of common biogas plants

Unit V Wave & Tidal Energy

Wave Energy: Introduction, Wave energy conversion devices. MHD Power Generation:
Introduction, Principles of MHD power generation, MHD systems. Tidal Power: Introduction,
Basic Principle of tidal power, Single-basin and double-basin tidal power systems.

Recommended Reference Books:

- 1 G. D. Rai: "Non-Conventional Energy Sources" Khanna Publishers, Delhi.
2. N. Mathur & N.S. Rathore: "New and Renewable Energy Sources",Bohra Ganesh
Publications, Udaipur.

BTME806: Advanced Manufacturing Methods

UNIT I.

Development and classification of non-conventional manufacturing processes, considerations in processes selection. Mechanics of material removal, tool design, effects of process parameters on MRR, accuracy and surface finish and applications of the various non-conventional machining processes like:

UNIT II.

Ultrasonic Machining(USM), abrasive & water jet machining (AJM), Electro Chemical Machines (ECM),

UNIT III.

Electro Chemical Grinding (ECG), Chemical Machining (CHM), Electrical Discharge Machining

UNIT IV.

(EDM), Electron Beam Machining (EBM) and Ion Beam machining (IBM) processes. High Energy Rate

Forming Methods (HERF)

UNIT V.

High Velocity Forming of Metals, Explosive forming,

Reference Books:

1. Pandey & Shan, Modern Machining Processes, Tara McGraw Hill, N.Delhi
2. P.K Mishra, Non Conventional Machining, Narosa Publishing House, N.Delhi
3. Amitabh Bhattacharya, New Technology, Institution of Engrs (I) Calcutta
4. ASTM, High Velocity Forming of Metals, PHI, N.Delhi
5. Ghosh & Mullick, Manufacturing Science, NewAge publishers Pvt. Ltd. N. Delhi
6. Serope Kalpak Jain & Steven R. Schmid, Manufacturing Engineering & Technology, Addison Wesley Ltd.. N. Delhi

BTME 807: CAM & Robotics Lab

LIST OF EXPERIMENTS:

1. To prepare part programming for turning operation in absolute mode.
2. To prepare part program in inch mode for plain turning operation.
- 3 To prepare part program for taper turning operation.
4. To prepare part program for threading operation.
- 5 To prepare part program for slot milling operation.

- 6 To prepare part program for gear cutting operation.
7. To prepare part program for multiple drilling in X and Z axis using drilling cycle.
- 8 To detect the sensor scanning system to overcome limitation of fixed sensors on various robotic applications, ultrasonic sensor, laser range finders, infrared detectors and miniature.
- 9 To find the horizontal and vertical movement up to 180° in either direction..
- 10 To determine 5 Axis Robotic Arm movement and its degree of rotation.
- 11 To study various Robotic Arm Configurations.
- 12 To study Pick and Place Robot

BTME808: MAT LAB

Experiment list

1. Introduction to Matlab: Understand the Mat lab Desktop, Command window and the Graph Window, Matlab Interactive Sessions, Menus and the toolbar
2. Make a program for multi dimensional Arrays, Arrays, Multidimensional Arrays, Element by Element Operations
3. Programming to Polynomial Operations Using Arrays
4. programming using Cell Arrays
5. Functions & Files: programming Elementary Mathematical Functions
6. Programming using User Defined Functions
7. Programming Techniques: a) Program Design and Development, Conditional Statements, Loops.
8. Plotting :Programming using XY- plotting functions
9. Potting Programming for Special Plot types, 3-D plots
10. Linear Algebraic Equations a) Elementary Solution Methods
11. Linear Algebraic Equations Matrix Methods for (LE)

BTME809 : NON CONVENTIONAL ENERGY LAB

1. Solar Radiation Measurement
2. Solar Distillation
3. Solar Pumping
4. Solar Cooker
5. Preparation of delicious food by using solar cooker.
6. Solar Water Heater (Thermosiphon)
7. Solar Water Heater (Forced Circulation)
8. Solar Lanterns and Street light
9. Study of KVIC Bio gas plant
10. Study of Janata Bio gas plant
11. Study of Deenabandhu Biogas plant

12 Study of fuel cells