B. Tech. (ME): Syllabus Revision in 2016-17.

S. No	Course Code	Session 2015-16	Session 2016-17	Remark Syllabus Change/ new course
1	**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. UNIT5-V Oscillation & Waves : Simple harmonic oscillator with example, energy of oscillator, Damping oscillator,viscous & solid friction damping,Qualityfactor,Resonance standing waves,elastic waves,	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. UNIT5-V Oscillation & Waves : Simple harmonic oscillator with example, energy of oscillator, Damping oscillator,viscous & solid friction damping,Qualityfactor,Resonance standing waves,elastic waves,	**No Change**
2	**BT102**	INTRODUCTION TO COMPUTER FUNDAMENTAL AND IT	INTRODUCTION TO COMPUTER FUNDAMENTAL AND IT	**Syllabus Change**

		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-V 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	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-V 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	**No Change**
3	**BT103**	**Applied Mathematics I** **UNIT-I** Functions of variables: Geometric	**Applied Mathematics I** **UNIT-I** Functions of variables: Geometric representation,	No Change

		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.	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.	
4	**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.,MaximumPower Transfer Theorems. **UNIT-III**	**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.,MaximumPower Transfer Theorems. **UNIT-III** **AC circuits**: Alternating Quanitities,Introduction, Generation of AC Voltages, Root Mean Square and Average Value of Alternating Currents and Voltages, Form Factor and Peak Factor, Phasor	**No Change**

		AC circuits: Alternating Quanitities,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-PhaseAC 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.	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-PhaseAC 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.	
5	**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	**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	**No Change**

		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.	communication. (C) Barriers to communication, qualities of good communication, the art of listening.	
6	**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	**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	**No Change**

		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-Pbsystems). **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.	system), two component systems (Ag-Pbsystems). **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.	
7	**BT107**	**Electrical and Electronics Lab-I** **List of Experiments** 1. Identification, Study & Testing of various electronic components: (a) Resistances-Various types, Color coding (b) Capacitors-Various 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.	**Electrical and Electronics Lab-I** **List of Experiments** 1. Identification, Study & Testing of various electronic components: (a) Resistances-Various types, Color coding (b) Capacitors-Various 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.	**No Change**

		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 & de soldering practice.	9. Application of diode as clipper and clamper. 10. Soldering & de soldering practice.	
8	**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.	**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	**No Change**

		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.	**13.** The determination of viscosity.	
9	**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.	**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.	**No Change**
10	**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.	**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	**No Change**

		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.	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.	
11	**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	**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**	**No Change**

		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	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	
12	**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	**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**	**No Change**

		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, Meissonier 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.	**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, Meissonier 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.	
13	**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	**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,	**No Change**

		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.	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.	
14	**BT203**	**ENGINEERING MECHANICS** Unit I Force System: Introduction, force, principle c 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	**ENGINEERING MECHANICS** Unit I Force System: Introduction, force, principle of transmis 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,	**No Change**

		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 momentum.	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 momentum.	
15	**BT204**	**<u>Digital Electronics</u>** **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	**<u>Digital Electronics</u>** **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	**No Change**

		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.	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.	
16	**BT205**	**<u>Applied Mathematics II</u>** **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	**<u>Applied Mathematics II</u>** **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.	**No Change**

		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.	**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.	
17	**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.	**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.	No Change
18	**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,	**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	No Change

		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.	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.	
19	**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.	**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.	
20	**BT209**	**COMPUTER PROGRAMMING LAB** **LIST OF EXPERIMENTS** 1. Write a program to calculate the area & perimeter of rectangle.	**COMPUTER PROGRAMMING LAB** **LIST OF EXPERIMENTS** 1. Write a program to calculate the area & perimeter of rectangle.	No Change

		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: 0 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	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: 0 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 20. Addition of two matrices 21. Subtraction of two matrices 22. Finding upper and lower triangular matrices 23. Transpose of a matrix 24. Product of two matrices. 25. Write a program to copy one file to other, use command line arguments.	

		the operation requires one or two matrices 20. Addition of two matrices 21. Subtraction of two matrices 22. Finding upper and lower triangular matrices 23. Transpose of a matrix 24. Product of two matrices. 25. Write a program to copy one file to other, use command line arguments. 26. Write a program to perform the following operators an Strings without using String functions 27. To find the Length of String. 28. To concatenate two string. 29. To find Reverse of a string. 30. To Copy one sting to another string. 31. 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. 32. Write a programmed to count the no of Lowercase, Uppercase numbers and special Characters presents in the contents of File.	26. Write a program to perform the following operators an Strings without using String functions 27. To find the Length of String. 28. To concatenate two string. 29. To find Reverse of a string. 30. To Copy one sting to another string. 31. 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. 32. Write a programmed to count the no of Lowercase, Uppercase numbers and special Characters presents in the contents of File.	
21	**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, Involutes, Archemedian 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.	**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, Involutes, Archemedian 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.	No Change
22	**BT211**	**Communication Skills Lab** 1. Introducing your self.	**Communication Skills Lab** 1. Introducing your self.	No Change

		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.	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.	
23	**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**	**BTME301: ADVANCE ENGINEERING MATHEMATICS-I** **UNIT 1 Numerical Methods –** Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Gauss's forward and backward interpolation formulae. Stirling's Formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae. Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. **UNIT 2 Numerical Methods – 2:** Numerical solution of ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge- Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Solution of polynomial and transcendental equations-Bisection method, Newton-Raphson method and Regula-Falsi method. **UNIT 3 Laplace Transform:** Definition and existence of Laplace transform, Properties of Laplace Transform and formulae, Unit Step function, Dirac Delta function, Heaviside function, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace transforms method. **UNIT 4 Fourier Transform:** Fourier Complex, Sine and Cosine transform, properties and formulae, inverse Fourier transforms, Convolution theorem, application of Fourier transforms to partial ordinary differential equation (One dimensional heat and wave equations only). **UNIT 5 Z-Transform:** Definition, properties and formulae, Convolution theorem, inverse Z transform, application of Z-transform to difference equation.	New Course

		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.		
24	**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, Ericssion 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.	**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, Ericssion 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.	No Change
25	**BTME 303**	**Electronic Measurements and Instrumentation**	**Electronic Measurements and Instrumentation**	No Change

		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'Arsonaval, 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,	**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'Arsonaval, 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.	

		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.		
26	**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 a 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	**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 a 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	No Change

		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.	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.	
27	**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, CO_2 - 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 Bean 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.	**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, CO_2 - 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 Bean 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	No Change

		UNIT V **Powder Metallurgy:** Definition, advantages, limitations and applications, Powder metallurgy processes and operations, metal powders, their characteristics and manufacture		
28	**BTME306**	**Material Science and <u>Engineering</u>** **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	**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	No Change

		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.	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.	
29	**BTME 307**	**Electronic Measurements and Instrumentation Lab** **<u>List of Experiment</u>** 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.	**MSE Lab** **<u>List of Experiments</u>** 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.	Code Change

			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.	
30	**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	**BTME 308 Basic Mechanical Engineering Lab** Exposure to a wide range of applications of mechanical engineering through a variety of activities, including hands-on assembly and disassembly of machines, such as, bicycle, sewing machine, pumps, engines, air-conditioners, machine-tools, amongst others; observational study of complex systems via cut sections, visits, videos and computer simulations; design of simple machines/systems including specifications formulation; visits to industries.	New Course
31	BTME309	**Production Technology Lab** **List of Experiments:** 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.	**Production Technology Lab** **List of Experiments:** 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.	No Change
32	BTME310	**MSE Lab** **List of Experiments** 1. Material types and their characteristic properties a. A comparative study – qualitative b. Examples of materials and their applications	**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.	Code Change

		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.	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.	
33	**BTME 311**	**Machine Drawing** **<u>List of Experiments:</u>** **<u>To prepare Drawing Sheets as mentioned below:</u>** **(a)** Machine Tool Parts: Shaper tool head, Lathe Tail Stock (b) IC. Engine parts: connecting rod, crank shaft, etc,	**Machine Drawing** **<u>List of Experiments:</u>** **<u>To prepare Drawing Sheets as mentioned below:</u>** **(a)** Machine Tool Parts: Shaper tool head, Lathe Tail Stock (b) IC. Engine parts: connecting rod, crank shaft, etc,	No Change
34	**BTME401**	**Fluid Mechanics and Hydraulics**	**<u>BTME401: Kinematics of Machines</u>**	Code Change

		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.	**Unit 1**. Kinematics: Elements, pairs , mechanisms, four bar chain and its inversions,velocity and acceleration, Klein's construction, coriolis component, instantaneous center method **Unit 2.** Synthesis of mechanisms, pantograph, scott-Russel, Tchbeicheff straight line, indicator diagram mechanisms Automotive vehicle mechanisms: Overhead valve mechanism, Davis and Ackerman steering mechanism, Trifler suspension and Hooke'sjoint. **Unit 3.** Power transmission: Belts and ropes, effect of centrifugal force, creep, chain drive Friction: Laws of static, dynamic and rolling friction, dry and viscous friction, inclined plane and screw jack, pivots and friction axis, bearing, Theory of film lubrication. **Unit 4.** Brakes: Band, block and band & block brakes, braking action, braking system of automobiles. Clutches Dynamometers: absorption and transmission type dynamometers, prony, rope and hydraulic dynamometers **Unit 5.** 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.	
35	**BTME402**	**Automobile Engineering** **UNIT I** **FRAME & BODY:** Layout of chassis, types of chassis frames and bodies, their	**Fluid Mechanics and Machines** **UNIT I** Fluid Properties: Definition of a fluid, Viscosity-dynamic and kinematic, Surface Tension Fluid	Content Change and Code Change

		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)	Statics: Basic equation of fluid statics, Manometers, Force on plane areas and curved surfaces, center of pressure, Buoyant force, Stability of floating and submerged bodies. Stability of floating and submerged bodies. **UNIT II** Fluid flow concepts and Basic control volume equations: General control equation, conservation of mass, energy equation and its application, Momentum equation and its applications Basic governing differential equation: Reynolds transport equation, continuity equation, momentum equation, energy equation, Bernoulli's equation. **UNIT III** Viscous flow: Laminar flow through pipe and between parallel plate. Turbulent flow: Relation, Prandle mixing length, Losses in open and closed conduit **UNIT IV** Measurements: Pressure, velocity,flow measurement orifices, venturimenter, orificemeter, nozzle meter, notches and weirs. Flow through pipe: Major and minor Losses in pipe, Hydraulic and energy gradient line, Network of pipes-series and parallel. **UNIT V** Hydraulic Turbines: Classification of hydraulic turbines, work done and efficiencies of Pelton, Francis and Kaplan turbines, Draft tube,Specific speed and unit quantities Hydraulic systems: Hydraulic press, Hydraulic accumulator, Hydraulic Intensifier, Hydraulic Ram, Hydraulic lift, Hydraulic coupling, Hydraulic torque convertor Gear pump.	
36	**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,	**Machining & Machine Tools** **UNIT I** Classification of metal removal process and machines: Concept of generatrix and directrix Geometry of single point cutting tool and tool angles, tool nomenclature in ASA, ORS, NRS and interrelationship. Concept of orthogonal and oblique	New Course

		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.	cutting.Mechanism of Chip Formation: Type of chips. Mechanics of metal cutting; interrelationships between cutting force, shear angle, strain and strain rate. Various theories of metal cutting. Thermal aspects of machining and measurement of chip tool interface temperature. Friction in metal cutting. Introduction to tool geometry of milling cutters and drills. **UNIT II** Concept of machinability, machinability index, factors affecting machinability, Different mechanism of tool wear. Types of tool wear (crater, flank etc), Measurement and control of tool wear, Concept of tool life,Taylor's tool life equation (including modified version). Different tool materials and their applications including effect of tool coating. Introduction to economics of machining. Cutting fluids: Types, properties, selection and application methods **UNIT III** Basic machine tools: Constructional configuration, specifications and estimation of machining time on lathe, drilling, shaping, milling, grinding and broaching machine. Special Purpose Machine Tools: Automatic lathes, capstan and turret lathe machines, operational planning and turret tool layout, sequence of operations. **UNIT IV** Introduction to Grinding-Need and different methods of grinding, Abrasives; natural and synthetic, manufacturing and selection of grinding wheels, Wheel specifications, mounting and dressing. Surface finishing: Honing, lapping, super-finishing, polishing and buffing. Thread Manufacturing: casting; thread chasing; thread cutting on lathe; thread rolling, die threading and tapping; thread milling and thread grinding. **UNIT V** GearManufacturing Processes: hot rolling; stamping; powder metallurgy; extruding etc. Gear generating processes: gear hobbling, gear shaping. Gear finishing processes: shaving, grinding, lapping, shot blasting, phosphate coating, Gear testing. High Velocity Forming Methods: Definition; Hydraulic forming, Explosive forming, Electro-hydraulic forming, Magnetic pulse forming.	
37	**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**	**Design of Machine Elements - I** **UNIT I** Materials: Mechanical Properties and IS coding of various materials, Selection of material from properties and economic aspects Manufacturing Considerations in Design: Standardization, Interchangeability, limits, fits tolerances and surface roughness, BIS codes, Design consideration for cast, forged and machined parts. Design for assembly. **UNIT II**	Content change and Code Change

		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** Charactertics of a good wage or incentive system, method of wage payment, concept of wage incentive schemes: finnancial 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	Design for Strength: Modes of failure, Strength and Stiffness considerations, Allowable stresses, factor of safety, Stress concentration: causes and mitigation, fatigue failures. Design of Members subjected to direct stress: pin, cotter and keyed joints. **UNIT III** Design of Members in Bending: Beams, levers and laminated springs. Design for stiffness of beam: Use of maximum deflection formula for various end conditions for beam design **UNIT IV** Design of Members in Torsion Shaft and Keys: Design for strength, rigidity. Solid and hollow shafts. Shafts under combined loading. Sunk keys Couplings: Design of muff coupling, flanged couplings: rigid and flexible **UNIT V** Design of Threaded fasteners: Bolt of uniform strength, Preloading of bolts: Effect of initial tension and applied loads, Eccentric loading Power screws like lead screw, screw jack Design of members which are curved like crane hook, body of C-clamp, machine frame etc.	
38	**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**	**INDUSTRIAL ENGINEERING** **UNIT I** Concept and definition of Industrial Engineering, Historical development of IE, Role of Industrial Engineer, Applications of IE. Concept of Productivity, Work Study and Productivity, Techniques of work study, basic procedure, approach to method study, method study charts and diagrams, principles of motion economy, **UNIT II** Work measurement; basic procedure, techniques: Stop watch time study and work sampling, rating, determination of standard time, Evolutionof Management Theory, scientific management, Contributions of Taylor, Fayol , Mayo to scientific management, Levels of Management Administration and Management, fundamental functions of	Content Change and Code Change

		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	management, Decision making. **UNIT III** Business Forms and Organization: Forms of Business: Single proprietorship, partnership, joint stock company, co-operative society, State undertakings. Formation of Joint Stock Companies: Registration, issue of Prospectus, Commencement Certificate. Organization: meaning, Types of organization; Line, Functional, Line Staff organization and line Staff Committee organization, span of control. Finance & Financial Statements: Introduction, Needs of Finance, Kinds of Capital, Sources of fixed capital, Shares. Borrow capital, surplus profits. **UNIT IV** Sources of working capital and its management, Profit & Loss Statement, Balance Sheet, Financial ratios: Liquidity ratio, Profits investment ratio, equity ratio, inventory ratio. Time value of money: Simple and compound interest, Time value equivalence, Compound interest factors, Cash flow diagrams, Calculation of time –value equivalences. Present worth comparisons, Comparisons of assets with equal, unequal life, comparison of deferred investments, Time value of money II: Future worth comparison, payback period comparison. Rate of return, internal rate of return, comparison of IRR with other methods **UNIT V** Depreciation: Causes, Basic methods of computing depreciation charges; Straight line, Sinking fund, Declining Balance and Sum of year's digits method. Breakeven analysis: Basic concepts, Linear Breakeven analysis for single product, Breakeven charts, Dumping.	
39	**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**	**I.C. Engines** **UNIT I** History of IC engines: Nomenclature, Classification & Comparison, SI & CI, 4stroke- 2 stroke, First Law analysis, Energy Balance. Fuel-air cycles, Actual cycles. Testing & Performance: Performance parameters, Measurement of operating parameters e.g. speed, fuel & air consumption, Powers, IHP, BHP, FHP, Efficiencies Thermal, Mechanical, Volumetric, Emission Measurement, Indian & International standards of Testing, Emission.	Code Change

		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.	**UNIT II** Fuel & Combustion: Combustion in CI & SI engines, Ignition Limits, Stages of combustion, Combustion parameters. Delay period and Ignition Lag, Turbulence and Swirl, Effects of engine variables on combustion parameters, abnormal combustion in CI & SI engines, Detonation & knocking, Theories of detonation, Control of abnormal combustion, Combustion chamber design principles, Types of combustion chamber. Fuel: Conventional Petroleum, structure, Refining Fuels for SI & CI engines, Knock rating, Additives, Fuels for Turbine & Jet Propulsion. Alternative Fuels: Methanol, Ethanol, Comparison with gasoline, Manufacturing, Engine performance with pure Methanol, Ethanol & blends, Alcohols with diesel engine, Vegetable oils, Bio gas. **UNIT III** Engine Systems & Components: Fuel System (SI Engine), Carburetion & Injection, process & parameters, properties of A/F mixture, Requirements of A/F ratios as per different operating conditions, 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 system: Conventional & Modern ignition systems Magneto v/s Battery, CB point v/s Electronic ignition, Fuel Ignition Energy requirements. Spark advance, centrifugal, vacuum Firing order, spark plugs. **UNIT 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, Areas of heat flow, High temperature regions of combustion chamber. Heat Balance, Cooling Systems, Air, Water Cooling, Cooling system components. Supercharging: Objectives, Thermodynamic cycle & performance of super charged SI & CI engines, Methods of super charging, Limitations, Two stroke engines: Comparison of 4s & 2s engines construction & valve lining scavenging. Process parameters, systems, supercharging of 2 stroke engines. **UNIT V** Dual & Multi fuel engines: Principle, fuels, Combustion, performance Advantages, Modification in fuel system. Special Engines: Working principles of Rotary, Stratified charge, Free piston, Variable compression ratio engines.	
40	**BTME407**	**Fluid Mechanics and hydraulics Lab** **List Of Experiments**	**Kinematics of Machine Lab** **List Of Experiments**	Content Change and Code

		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.	1. To study inversions of four bar chain: Coupling Rod, Beam Engine 2. To study Steering Mechanisms; Davis and Ackerman. 3. Study of quick return mechanism and draw velocity and acceleration diagram. 4. Study of inversion of Double slider chain Oldham Coupling, Scotch Yoke and Elliptical Trammel. 5. Study of various cam-follower arrangements. 6. To plot displacement v/s angle of rotation curve for various cams 7. To determine co-efficient of friction using two roller oscillating arrangement. 8. Study of various types of dynamometers, Brakes and Clutches. 9. To determine moment of inertia of the given object using of Trifler suspension. 10. Perform study of the following using Virtual Lab http://www.vlab.co.in/ 11. Position, velocity and acceleration analysis of Grashof four bar mechanism 12. Position, velocity and acceleration analysis of Slider Crank mechanism	Change
41	**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	**Fluid Mechanics Lab** **List of Experiments:** 1. Determination of Meta-centric height of a given body. 2. Determination of Cd, Cv & Cc for given orifice. 3. Calibration of contracted Rectangular Notch and / Triangular Notch and determination of flow rate. 4. Determination of velocity of water by Pitot tube. 5. Verification of Bernoulli's theorem. 6.Calibration and flow rate determination using Venturimeter & Orifice meter and Nozzle meter 7. Determination of head loss in given length of pipe. 8. Determination of the Reynold's number for laminar, turbulent and transient flow in pipe. 9. Determination of Coefficient for minor losses in pipes. 10. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile. 11. To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.	Content Change, Code Change

42	**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.	**Production Practice-II** **List of Experiments:** 1. To study of single point cutting tool geometry and to grind the tool as per given tool geometry. 2. To study the milling machine, milling cutters, indexing heads indexing methods and to prepare a gear on milling machine. 3. To machine a hexagonal / octagonal nut using indexing head on milling machine. 4. To cut BSW/Metric internal threads on lathe machine. 5. a) To cut multi-start Square/Metric threads on lathe machine. b) Boring using a boring bar in a centre lathe. 6. Study of capstan lathe and its tooling and prepare a tool layout & job as per given drawing. 7. Demonstration on milling machine for generation of plane surfaces and use of end milling cutters. 8. Grinding of milling cutters and drills. 9. Exercise on cylindrical and surface grinders to machine surfaces as per drawing. 10. Cylindrical grinding using grinding attachment in a centre lathe	New Course
43	**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.	**Machine Design Sessional - I** **List of Experiments:** 1. Material selection and relevant BIS nomenclature 2. Selecting fit and assigning tolerances 3. Examples of Production considerations 4. Problems on: (a) Knuckle & Cotter joints (b) Torque: Keyed joints and shaft couplings (c) Design of screw fastening (d) Bending: Beams, Levers etc. (e) Combined stresses: Shafts, brackets, eccentric loading.	Code Change
44	**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	**Thermal Engineering Lab-I** 1. Study of working of four stroke petrol engine and four stroke diesel engine with the help of cut section models. 2. Study of working of two stroke petrol and two stroke diesel engine with the help of cut section models. 3. To draw valve timing diagram for a single cylinder diesel engine. 4. Study of various types of boilers. 5. Study of various types of mountings and	Course Name Change, Content Change

			accessories. 6. Demonstration of steering system and measurement of steering geometry angles and their impact on vehicle performance. 7. Study of braking system with specific reference to types of braking system, master cylinder, brake shoes. 8 . Study of transmission system including clutches, gear box assembly and differential. 9. Study of fuel supply system of a petrol engine (fuel pump and simple carburetor) 10. Study of fuel supply system of a Diesel engine (fuel pump and fuel injector) 11. Study of Ignition systems of an IC Engine (Battery and Magneto ignition system) and Electronic ignition system. 12. Study of Lubrication system of an IC Engine (mist, splash and pressure lubrication) 13. Study of cooling systems of an IC Engine (air cooling and water cooling)	
45	**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	**HEAT TRANSFER** **UNIT I:** Introduction: Heat transfer processes, conduction and radiation. Fourier's law of heat conduction, thermal conductivity, thermal conductivity of solids, liquids and gases, effect of temperature on thermal conductivity. Newton's law of cooling, definition of overall heat transfer coefficient. General parameters influence the value transfer coefficient. Conduction: General 3-Dimensoinal conduction equation in Cartesian, cylindrical and spherical coordinates; different kinds of boundary conditions; nature of differential equations; one dimensional heat conduction with and without heat generation; electrical analogy; heat conduction through composite walls; critical thickness of insulation **UNIT II:** Heat transfer from extended surfaces: Governing differential equation of fin, fin efficiency and effectiveness for different boundary conditions. Unsteady state heat conduction for slab, cylinder and sphere, Heisler chart. Convection: Review of Navier – Stokes and energy equation, hydrodynamic and thermal boundary layers; laminar boundary layer equations; forced convection appropriate non dimensional members; effect of Prandtl number; empirical relations for flow over a flat plate and flow through pipes. **UNIT III:** Natural convection: Dimensional analysis, Grashoff 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	Code Change

		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.	transfer; correlations for saturated liquid vaporization; condensation on flat plates; correlation of experimental results, drop wise condensation. **UNIT IV:** Heat exchanger: Types of heat exchangers, arithmetic and logarithmic mean temperature differences, heat transfer coefficient for parallel, counter and cross flow type heat exchanger; effectiveness of heat exchanger, N.T.U. method, fouling factor. Constructional and manufacturing aspects of Heat Exchangers. **UNIT 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.	
46	**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	**Dynamics of Machines** **UNIT I:** Governors: Comparison between flywheel and governor, Types of governor, Watt, Porter, Proell, Hartnell and spring controlled governors, sensitiveness of governors, stability of governors, isochronous and hunting, governor effort, power, controlling force diagram. **UNIT II:** Gyroscope: Principle of gyroscopic couple, effect of gyroscopic couple and centrifugal force on aero planes, ships and vehicle taking a turn, stabilization of sea vessels, stability of four wheeled vehicle moving in a curved path, curved path with banking, stability vehicle, gyroscopic effect on inclined rotating disc Inertia force analysis: Velocity and acceleration of slider crank and four bar mechanism, inertia force, piston thrust connecting rod, turning moment diagram, and flywheel. **UNIT III:** Gears: Classification, terminology, law of gearing, velocity of sliding, gear tooth profile, comparison of cycloidal and involute tooth profile, standard interchangeable tooth profile, length of path of contact, arc of contact, contact ratio, interference, undercutting, minimum number of teeth on pinion in contact with gear or rack, bevel, helical and spiral gears. **UNIT IV:** Gear Trains: Simple, compound, reverted and epicyclic gear trains, analytical, tabular, graphical and vector methods for finding velocity ratio, gear boxes- sliding and constant mesh, synchromesh and differential gear box. **UNIT V:** Balancing: Need of balancing, Balancing of rotating masses, single plane, different planes, balancing of reciprocating cylinder engine, multi-cylinder inline	Code Change

		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.	engines, V-engines, concept of direct and reverse cranks, partial balancing of locomotives, IC engines, V engines and balancing machines.	
47	**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, Granhoff 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	**Measurement & Metrology** **UNIT I:** Concept of measurement: General concept of measurement, Need for measurement, Generalized measuring system, Units, Standards, Sensitivity, Readability, Range of accuracy, Precision, Accuracy Vsprecision, Uncertainty. Repeatability and reproducibility, Errors in measurement, Types of error, Systematic and random error, Comparison between systematic error and random error, Correction, Calibration, Interchangeability. **UNIT II:** Linear and angular measurements: Linear measuring instruments: Vernier caliper, Micrometer, Interval measurements:- Slip gauges, Checking of slip gauges for surface quality, Optical flat, Limit gauges:- Gauge design, Problems on gauge design, Application of limit gauges; Comparators:- Mechanical comparators, Electrical comparator, Optical comparator, Pneumatic comparator; Sine bar, Use of sine bar, Limitations of sine bars, Sources of error in sine bars, Bevel protractor, Applications of bevel protractor , Autocollimator, Angle Dekkor **UNIT III:** Form measurement: Introduction, Screw thread measurement, Thread gauges, Measurement of gears: Gear errors, Spur gear measurement, Parkinson gear tester, Problems on gear measurement. Surface finish measurement:- Introduction, Elements of surface texture, Analysis of surface finish, Methods of measuring surface finish, Straightness measurement, Flatness testing, Roundness measurements **UNIT IV:** Laser and advances in metrology: Laser metrology, Laser telemetric system, Laser and led based distance measuring instruments, pattern formed in a laser, Principle of laser, Interferometry, Use of laser in interferometry, Laser interferometry. Machine tool metrology: Various geometrical checks on machine tool, Laser equipment for alignment testing, Machine tools tests, Alignment tests on lathe, milling machine, pillar type drilling machine, Acceptance tests for surface grinders, Coordinate measuring machine (CMM):- Types of CMM, Features of CMM, Computer based inspection, Computer aided inspection using robots.	New Course

		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	**UNIT V:** Measurement of power, flow and temperature related properties Measurement of force, Direct methods, Indirect methods:- Accelerometer, Load cells, Bourdon tube. Torque measurement: Prony brake, Torque measurement using strain gauges, Torque measurement using torsion bars, Measurement of power: Mechanical dynamometers, D.C. dynamometer, Eddy current or inductor dynamometers Measurement of flow: Orifice meter, Venturimeter, Flow nozzle, Variable area meters – rotameter, Hot wire anemometer, Pitot tube. Temperature measurement, Bimetallic strip, Calibration of temperature measuring devices, Thermocouples (Thermo electric effects), Thermistors, Pyrometers	
48	**BTME 504**	**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.	**Quality Assurance and Reliability** **UNIT I:** The meaning of Quality and quality improvement, dimensions of quality, history of quality methodology, quality control, Quality of design and quality of conformance, Quality policy and objectives, Economics of quality. Modeling process quality: Describing variation, frequency distribution, continuous and discrete, probability distributions, pattern of variation, Inferences about process quality: sampling distributions and estimation of process parameters. Analysis of variance. **UNIT II:** Statistical Quality Control: Concept of SQC, Chance and assignable causes of variation, statistical basis of control chart, basic principles, choice of control limits, sample size and sampling frequency, analysis of patterns on control charts. The magnificent seven Control chart for variables,: X-bar and R charts, X-bar and S charts, control chart for individual measurement. Application of variable control charts. **UNIT III:** Control chart for attributes: control chart for fraction non conforming P-chart, np-chart, c-chart and u-chart. Demerit systems, choice between attribute and variable control chart. SPC for short production runs. Process capability analysis using histogram and probability plot, capability ratios and concept of six sigma. **UNIT IV:** Quality Assurance: Concept, advantages, field complaints, quality rating, quality audit. Acceptance Sampling: Fundamental concepts in acceptance sampling, operating characteristics curve. Acceptance sampling plans, single, double and multiple sampling plans, LTPD, AOQL, AOQ Introduction to Quality systems like ISO 9000 and ISO 14000. **UNIT V:** Reliability and Life Testing- Failure models of	Code Change

			components, definition of reliability, MTBF, Failure rate, common failure rate curve, types of failure, reliability evaluation in simple cases of exponential failures in series, paralleled and series-parallel device configurations, Redundancy and improvement factors evaluations. Introduction to Availability and Maintainability Introduction to Taguchi Method of Design of Experiments, Quality loss function.	
49	**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	**SOCIOLOGY AND ECONOMICS FOR ENGINEERS** **UNIT I:** Introduction to sociological concepts-structure, system, organization, social institutions, Culture social stratification (caste, class, gender, power).State & civil society. Social change in contemporary India: Modernization and globalization, Secularism and communalism, Nature of development, **UNIT II:** Processes of social exclusion and inclusion, Changing nature of work and organization. Political economy of Indian society. Industrial, Urban, Agrarian and Tribal society; Caste, Class, Ethnicity and Gender; Ecology and Environment **UNIT III:** Basic Principles and Methodology of Economics. Demand/Supply – elasticity –. Theory of the Firm and Market Structure. Basic Macroeconomic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes. **UNIT IV:** Public Sector Economics –Welfare, Externalities, Labour Market. Components of Monetary and Financial System, Central Bank – Monetary Aggregates; Commercial Banks & their functions; Capital and Debt Markets.Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve **UNIT V:** Indian economy Brief overview of post independence period – plans. Post reform Growth, Structure of productive activity. Issues of Inclusion– Sectors, States/Regions, Groups of people (M/F), Urbanization. Employment–Informal, Organized, Unorganized, Public, Private. Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors.	New Course

		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.		
50	**BTME506 A**	**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.	**Computer Aided Design and Graphics** **UNIT I:** Overview of Computer Graphics: Picture representation, Coordinate Systems, Raster Scan Display, DDA for line generation and Bresenham's algorithm for line and circle generation; Graphics standards: GKS, IGES, STEP, DXF. Different types of models. Parametric representation of plane curves: line, circle, ellipse,parabola and hyperbola. **UNIT II:** Parametric representation of Space Curves: Cubic spline curve, Bezier Curve and B Spline Curves. Blending of Curves. Parametric representation of Surfaces: Hermite Bicubic surfaces, Bezier surfaces and Bspline surfaces. **UNIT III:** **Solid Representation:** B-rep. and CSG. Comparison between three types of models. **UNIT IV:** **Two and Three Dimensional Transformation of Geometric Models:** Translation, Scaling Reflection, Rotation and Shearing, Homogeneous Representation, Combined Transformation. **Projection of Geometric models**: Parallel and Perspective Projection. **UNIT V:** **Clipping:** Point clipping, Line clipping, Cohen-Sutherland algorithm etc., Viewing transformation. **Hidden line and surface removal**: Techniques and Algorithms. Shading and Rendering.	New Course
51	**BTME 506B**	**FUNDAMENTAL OF AERODYNAMICS** **UNIT I**	**AUTOMOBILE ENGINEERING** **UNIT I.** **Frame & Body:** Layout of chassis, types of chassis	Code Change

		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; Ranking-Hugoniot relations; increase in entropy; Prandtl's relations; change in stagnation pressure across the shock.	frames and bodies, their constructional features and materials. **Clutches:** single plate, multi-plate, cone clutch, semi centrifugal, electromagnetic, vacuum and hydraulic clutches. Fluid coupling. **Brakes:** Classification and function; Mechanical, hydraulic, vacuum air and self engineering brakes; Brake shoes and lining materials. **UNIT II.** **Gear Boxes**: Sliding mesh, constant mesh, synchromesh and epicyclic gear boxes, Automatic transmission system; Hydraulic torque converter; **Drives**: Overdrive, Propeller shaft, Universal joints, Differential; Rear axle drives. Hotchkiss and torque tube drives; Rear axle types; Front wheel and All wheel drive. **UNIT III** **Wheels and Tyres**: Tyre types, Tyre construction; Tyre inflation pressure, Tyre wear and their causes; Re-treading of the tyre, **Steering system:** steering gear boxes, Steering linkages, Steering mechanism, Under and Over steering. Steering Geometry, Effect of Camber, caster, king pin inclination, toe in and toe out; Power steering; Integral and linkage types **Suspension system:** objective and requirements, Suspension spring, front and rear suspension systems, Independent suspension system Shock absorbers. **UNIT 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 Systems)	
52	**BTME506 C**	**Object Oriented Programming** **UNIT I** Evolution of Programming Paradigms; Structured versus Object-Oriented Development; Elements of Object Oriented Programming – encapsulation, data hiding,	**STATISTICS FOR DECISION MAKING** **UNIT I** Introduction - Statistical Terminology: Descriptive statistics or exploratory data analysis, inferential statistics, population, sample, variable, parameter,	New Course

		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.	statistic, random sample. Collecting Data: Historical data, types of studies (comparative,descriptive or noncomparative, observational, experimental), samplesurveys, sampling and nonsampling errors, bias, representative sample, judgment sampling, quota sampling, simple random samples, sampling rate, sampling frame, stratified random sampling, multistage cluster sampling, probability-proportional-to-size sampling, systematicsampling. **UNIT II** Summarizing and Exploring Data: Variable types (categorical,qualitative, nominal, ordinal, numerical, continuous, discrete, interval, ratio), summarizing categorical data (frequency table, bar chart, Pareto chart, pie chart), summarizing numerical data (mean, median), skewness, outliers, measures of dispersion (quantiles, range, variance, standard deviation, interquartile range, coefficient of variation) s tandardized z-scores, histogram, bivariate numerical data (scatter plot, simple correlation coefficient, sample covariance), straight line regression, summarizing time-series data, data smoothing, forecasting techniques. Basic Concepts of Inference: Estimation, hypothesis testing, pointestimation, confidence interval estimation, estimator, estimate, bias and variance of estimator, mean square error, precision and standard error, confidence level and limits, null and alternative hypothesis, type I and II error, probabilities of type I and II error, acceptance sampling, simple and composite hypothesis, P-value, one-sided and two – sided tests. **UNIT III** Inference for Single Samples: Inference for the mean (large samples), confidence intervals for the mean, test for the mean, sample size determination for the z-interval, one-sided and two -sided z-test, inference for the mean (small samples), t distribution. Inference for Two Samples: Independent sample design, matched pair design, pros and cons of each design, side by side box plots, comparing means of two populations, large sample confidence interval for the difference of two means, large sample test of hypothesis for the difference of two means, inference for small samples (confidence intervals and tests of hypothesis). **UNIT IV** Inference for Proportions and Count Data: Large sample confidence interval for proportion, sample size determination for a confidence interval for proportion, Large sample hypothesis test on proportion, comparing two proportions in the independent sample design (confidence interval and test of hypothesis), chi-square statistic **UNIT V** Simple Linear Regression and Correlation: Dependent and independent variables, probability model for	

			simple linear regression, least squares fit, goodness of fit of the LS line, sums of squares, analysis of variance, prediction of future observation, confidence and prediction intervals, Multiple Linear Regression: Probability model for multiple linear regression, least squares fit, sums of squares. Use Excel, R, and MATLAB®_in the class.	
53	**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.	**Heat Transfer Lab** 1.To Determine Thermal Conductivity of Insulating Powders. 2. To Determine Thermal Conductivity of a Good Conductor of Heat (Metal Rod). 3. To determine the transfer Rate and Temperature Distribution for a Pin Fin. 4. To Measure the Emissivity of the Test plate Surface. 5. To Determine Stefan Boltzmann Constant of Radiation Heat Transfer. 6. To Determine the Surface Heat Transfer Coefficient For Heated Vertical Cylinder in Natural Convection. 7. Determination of Heat Transfer Coefficient in Drop Wise and Film Wise condensation. 8. To Determine Critical Heat Flux in Saturated Pool Boiling. 9. To Study and Compare LMTD and Effectiveness in Parallel and Counter Flow Heat Exchangers. 10. To Find the Heat transfer Coefficient in Forced Convection in a tube. 11. To study the rates of heat transfer for different materials and geometries 12.To understand the importance and validity of engineering assumptions through the lumped heat capacity method.	Content Change, Course Name Change
54	**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=Iωωp 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.	**Dynamics of Machines Lab** 1.To verify the torque relation for gyroscope. 2. To plot force vs. radius and lift vs. speed curves for governors. 3. To plot pressure distribution curves on a journal bearing. 4. To perform wheel balancing. 5. To perform static and dynamic balancing on balancing set up. 6. To determine mass moment of inertia of a flywheel. 7. Study of a lathe gear box. 8. Study of a sliding mesh automobile gear box. 9. Study of a planetary gear box.	No Change

55	**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.	**PRODUCTION ENGG. Lab** 1.Study of various measuring tools like dial gauge, micrometer, Vernier caliper and telescopic gauges. **2.**Measurement of angle and width of a V-groove by using bevel protector.. **3.** (a) To measure a gap by using slip gauges (b) To compare & access the method of small-bore measurement withthe aid of spheres. **4.** Measurement of angle by using sine bar. **5.**(a) Measurement of gear tooth thickness by using gear tooth Vernier caliper. (b) To check accuracy of gear profile with the help of profile projector. **6.**To determine the effective diameter of external thread by using threewire method. **7.**To measure flatness and surface defects in the given test piece with the help of monochromatic check light and optical flat. **8.**To check the accuracy of a ground, machined and lapped surface - (a)Flat surface (b) Cylindrical surface. **9.**Find out Chip reduction co-efficient (reciprocal of chip thickness ratio) during single point turning. **10.** Forces measurements during orthogonal turning. **11.** Torque and Thrust measurement during drilling. **12.** Forces measurement during plain milling operation. **13.**Measurement of Chip tool Interface temperature during turning using thermocouple technique.	Code Change, Content Change
56	**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	**Professional Ethics and Disaster Management** **1.Human values:** Effect of Technological Growth and Sustainable Development. Profession and Human Values: Values crisis in contemporary society. Nature of values. Psychological Values, Societal Values and Aesthetic Values. Moral and Ethical values. **2.Professional ethics:** Professional and Professionalism-Professional Accountability, Role of a professional, Ethic and image of profession; Engineering Profession and Ethics: Technology and society, Ethical obligations of Engineering professionals, Roles of Engineers in industry, society, nation and the world; Professional Responsibilities: Collegial_Loyalty, Confidentially, Conflict of Interest, Whistle Blowing. **3 Disaster management:** Understanding Disasters and Hazards and related issues social and	New Course

		given MS rod. 8. Study of capstan lathe and its tooling and prepare a tool layout & job as per given drawing.	environmental. Risk and Vulnerability. Types of Disasters, their occurrence/ causes, impact and preventive measures: Natural Disasters- Hydro-meteorological Based Disasters like Flood, Flash Flood, Cloud Burst, Drought, Cyclone, Forest Fires; Geological Based Disasters like Earthquake, Tsunami, Landslides, Volcanic Eruptions. **Man made Disasters:** Chemical Industrial Hazards, Major Power Break Downs, Traffic Accidents, Fire Hazards, Nuclear Accidents. Disaster profile of Indian continent. Case studies. Disaster Management Cycle and its components. **4** In order to fulfill objectives of course, a) The institute shall be required to organize at least 3 expert lectures by eminent social workers/professional leaders. b) Each student shall compulsorily be required to: i. Visit a social institution/NGO for at least 7 days during the semester and submit a summary report. ii. Perform a case study of a disaster that has occurred in last decade and submit a summary report.	
57	**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	-	
58	**BTME601**	**REFRIGERATION AND AIR CONDITIONING** **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	**BTME601: DESIGN OF MACHINE ELEMENTS- II** **I** **Fatigue Considerations in Design:** Variable load, loading pattern, endurance stresses, Influence of size, surface finish, notch sensitivity and stress concentration. Goodman line, Soderberg line, Design of machine members subjected to combined, steady and alternating stresses. Design for finite life, Design of Shafts under Variable Stresses, Bolts subjected to variable stresses. **II** **Design of IC Engine components:** Piston, Cylinder, Connecting Rod and Crank Shaft. **III** Design of helical compression, tension, torsional springs, springs under variable stresses. **4** Design of belt, rope and pulley drive system, **Design of gear teeth:** Lewis and Buckingham equations, wear and	Code Change

		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.	dynamic load considerations. Design and force analysis of spur, helical, bevel and worm gears, Bearing reactions due to gear tooth forces. **V** **Design of Sliding and Journal Bearing:** Methods of lubrication, hydrodynamic, hydrostatic, boundary etc. Minimum film thickness and thermal equilibrium. **Selection of anti-friction bearings** for different loads and load cycles, Mounting of the bearings, Method of lubrication.	
59	**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	**NEWER MACHINING METHODS** **I** Introduction and classification of advanced machining process, consideration in process selection, difference between traditional and non-traditional process, Hybrid process. **Abrasive finishing processes**: AFM, MAF (for Plain and cylindrical surfaces). **II** **Mechanical advanced machining process**: Introduction, Mechanics of metal removal, process principle, Advantages, disadvantages and applications of AJM,USM,WJC. **III** **Thermo electric advanced machining process**: Introduction, Principle, process parameters,advantages, disadvantages and applications about EDM, EDG, LBM, PAM, EBM **IV** **Electrochemical and chemical advanced machining process**: ECM, ECG, ESD, Chemical machining, Anode shape prediction and tool design for ECM process. Tool (cathode) design for ECM Process. **V**	New Course

		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.	Intorduction to Micro and nanomachining, Nanoscale Cutting, Diamond Tools in Micromachining, Conventional Processes: Microturning, Microdrilling and Micromilling, Microgrinding, Non-Conventional Processes: Laser Micromachining, Evaluation of Subsurface Damage in Nano and Micromachining, Applications of Nano and Micromachining in Industry.	
60	**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**	**MECHATRONICS** **I** **Introduction:** Introduction, scope and applications of Mechatronics systems. Process control automation, FMS and CNC Machines. **MEMS:** Basics of Micro- and Nanotechnology, microprocessor-based controllers and Microelectronics **II** **Introduction to Sensors:** Linear and Rotational Sensors, Acceleration, Force, Torque, Power, Flow and Temperature Sensors, Light Detection, Image, and Vision Systems, Integrated Micro-sensors, **Introduction to Actuators:** Electro-mechanical Actuators, Electrical Machines, Piezoelectric Actuators, Hydraulic and Pneumatic Actuation Systems, MEMS: Micro-transducers Analysis, Design and Fabrication. **III** **Systems and Controls:** The Role of Controls in Mechatronics, Role of Modelling in Mechatronics Design, Signals and Systems: Continuousand Discrete-time Signals, Z-Transforms and Digital Systems, Continuous- and Discrete-time State-space Models. **Advanced Control Systems:** Digital Signal Processing for Mechatronics Applications, Control System Design, Adaptive and Nonlinear Control Design, Neural Networks and Fuzzy Systems, Design Optimization of Mechatronics Systems. **IV**	New Course

		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 offriction 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.	**Data Acquisition and related Instrumentation:** Introduction to Data Acquisition Measurement Techniques: Sensors and Transducers, Quantizing theory, Analog to Digital Conversion, Digital to Analog (D/A) conversation, Signal Conditioning. **Real time Instrumentation:** Computer-Based Instrumentation Systems, Software Design and Development, Data Recording and Logging. **V** **Design of Mechatronics systems:** Introduction of mechatronics systems: Home appliances, ABS (anti-lock braking system) and other areas in automotive engineering, Elevators and escalators, Mobile robots and manipulator arms, Sorting and packaging systems in production lines, Computer Numerically Control (CNC) production machines, Aeroplanes and helicopters, Tank fluid level and temperature control systems.	
61	**BTME604**	**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	**VIBRATION ENGINEERING** **I** **Introduction to Sound:** Frequency dependent human response to sound, Sound pressure dependent human response, Relationship among sound power, sound intensity and sound pressure level. **Introduction to Noise:** Auditory and Non auditory effects of Noise, Major sources of the noise, Industrial noise sources, Industrial noise control strategies. **Introduction to Vibration:** Importance and scope of vibrations, terminology and classification, Concept of Degrees of freedom, Harmonic motion, vectorial representation, complex number representation, addition. **II** **Undamped Single Degree of Freedom System:** Derivation of equation of motion for one dimensional longitudinal, transverse and torsional vibrations without damping using Newton's second law, D' Alembert's principle and Principle of conservation of energy, Compound pendulum and centre of percussion. **Damped vibrations of single degree of freedom systems:** Viscous damping, under-damped, critically damped and over-damped systems, Logarithmic decrement. Vibration characteristics of Coulomb damped system and Vibration characteristics of Hysteretic damped systems. **III** **Forced Vibrations of Single Degree of Freedom**	Course Name Change, Content Change

		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,	**Systems:** Forced vibration with constant harmonic excitation, Steady state and transient parts, Frequency response curves and phase angle plot, Forced vibration due to excitation of support. **Vibration Isolation and Transmissibility:** Force transmissibility, Motion transmissibility, Forced vibration with rotating and reciprocating unbalance, Materials used in vibration isolation. **IV** **System with Two Degrees of Freedom:** principle mode of vibration, Mode shapes, Undamped forced vibrations of two degrees of freedom system with harmonic excitation, Vibration Absorber, Undamped dynamic vibration absorber and centrifugal pendulum absorber **Critical Speed of Shaft:** Critical speed of a light shaft without damping, critical speed of shaft having multiple discs, secondary critical speed. **V** **Many Degrees of Freedom Systems (Exact analysis)**: Equation of Motion, The matrix method, Eigen Values and Eigen Vectors, Method of influence Coefficients and Maxwell's reciprocal theorem. Torsional vibrations of multi rotor system, vibrations of geared system, Generalized coordinates and coordinate coupling **Many Degrees of Freedom Systems (approximate methods**): Rayleigh's, Dunkerley's, Stodola's and Holzer's methods **Vibrations of continuous systems:** Transverse vibration of a string, Longitudinal vibration of a bar, Torsional vibration of a shaft.	
62	**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	**STEAM ENGINEERING** **I** **Steam generators:** Classification of Boilers, water and fire tube boilers, High pressure boilers, Advantages of high pr. Boilers, Natural and forced circulation boilers, Water wall. Steam drum internal, steam super heaters, Economizers, air preheater, induced, forced and balanced draught boilers, Fluidized bed boilers **II** Definition and type of nozzle and diffuser equation of continuity, sonic velocity, mach no. and stagnation properties, the steady flow energy equation for nozzles, momentum energy equation for flow through steam nozzles nozzle efficiency, effect of friction, nozzle for uniform pressure drop, throat pressure for maximum discharge or chock flow, critical pressure ratio, design of nozzle and diffuser. **III** **Steam Turbines:** Principle and working of steam turbines, type of turbines, compounding for pressure and velocity. Overview and difference of various type of turbine, different types of governing of turbines.	Code Change

		modeling, Monte Carlo simulation, simulation language ARENA,	**Impulse turbine:** The effect of blade friction on velocity diagram. Force, work and power, Blade or diagram efficiency, Gross stage efficiency, steam speed to blade, speed ratio for optimum performance, turbine performance at various loads **IV** **Impulse reaction turbine:** Velocity diagram and work done , degree of reaction, Parson turbine, blade efficiency, gross stage efficiency comparison of enthalpy drop in various stages, size of blades in impulse reaction turbines for various stages of impulse reaction and impulse turbine. **Regenerative Feed Heating Cycles**: Introduction, Ideal regenerative feed heating cycle, Regenerative heating cycles and their representation on T-s and h-s Diagram, Representation of actual process on T-s and h-s Diagram Regenerative cycles, types of feed heating arrangements, Optimum feed water temperature and saving in Heat Rate. directcontact and surface heaters. **V** **Reheating of steam**: Practical reheating and Non-reheating cycles, advantage and disadvantages of reheating, reheat regenerative cycle, regenerative water extraction cycles. Process heat and by product power cycle, pass out turbine, Binary vapour cycle. Condensers.	
63	**BTME606. A**	**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	**NON DESTRUCTIVE EVALUATION AND TESTING** **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. **Visual Inspection:** Basic Principle and Applications. **Liquid Penetrant Testing:** Principle, Procedure and Test Parameters, Materials, Limitations and Applications. **II** **Radiographic Inspection:** Principles of X – ray radiography, equipment, Absorption, Scattering, X-ray film processing, General radiographic procedures, Reading and Interpretation of Radiographs, Industrial radiographic practice, Limitations and Applications, Welding defects detection. Gamma ray radiography. **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. **IV**	Code Change

		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).	**Magnetic Particle Inspection:** Methods of generating magnetic field, Demagnetization of materials, Magnetic particle test: Principle, Test Equipment and Procedure, Interpretation and evaluation. Introduction to Accostic Emission Testing and Thermography. **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	
64	**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	**DESIGN AND MANUFACTURING OF PLASTIC PRODUCTS** **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. **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 **III** Polymer processing techniques such as extrusion, compression and transfer moulding. Injection moulding, blow moulding, thermoforming, rotational moulding, calendaring. **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, SheetMetal Nuts, Specialty Plastic Fasteners	Code Change

		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	**V** Machining of Plastics: Drilling and Reaming,Thread Tapping, Sawing, Milling, Turning, Grinding. Finishing and Decorating of Plastics: Painting, Vacuum Metallizing and Sputter Plating, Electroplating, Flame Spraying/Arc Spraying, Hot Stamping	
65	**BTME606.C**	**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	**MAINTENANCE MANAGEMENT** **I** Introduction -Fundamentals of Maintenance Engineering. Maintenance Engineering its importance in material & energy conservation, inventory control, productivity, safety, pollution control etc. Safety Regulations, pollution problems, human reliability, total quality management (TQM), total productivity maintenance (TPM), environmental issues in maintenance, ISO 9000. **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, organisation of maintenance department. **III** Tribology in Maintenance, friction wear and lubrication, friction & wear mechanisms, prevention of wear, types of lubrication mechanisms, lubrication processes. Lubricants - types, general and special purpose, additives, testing of lubricants, degradation of lubricants, seal & packings. Repair methods for basic machine elements: Repair methods for beds, slideways, spindles, gears, lead screws and bearings– Failure analysis– Failures and their development– Logical fault location methods– Sequential fault location. **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. **V** Reliability, availability & maintainability (RAM) Analysis – Introduction to RAM failure mechanism, failure data analysis, failure distribution, reliability of repairable and non repairable systems. Improvement	New Course

		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	in reliability, reliability testing, reliability prediction, utilisation factor, system reliability by Monte Carlo Simulation Technique.	
66	**BTME607**	**REFRIGERATION & AIR CONDITIONING LAB** **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.	**MACHINE DESIGN SESSIONAL-II** **Problems on:** **1** Fatigue loading. **2** Helical compression, tension and torsional springs design. **3** Curved Beams. **4** Preloaded bolts and bolts subjected to variable stresses. **5** Belt, Rope and Chain drive system. **6** Gear Design. **7** Sliding contact bearing design. **8** Anti-friction bearing selection	New Course
67	**BTME608**	**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.	**INDUSTRIAL ENGINEERING LAB-I** **1** Case study on X bar charts and process capability analysis **2** P Chart: (a)Verify the Binomial Distribution of the number of defective balls by treating the balls with a red colour to be defective. (b) Plot a P-chart by taking a sample of n=20 and establish control limits **3** To plot C-chart using given experimental setup **4** Operating Characteristics Curve: (a) Plot the operating characteristics curve for single sampling attribute plan for n = 20 ; c = 1 , 2 , 3 Designate the red ball to defective. (b) Compare the actual O.C. curve with theoretical O.C. curve using approximation for the nature of distribution	New Course

			5 Distribution Verification: (a) Verification of Normal Distribution. (b) To find the distribution of numbered cardboard chips by random drawing one at a time with replacement. Make 25 subgroups in size 5 and 10 find the type of distribution of sample average in each case. Comment on your observations **6** Verification of Poisson distribution **7** Central Limit Theorem: (a) To show that a sample means for a normal universe follow a normal distribution (b) To show that the sample means for a non normal universe also follow a normal Distribution. **8** Solve problems using available Statistical Process Control software in lab	
68	**BTME609**	**MECHANICAL 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.	**MECHATRONICS LAB** **1**Study the following devices (a) Analog & digital multimeter (b) Function/ Signal generators (c) Regulated d. c. power supplies (constant voltage and constant current operations) **2** Displacement Measurement using Capacitive & inductive Pick –ups. **3** Study of Speed Measurement System: (a) Magnetic Pick-up (b) Stroboscope **4** Study of Load Measurement System Load Cell **5** Measurement of temperature using thermocouple, thermistor and RTD **6** Measurement of displacement using POT, LVDT & Capacitive transducer **7** Torque measurement using torque measuring devices **8** Strain Measurement using strain gauge **9** Frequency to Voltage Converter and vice versa **10** Position and velocity measurement using encoders **11**Study on the application of data acquisition system for industrial purposes **12** Speed control of DC motor using PLC. **13** Study of Load Measurement System Load Cell	New Course
69	**BTME610**	**HYDRAULIC MACHINES AND HYDRAULIC POWER PLANT 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	**VIBRATION ENGINEERING LAB.** **1** To verify relation T = 2R□□(l/g) for a simple pendulum. **2** To determine radius of gyration of compound pendulum. **3** To determine the radius of gyration of given bar by using bifilar suspension. **4** To determine natural frequency of a spring mass system. **5** Equivalent spring mass system. **6** To determine natural frequency of free torsional vibrations of single rotor system. i. Horizontal rotor	Code Change, Content Change

		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 To Study the performance characteristics of the Hydraulic Ram	ii. Vertical rotor **7** To verify the Dunkerley's rule. **8** Performing the experiment to find out damping co-efficient in case of free damped torsional vibration **9** To conduct experiment of trifler suspension. **10** Harmonic excitation of cantilever beam using electro-dynamic shaker and determination of resonant frequencies. **11** Study of Vibration measuring instruments. **12** Perform study of the following using Virtual Lab http://www.vlab.co.in/ **13** Forced Vibration of a Cantilever Beam with a Lumped Mass at Free End: To calculate the natural frequency and damping ratio for forced vibration of a single DOF cantilever beam system, experimentally; and compare the results with theoretical values. **14** Harmonicaly Excited Forced Vibration of a Single DOF System: To analyze the forced vibration response of a single DOF system at different damping ratio and frequency ratio. **15** Perform study of the following using Virtual Lab http://www.vlab.co.in/ **16** Forced Vibration of a Cantilever Beam with a Lumped Mass at Free End: To calculate the natural frequency and damping ratio for forced vibration of a single DOF cantilever beam system, experimentally; and compare the results with theoretical values. **17** Harmonicaly Excited Forced Vibration of a Single DOF System: To analyze the forced vibration response of a single DOF system at different damping ratio and frequency ratio.	
70	BTME 701	PROJECT INDUSTRIAL TRAINING /	**BTME701: FINITE ELEMENT METHODS** **I** Introduction to FEM and its applicability, Review of :Matrix algebra, Gauss elimination method, Uniqueness of solution, Banded symmetric matrix and bandwidth. Structure analysis: Two-force member element, Local stiffness matrix, coordinate transformation, Assembly, Global stiffness matrix, imposition of Boundary conditions, Properties of stiffness matrix **II** One-dimensional Finite Element Analysis: Basics of structural mechanics, stress and strain tensor, constitutive relation, Principle of minimum Potential, General steps of FEM, Finite element model concept / Discretization, Derivation of finite elements, equations using potential energy approach for linear and quadratic 1-D bar element, shape functions and their properties, Assembly, Boundary conditions, Computation of stress and strain. **III** Two Dimensional Finite Element Analysis: Finite element formulation using three nodded triangular	New Course

			(CST) element , Plane stress and Plain strain problems, Shape functions, node numbering and connectivity, Assembly, Boundary conditions, Isoparametric formulation of 1-D bar elements, Numerical integration using gauss quadrature formula, computation o tress and strain. **IV** Finite Element Formulation from Governing Differential Equation: Method of Weighted Residuals, Collocation, Sub domain method, Least Square method and Galerkin's method, Application to one dimensional problems, one-dimensional heat transfer, etc. introduction to variational formulation (Ritz Method.) **V** Higher Order Elements: Lagrange's interpolation formula for one and two independent variable, Convergence of solution, compatibility, element continuity, static condensation, p and h methods of mesh refinement, Aspect ratio and element shape, **5** Application of FEM, Advantages of FEM, Introduction to concept of element mass matrix in dynamic analysis.	
71	**BTME702**	-	**REFRIGERATION AND AIR CONDITIONING** **I** **Introduction:** Refrigeration and second law of Thermodynamics, Refrigeration effect and unit of Refrigeration, Heat pump, reversed Carnot cycle. **Vapour Compression Refrigeration System:** Analysis of simple vapour compression Refrigeration cycle by p-h and T-S diagram. Effect of operating conditions **Multiple Evaporator and compressor system:** Application, air compressor system, Individual compressor, compound compression, cascade system. Application, air compressor systems, individual compressor, compound compression, cascade system. **II** **Gas Cycle Refrigeration:** Limitation of Carnot cycle with gas, reversed Brayton cycle, Brayton cycle with regenerative heat exchanger. Air cycle for air craft: Necessity of cooling of air craft, Basic cycle, boot strap, regenerative type air craft refrigeration cycle. **III** **Other refrigeration systems** (description only): Vapour absorption refrigeration system, Electrolux refrigerator, Lithium Bromide – Water system, Water vapour refrigeration system, Vortex tube refrigeration system, thermo electric refrigeration system. **Refrigerants:** Classification, Nomenclature, selection of Refrigerants, global warming potential of CFC Refrigerants. Refrigeration Equipments: Compressor, condenser,	Code Change

			evaporator, expansion devices, types & working. **IV** **Psychrometry:** Psychrometric properties, psychometric relations, pyschrormetric charts, psychrometric processes, cooling coils, By-pass factor, Apparatus Dew point temperature and air washers. **Human Comfort:** Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart. **V** **Cooling load calculations:** Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychrometric calculation for cooling. **Selection of air conditioning:** Apparatus for cooling and dehumidification, Air conditioning system, year round air conditioning.	
72	**BTME703**		**OPERATIONS RESEARCH** **I** **Overview of Operations Research** **Linear Programming**: Applications and model formulation, Graphical method, Simplex method, duality and Sensitivity analysis. Transportation Model and Assignment Model including travelling salesman problem. **II** **Integer Linear Programming:** Enumeration and cutting Plane solution concept, Gomory's all integer cutting plane method, Branch and Bound Algorithms, applications of zero-one integer programming. **Replacement Models:** Capital equipment replacement with time, group replacement of items subjected to total failure. **III** **Queuing Theory**: Analysis of the following queues with Poisson pattern of arrival and exponentially distributed service times, Single channel queue with infinite customer population, Multichannel queue with infinite customer population, **Competitive Situations and Solutions**: Game theory, two person zero sum game, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy, approximate solution, and simplified analysis for other competitive situations. Application of linear programming **IV** Theory of Decision making: Decision making under certainty, risk and uncertainty. Decision trees. **Deterministic Inventory control models:** functional role of inventory, inventory costs, model building, Single item inventory control model without shortages, with shortage and quantity discount.	Code Change

			Inventory control model with uncertain demand, service level, safety stock, P and Q systems, two bin system. Single period model. Selective Inventory control techniques. **V** **Probabilistic Inventory control models:** Instantanoues demand without setup cost and with setup cost, Continuous demand without setup cost **Simulation**: Need of simulation, advantages and disadvantages of simulation method of simulation. Generation of Random numbers, Generation of Normal Random numbers. Use of random numbers for system simulation. , Monte Carlo simulation, simulation language ARENA, Application of simulation for solving queuing Inventory Maintenance, Scheduling and other industrial problems	
73	**BTME704**		**TURBOMACHINES** **I** **Basic Concepts of Turbo Machines:** Definition & classification of Turbo machine, Basic laws and governing equations: continuity equation, steady flow energy equation(1st law of thermodynamics),2nd law of thermodynamics applied to turbo machines, Newton's 2nd law of motion applied to turbomachines - Euler's pump equation and Euler's turbine equation Dimensional analysis applied to hydraulic machines, power coefficient, flow coefficient, head coefficient, non-dimensional specific speed, Range of specific speeds for various turbo machines, Dimensional analysis applied to compressible flow machines, pressure ratio as a Function of temperature ratio, mass flow rate parameter and speed parameter **II** **Centrifugal Compressors and Fans:** Components and description, velocity iagrams, slip factor, energy transfer, power input factor, stage pressure rise and loading coefficient, pressure coefficient, degree of reaction, Centrifugal compressor characteristic, surging, rotating Stalland Choking **Axial Flow Compressors and Fans:** Basic constructional features, Advantages of axial flow compressors, working principle, velocity triangle, elementary theory, stage work, work done factor, stage loading, degree of reaction; vortex theory, simple design calculations, introduction to blade design, cascade test, compressibility effects, operating characteristics **Reciprocating Compressors:** Basic constructional features, working principle, work done calculation, single and double acting compressors **III** **Centrifugal Pumps:** Main parts, work done and	Code Change

			velocity triangles, slip and slip factor, pump losses and efficiencies, minimum starting speed,net positive suction head, performance curve. **Axial Flow Pumps:** Description, velocity triangles, work done on the fluid, energy transfer, axial pump characteristics, cavitation. **Reciprocating Pumps:** Classification, component and working, single acting and double acting, discharge, work done and power required, coefficient of discharge, indicator diagram, slip, effect of friction and acceleration, theory of air vessels. **IV** **Gas power cycles**: Ideal and practical gas turbine cycle, heat exchange cycle, reheat cycle, intercooled cycle, Comparison of various cycles. **Thermodynamic Cycles**: Advantages, disadvantages and performance characteristics of Ram jet engine, pulse jet engine, turbo prop engine, turbo jet engine, turbo fan engine, Calculation of specific thrust and efficiency **V** **Gas Turbines:** impulse and reaction type gas turbines, Velocity triangles and calculation of work done, efficiency etc.	
74	**BTME705**		**OPERATIONS MANAGEMENT** **I** Introduction to operations management (OM), the scope of OM; Historical evolution of OM; Trends in business; the management process. Operations Strategy, Competitiveness and Productivity Demand Forecasting: components of forecasting demand, Approaches to forecasting: forecasts based on judgment and opinion, Time series data. Associative forecasting techniques, Accuracy and control of forecasts, Selection of forecasting technique. **II** Product and Service design, Process selection, Process types, Productand process matrix, Process analysis.Capacity Planning: Defining and measuring capacity, determinants of effective capacity, capacity strategy, steps in capacity planning process, determining capacity requirements, Capacity alternatives, Evaluation of alternatives; Cost-Volume analysis. **III** Facility Location: Need for location decisions, factors affecting location, qualitative and quantitative techniques of location. Facilities layout: Product, Process, Fixed position, combination and cellular layouts; Designing product and process layout, line balancing. Material Handling Planning levels: long range, Intermediate range and Short range planning, Aggregate planning: Objective,	Code Change

			Strategies, and techniques of aggregate planning. Master scheduling; Bill of materials, MRP; inputs processing and outputs, and overview of MRPII , use of MRP to assist in planning capacity requirements, Introduction to ERP **IV** Production Control: Capacity control and priority control, production control functions; Routing, scheduling, dispatching, expediting and follow up. Techniques of production control in job shop production, batch production and mass production systems. sequencing: priority rules, sequencing jobs through two work centers, scheduling services Introduction to Just-in-time (JIT) and Lean Operations: JIT production, JIT scheduling, synchronous production, Lean operations system **V** Supply Chain Management (SCM): Need of SCM, Bullwhip effect, Elements of SCM, Logistics steps in creating effective supply chain, Purchasing and supplied management. **Project Management:** Nature of projects, project life cycle, Work breakdown structure, PERT and CPM, Time-Cost trade-offs: Crashing. Resource allocation, leveling	
75	**BTME706. A**		**MICRO AND NANO MANUFACTURING** **I** Nanoscale Cutting:- Introduction, Material representation and microstructure, Atomic interaction; Nonomachining:- Introduction, Nanometric machining, Theoretical basis of machining; Meso-micromcahining:- Introduction, size effects in micromachining, mechanism for large plastic flow, origin of the size effect, Mesomachining processes. Product quality in micromachining, Burr formation in micromachining operations. **II** Microturning:- Characteristic features and applications, Microturning tools and tooling systems, Machine tools for microturning **Microdrilling:** Characteristic features and applications, Microdrills and tooling systems, Machine tools for microdrilling Micromilling:- Characteristic features and applications, Micromills and tooling systems, Machine tools for micromilling, Micro machining high aspect ratio microstructures, micromolding, micromolding processes, micromolding tools, micromold design, micromolding applications, limitations of micromolding. **III** **Microgrinding and Ultra-precision Processes:** Introduction, Micro and nanogrinding, Nanogrinding apparatus, Nanogrinding procedures, Nanogrinding tools, Preparation of nanogrinding wheels, Bonding systems, Vitrified bonding **Non-Conventional Processes:** Laser Micromachining:- Introduction, Fundamentals of lasers, Stimulated	New Course

			emission, Types of lasers, Laser microfabrication, Nanosecond pulse microfabrication, Shielding gas, Effects of nanosecond pulsed microfabrication, Picosecond pulse microfabrication, Femtosecond pulse microfabrication, Laser nanofabrication. **IV** **Diamond Tools in Micromachining:** Introduction, Diamond technology, Hot Filament CVD (HFCVD), Preparation of substrate, Selection of substrate material, Pre-treatment of substrate, Modified HFCVD process. Deposition on complex substrates, Diamond deposition on metallic (molybdenum) wire, Deposition on WC-Co microtools, Diamond deposition on tungsten carbide, (WC-Co) microtool, Performance ofdiamond-coated microtool **V** **Evaluation of Subsurface Damage in Nano and Micromachining:** Introduction, Destructive evaluation technologies, Cross-sectional microscopy, Preferential etching, Angle lapping/angle polishing, X-ray diffraction, Micro-Raman spectroscopy. **Applications of Nano and Micromachining in Industry:** Introduction, Typical machining methods, Diamond turning, Shaper/planner machining, Applications in optical manufacturing, Aspheric lens, Fresnel lens, Microstructured components, Semiconductor wafer production.	
76	**BTME706.B**	-	**ROBOTICS** **I** **Introduction to Robotics:** Evolution of Robots and Robotics, Laws of Robotics, What is and What is not a Robot, Progressive Advancement in Robots. Robot Anatomy, Human Arm Characteristics, Design and Control Issues, Manipulation and Control, Sensors and Vision, ProgrammingRobots, The Future Prospects, Notations. **II** **Robot End Effectors:** Classification of end effectors, drive system for grippers, Mechanical, Magnetic, Vaccum, Adhesive grippers, Hooks, Scoops, Miscellaneous devices, Gripper force analysis and Design, Active and Passive Gripeers **Coordinate Frames, Mapping and Transforms:** Coordinate Frames, Description of Objects in Space, Transformation of Vectors, Inverting a Homogeneous Transform, Fundamental Rotation Matrices. **III** **Symbolic Modeling of Robots:** Direct Kinematic Model, Mechanical Structure and Notations, Description of Links and Joints, Kinematic Modeling of the Manipulator, Denavit – Hartenberg Notation, Kinematic	New Course

			Relationship between Adjacent Links, Manipulator Transformation Matrix. Introduction to Inverse Kinematic model, Solvability of Inverse Kinematics model, Solution techniques. **IV** **Robotic Sensors:** The Meaning of Sensing, Sensors in Robotics, Kinds of Sensors used in Robotics, Choosing the right sensors **Robotic vision:** Introduction to Robotic Vision, Industrial Applications of Vision-Controlled Robotic Systems, Process of Imaging, Architecture of Robotic Vision Systems, Image Acquisition, Image Representation and Image Processing **V** **Robot Applications:** Industrial Applications, Material Handling, Processing Applications, Assembly Applications, Inspection Application, Principles for Robot Application and Application Planning, Justification of Robots, Robot Safety, Non-Industrial Applications. **Robot Programming:** Robot languages, Classification of Robot language, Computer control and robot software, VAL system and language	
77	**BTME706.C**		**CNC MACHINES AND PROGRAMMING** **I** Introduction: Definition of NC, Applications of NC ,Historical Developments in Automation, Classification of NC Systems, Comparison of NC and Conventional Machines, Advantages of NC **II** NC Hardware: Architecture of NC Systems, Design Considerations, Mechanical Elements, Structure, Guideways and Slides, Guideway Elements, Transmission Systems, Spindle Unit, Coolant system, Lubrication System, Tool and work Changing Mechanisms, Electrical Elements, Drives, Sensors, Control Loops, Computing Elements/ Firmware, Interpolators **III** NC Software: Introduction, Manual Part Programming, Computer- Assisted Part Programming, Language Based , Geometric ModelingBased, Automatic Part Program Generation, **IV** CAPP Systems , 5 Axis Programming, Post-Processing, Programming Robots and CMMs NC Simulation, Kinematic simulation, Volumetric simulation, Applications of Volumetric NC Simulation, Verification **V** Advanced Topics:, Adaptive Control, Off-line adaptive control, Various optimisation criteria, Hardware Based AC, Software Based AC, Tooling and Instruments for NC Special Considerations in High Speed Cutting (HSC) and Die Sinking, Rapid Product	New Course

			Development, CAM, FMS, CIM	
78	**BTME707**		**THERMAL ENGINEERING LAB-II** **1** To perform constant speed load test on a single cylinder diesel engine and to plot performance curves: indicated thermal efficiency, brake thermal efficiency, mechanical efficiency Vs. Brake power, and heat balance sheet. **2** To estimate the Indicated Power, Friction Power and Mechanical Efficiency of a multi-cylinder Petrol Engine. (Morse Test) **3** Analysis of engine exhaust gases using Orsat apparatus / gas analyzer. **4** To study refrigeration cycle, determination of coefficient of performance of cycle and tonnage capacity of refrigeration unit. **5** To determine the COP and tonnage capacity of a Mechanical heat pump. **6** To study various controls used in Refrigeration and Air conditioning system. **7** Determination of dryness fraction of steam. **8** Study and Performance of Simple Steam Turbine **9** Performance characteristics of Pelton wheel turbine. **10** Performance characteristics of Francis turbine. **11** Performance characteristics of Kaplan turbine. **12** Performance characteristics of variable speed centrifugal pump. **13** Performance characteristics of rated speed centrifugal pump.	New Course
79	**BTME708**		**FINITE ELEMENT LAB.** **1** Laboratory work for the solution of solid mechanics problems, heat transfer problems, and free vibration problems **A: by using FE packages such as NASTRAN/ ANSYS/ SIMULIA/** **ABAQUS** **2** Introduction of GUI of the software in the above mentioned areas realistic problems. **3** Analysis of beams and frames (bending and torsion problems) **4** Plane stress and plane strain analysis problems **5** Problems leading to analysis of axisymmetric solids **6** Problems leading to analysis of three dimensional solids (a) Heat transfer problems (b) Modal analysis problem **B: by writing own code for finite element analysis using MATLAB** **for:** **7** Plane stress and plane strain analysis problems **8** Modal Analysis problem	New Course
80	**BTME801**	**FUNDAMENTAL OF AERODYNAMICS**	**BTME801: COMPUTER INTEGRATED**	New Course

		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; Ranking-Hugoniot relations; increase in entropy; Prandtl's relations; change in stagnation pressure across the shock.	**MANUFACTURING SYSTEMS** **I** **Introduction to CIM:** Overview of Production Systems, the product cycle, Automation in Production Systems, computer's role in manufacturing, sources and types of data used in manufacturing. The Beginning of CAM: Historical Background, Numerical Control (NC): Basic components of an NC system, coordinate system and motions control systems. Computer Numerical Control (CNC): features of CNC, machine control unit, CNC software. Direct Numerical Control and Distributed Numerical Control. Applications, advantages and disadvantages of NC. Adaptive control of machining system. **II** NC Part programming: Manual and computer assisted part programming, Part programming with APT. NC part programming using CAD/CAM software. NC cutter path verification. **III** Computer Aided Process Planning: Traditional Process Planning, Retrieval process planning system, Generative Process Planning, Machinability data systems, computer generated time standards. Group Technology: Introduction, part families, part classification and coding, coding system and machining cells. **IV** Computer Aided Production Management Systems: Introduction to computer aided PPC, Introduction to computer aided inventory management, manufacturing resource planning (MRPII), computer process monitoring and shop floor control, computer process control. Computer Aided Quality Control; Computer in quality control, contact inspection methods, Non contact inspection methods, optical and non optical computer aided testing. **V** Computer Aided Material Handling; Computer control on material material handling for automated inspection and assembly. Computer Integrated Manufacturing Systems: Introduction, types special manufacturing systems, flexible manufacturing systems (FMS). Collaborative Engineering; Introduction, Faster Design throughput, Web based design, Changing design approaches, extended enterprises, concurrent engineering, Agile and lean manufacturing.	
81	**BTME802**	**QUALITY CONTROL & QUALITY ASSURANCE** **<u>UNIT-I</u>** **Introduction :** Definition and Need of quality, Aspects of quality, Quality	**BTME802: LAWS FOR ENGINEERS** **I** **Constitutional Law***:* The Preamble; Fundamental Rights; Directive principles of State policy; Fundamental Duties; Emergency provisions – kinds, legal requirements and legal effects.	New Course

		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.	**General Principles of Contract under Indian Contract Act, 1872:** General principles of contract – Sec. 1 to 75 of Indian Contract Act and including Government as contracting party, Kinds of government contracts and dispute settlement, Standard form contracts; nature, advantages, unilateral character, principles of protection against possibility of exploitation, judicial approach to such contracts, exemption clauses, clash between two standard form contracts. **II** **Introduction to Human Rights:** Theoretical foundation, Historical development of human rights; Human Rights in Indian tradition and Western tradition; Covenant on Civil & Political Rights 1966 including Optional Protocol – I (Individual Complaint Mechanism) & Optional Protocol – II (Abolition of Death Penalty); Covenant on Economic, Social and Cultural Rights 1966 including Optional Protocol – I (2002); Enforcement of Human Rights in India including Supreme Court, High Courts, Statutory Commissions – NHRC, NCW, NCM, NC-SC/ST etc. **Labour Laws:** Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen Compensation Act, 1923. **III** **Right to Information Act, 2005:** Evolution and concept; Practice and procedures; Official Secret Act, 1923; Indian Evidence Act, 1872; Information Technology – legislation and procedures, Cyber crimes – issues and investigations. **Law relating to Intellectual property:** Introduction– meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; International instruments on IP – Berne convention, Rome convention, TRIPS, Paris convention and international organizations relating IPRs, WTO etc; **IV** Law relating to Copyright in India, Meaning of copyright – literary, dramatics and musical works, sound records and cinematographic films, computer programs, Ownership of copyrights, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Trademarks under Trademark Act, 1999 including Rationale of protection of trademarks as Commercial aspect and Consumer rights, Trademarks, registration, procedures, Distinction between trademark and property mark, Doctrine of deceptive similarity, Passing off an infringement and remedies;	

			Law relating to Patents under Patents Act, 1970, Patentable inventions with special reference to biotechnology products, Patent protection forcomputer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies. **V** **Corporate Law**: Meaning of corporation; Law relating to companies, public and private (Companies Act, 1956) general provisions; Law and multinational companies – International norms for control, FEMA 1999, Corporate liability, civil and criminal. **Election provisions under Indian Constitution** (Art.324–329): Representation of Peoples Act and Prevention of Corruption Act, 1988; Superintendence, directions and control of elections to be vested in Election Commission; Election to the house of people and to the legislative assemblies of States to be on the basis of adult suffrage. Candidate electoral rights.	
82	**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,	**BTME803: POWER GENERATION** **I Introduction to economics of power generation:** Load duration curves, location of power plants, power plant economics. **II** **Analysis of Steam Power Plants (SPP):** Components of steam power plants, Effect of variations, variation of steam condition on thermal efficiency of steam power plant. Typical layout of SPP. Efficiencies in a SPP. **III** **Analysis of Hydroelectric Power Plants (HEPP):** Components of HEPP, Typical layout of HEPP, Performance of turbines and comparison. **Analysis of Diesel and Gas Turbine Power Plants:** General layout of Diesel and Gas Turbine power plants, Performance of Diesel and Gas Turbine power plants, comparison with other types of power plants. **IV** **Wind Energy:** Wind energy potential measurement, general theories of wind machines, basic laws and concepts of aerodynamics, aerofoildesign; wind mill and wind electric generator. Description and performance of the horizontal–axis wind machines. Description and performance of the vertical–axis wind machines. The generation of electricity by wind machines, **V**	New Course

		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,	**Solar radiation:** its measurement and prediction. Flat plate collectors, liquid and air type. Theory of flat plate collectors, advanced collectors, optical design of concentrators, selective coatings, solar water heating, thermal storage. Conversion of heat into mechanical energy. Solar cells, photovoltaic effect, performance of a solar cell, P-V material, performance of solar cells, P-V modules. Solar P-V plants, Economies of solar photovoltaic's	
83	**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	**BTME804 A: PRODUCT DEVELOPMENT AND LAUNCHING** **I** **Importance of New Product:** Definition-importance-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, Modification of this process for other types of products. **II** **Need Analysis:** Problem Formulation Establishing economic existence of need, Need Identification and Analysis, Engineering Statement of Problem, Establishing Target Specification. **III** **Generation of Alternatives and Concept Selection:** Concept generation- a creative process, Creativity, Road Elects to creative thinking-Fear of criticism and Psychological set, Tools of creativity like brain storming, Analogy, Inversion etc., Creative thinking Process, Concept feasibility and Concept Selection, Establishing Engineering Specification of Products. **IV** **Preliminary and 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 pointof view of Manufacturing, Ergonomics and aesthetics. **V** **Management of New Product:** Development and Launch New Product Management's Challenges, Maintaining focus, Promotion of Right Culture, Management of Creativity, Top Management attention, Design Team Staffing and Organization,	Code Change

		design ,functional design practice , Product value ,design for safety ,for reliability and environmental consideration ,economic analysis ,profit and competitiveness	Setting key mile stone, Identification of Risk Areas, Project Execution and Evaluation Product Launch Strategies,	
84	**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.	**BTME804.B: COMPUTATIONAL FLUID DYNAMICS** **I** **Introduction to Computational Fluid Dynamics and Principles of Conservation**: Conservation of mass, linear momentum: Navier-Stokes equation, Conservation of Energy, General scalar transport equation, Reynolds transport theorem, **Classification of Partial Differential Equations and Physical Behaviour:** Elliptic, parabolic and hyperbolic partial differential equations **Approximate Solutions of Differential Equations:** Error Minimization Principles, Approximate solutions of differential equations, variational approach, Weighted residual approach: trial function and weighting function, Essential and natural boundary conditions, Least square method, Galerkin's method, Rayleigh-Ritz method **II** **Fundamentals of Discretization:** Pre-processing, Solution, Postprocessing, Finite Element Method, Finite difference method, Well posed boundary value problem, Conservativeness, Boundedness, Transportiveness, Finite volume method (FVM), 1-D steady state heat conduction without and with constant source term **Finite Volume Method:** FV Discretization of a 1-D steady state diffusion type problem, Composite material with position dependent thermal conductivity, Source term linearization, Implementation of boundary conditions, 1-D unsteady state diffusion problems: implicit, fully explicit and Crank-Nicholson scheme **III** **Solution of Systems of Linear Algebraic Equations:** Solution techniques for systems of linear algebraic equations: Elimination, Iteration and Gradient Search method, L-U decomposition technique, Tridiagonal matrix algorithm (TDMA): Thomas algorithm **Iteration methods:** Generalized analysis of the iterative methods, Sufficient condition for convergence, Scarborough criteria of for convergence Relaxation methods, Preferential characteristics of iterative methods, Multigrid method, Line by line TDMA, Alternating direction implicit method, Gradient search methods: Steepest descent method, Conjugate gradient method **IV** **Discretization of Convection-Diffusion Equations: A Finite Volume Approach:** Central difference scheme, Upwind scheme, Exponential scheme and Hybrid scheme, Power law scheme, Generalized convection-	New Course

			diffusion formulation, The concept of false diffusion, QUICK scheme. **Discretization of Navier Stokes Equations:** Discretization of the Momentum Equation: Stream Function-Vorticity approach and Primitive variable approach, Staggered grid and Collocated grid, SIMPLE Algorithm, SIMPLER Algorithm **V** **Introduction to Turbulence Modeling:** Vorticity transport equation, Homogeneous turbulence and isotropic turbulence, Reynolds average Navier stokes (RANS) equation, Necessity of turbulence modeling, Turbulence model: Eddy viscosity, Mixing length, The S-T model, RNG S-T model, S-U model, Reynolds stress model (RSM),Large eddy Simulation (LES),Direct numerical simulation (DNS) The basic structure of a CFD code: Pre-processor, Solver and Postprocessor, User-defined-subroutines, Solution to some basic problems in heat transfer and fluid flow	
85	**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,	**BTME804.C: TOTAL QUALITY MANAGEMENT** **I** Introduction to TQM: Definition, Basic approach, Guru's of TQM, TQM framework, benefits. Leadership: Characteristics of Quality Leadership, Leadership Concepts, The 7 Habits of Highly Effective People, The Deming Philosophy, The Role of TQM Leaders, Quality Council, Core Values, Concepts, and Framework, Quality Statements, Strategic Planning Communications, Decision Making. Customer Satisfaction: Introduction, Customer Perception of Quality, Feedback, Using Customer Complaints, Service Quality, Translating Needs into Requirements, Customer Retention. **II** Continuous Process Improvement: Introduction, Process, The Juran Trilogy, Improvement Strategies, Types of Problems PDSA Cycle, Problem-Solving Method, DMAIC, Kaizen, Reengineering. Supplier Partnership: Principles of Customer/Supplier Relationship Partnering, Sourcing Supplier, Selection ,Supplier Certification Supplier Rating, Relationship Development. Performance Measures: Basic Concepts, Strategy, performance measure presentation, Cost of Quality, Malcolm Baldrige and Rajiv Gandhi National Quality Award, Balanced Score Card **III** Lean Enterprise: Historical Review, Lean Fundamentals, Value Stream Map, Implementing Lean, Benefits. Six Sigma: Statistical Aspects, Improvement Methodology, Organizational Structure Benefits. Benchmarking: Benchmarking Defined, Reasons to Benchmark, Process, deciding what to benchmark,	New Course

			Pitfalls and Criticisms. **IV** Quality Management Systems: Benefits of ISO Registration, ISO Series of Standards, Sector-specific Standards, ISO 9001 Requirements, Implementation, Documentation, Writing the Documents, Internal Audits, Registration. Environmental Management Systems: ISO 14000 Series Standards, Concepts of ISO 14001, ISO 14001, Requirements, Benefits, Integrating QMS and EMS. Other EMS Systems, Relationship to Health and Safety Quality Function Deployment: The QFD Team, Benefits, the voice of the Customer, Organization of Information, House of Quality, Building a House of Quality, QFD Process. Total Productive Maintenance: The Plan, Learning the New Philosophy, Promoting the Philosophy, Training, Improvement Needs, Goal, Developing Plans, Autonomous Work Groups **V** Management Tools: Forced Field Analysis, Nominal Group Technique, Affinity Diagram, Interrelationship Digraph, Tree Diagram, Matrix Diagram, Prioritization Matrices, Process Decision Program Chart, Activity Network Diagram Experimental Design: Introduction, Basic Statistics, Hypothesis, t Test F Test. One Factor at a Time Orthogonal Design, Point and Interval Estimate, Two Factors Full Factorials. Taguchi's Quality Engineering: Introduction, Loss Function, Orthogonal Arrays, Signal-to-Noise Ratio, Parameter Design, Tolerance Design, Case study	
86	**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^{o} in either direction.. 10 To determine 5 Axis Robotic Arm	**BTME805: CAM LAB.** **1** To prepare part programming for plain turning operation. **2** To prepare part programming for turning operation in absolute mode. **3** To prepare part program in inch mode for plain turning operation. **4** To prepare part program for taper turning operation. **5** To prepare part program for turning operations using turning cycle. **6** To prepare part program for threading operation. **7** To prepare part program for slot milling operation. **8** To prepare part program for gear cutting operation. **9** To prepare part program for gear cutting using mill cycle. **10** To prepare part program for drilling operation. **11** To prepare part program for multiple drilling operation in Z-axis. **12** To prepare part program for multiple drilling in X-axis. **13** To prepare part program for multiple drilling in X and Z axis using drilling cycle	Course Name Change

		movement and its degree of rotation. 11 To study various Robotic Arm Configurations. 12 To study Pick and Place Robot		
87	**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)	**BTME806: CAD LAB.** **1** Introduction and 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	Code Change
88	**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	**BTME807: INDUSTRIAL ENGINEERING LAB-II** **1** Determination of time standard for a given job using stopwatch time study. **2** Preparation of flow process chart, operation process chart and man machine charts for an existing setup and development of an improved process. **3** Study of existing layout of a workstation with respect to controls and displays and suggesting improved design from ergonomic viewpoint. **4** To carry out a work sampling study. **5** To conduct process capability study for a machine in the workshop. **6** To design a sampling scheme based on OC curve. **7** To conduct Shewart's experiments on known population **8** Generation of random numbers for system simulation such as facility planning, job shop	New Course