

Title of the course : **Mathematics - I**
 Subject Code : **AM - 111**
 Weekly load : 5 Hrs. LTP 4-1-0
 Credit : 5 (Lecture 4; Tutorial 1; Practical 0)

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Trigonometry	Introduction to trigonometric formulas. Trigonometric ratios of multiple and sub-multiple angles ($2A$, $3A$, $A/2$). Product formulae, conversion from sum or difference to product and vice-versa (without proof). Solutions of simple trigonometric equations. Inverse trigonometric functions and their properties.	10
	2. Algebra	Arithmetic progression, geometric progression, arithmetico-geometric series. Special series: $\sum n$, $\sum n^2$, $\sum n^3$. Binomial theorem for positive integral index (without proof), general and particular terms. Binomial theorem for any index (without proof), first and second approximation, simple problems.	12
	3. Complex Numbers	Complex number in the form of $a+ib$, Argand diagram, polar form and exponential form, algebra of complex numbers, modulus and argument of a complex number, square root of a complex number, cube root of unity. De-Moivre's theorem (without proof) and simple problems.	8
Unit-2	4. Straight Line	Distance and section formulae. Equation of straight line in various standard forms, intersection of two straight lines, angle between two lines, condition of parallelism and perpendicularity, perpendicular distance formula. Equations of two straight lines bisecting angle between two lines.	10
	5. Circle	General equation of a circle, diameter form, centre and radius of a circle, circle through three non-collinear points, tangent and normal to a circle at a given point on it. Intersection of a straight line and a circle. Orthogonal circles.	8
	6. Conic Section	Parabola, ellipse and hyperbola. To find equation when directrix, focus and eccentricity are given. Estimating focus, directrix, latus-rectum, axes, eccentricity, vertex etc. when equation of the conic is given.	12

Total=60

Recommended Books:

1. Text books on Mathematics for XI, NCERT, New Delhi
2. Shanti Narayan, Coordinate Geometry, S. Chand and Co.
3. Thomas & Finney, Calculus, Pearson Education.

Title of the course : **PHYSICS- I**

Subject Code : **PH-111**

Weekly load : 6 LTP 4-0-2

Credit : 5 (Lecture 4; Practical 1)

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	UNITS AND MEASUREMENTS	Need for measurements, system of units, S.I. units, fundamental and derived units. Dimensional formula, dimensional equations and their applications. Error in Physical measurements-causes & types. Combination of errors (qualitative ideas). Numerical Problems	08
	VECTOR ANALYSIS	Scalars and vectors, vectors in two and three dimensions, unit vector, laws of vector addition, Resolution of a vector in a plane, rectangular components, scalar and vector products. Numerical Problems	08
	DESCRIPTION OF MOTION	Motion in two dimensions, projectile motion, uniform circular motion, qualitative concepts of torque, angular momentum, conservation of angular momentum, centripetal and centrifugal forces. Numerical Problems	08
	LAWS OF MOTION	Laws of motion, conservation of linear momentum, qualitative concepts of rocket propulsion. Friction and its cause, Static and kinetic friction, self-adjusting nature of friction, laws of limiting friction, rolling friction, angle of friction and angle of repose, methods to reduce friction. Numerical Problems	08
Unit-2	GRAVITATION	Universal law of gravitation, Inertial and gravitational mass, relation between g and G , variation of acceleration due to gravity (with altitude and depth), orbital velocity, escape velocity, elementary ideas of geo-stationary satellite. Numerical Problems	08
	SIMPLE HARMONIC MOTION	Periodic motion, simple harmonic motion (S.H.M.) K.E. and P.E. in S.H.M., simple pendulum and oscillations of mass attached to vertical spring. Concepts of seconds pendulum, Wave motion, its kinds and properties, speed, frequency, amplitude, time period and displacement of wave, principle of superposition. Numerical Problems	08
	PROPERTIES OF	Interatomic and intermolecular forces, elastic properties, Hooke's law, Three moduli of elasticity, Poisson's ration, surface tension and	08

	MATTER	surface energy, angle of contact, examples of drops and bubbles, capillary rise, Viscosity, Stokes law (treatment by dimensional analysis), Streamline and turbulent flow, Bernoulli's theorem. Numerical Problems	
	HEAT AND THERMODYNAMICS	First law of thermodynamics, specific heat at constant volume and constant pressure of ideal gas, relation between C_p and C_v . Thermodynamic processes (reversible, irreversible, isothermal and adiabatic), second law of thermodynamics. Thermal conductivity, black body radiation, Wien's law, Stefan's law, Newton's law of cooling. Numerical Problems	08

Total=64

Recommended Books:

1. Fundamental Physics Class (XI) by K L Gomber and K L Gogia Pardeep Publications
2. Fundamental of Physics by Haliday and Resnick and Walker John Wiley & Sons

List of Experiments

PH-111

1. To measure the length, breadth and height of a geometrical body using Vernier Calipers and to find its volume.
2. To measure the diameter of a wire by using a screw gauge and to find its area of cross-section.
3. To measure the radius of curvature of a given lens / mirror by using Spherometer.
4. To determine the density of a given body using physical balance.
5. To determine the area of cross-section of a given small object using Travelling microscope.
6. To determine the value of "g" by Simple Pendulum.
7. To find the coefficient of friction between wood and glass using a horizontal surface.
8. To determine the coefficient of viscosity of glycerin by Stokes method.
9. To determine the surface tension of water using capillary rise method.
10. To determine the force constant/spring constant using Hook's Law.
11. To determine the Young's modulus of the material of a rectangular bar by bending.
12. To determine the value of "g" at a place by using free fall apparatus.

Title of the course : **CHEMISTRY-I**
 Subject Code : **CY-111**
 Weekly load : 6 LTP 4-0-2
 Credit : 5 (Lecture 4; Practical 1)

Main Topics	Course Outlines	Lecturers
UNIT-I		
1. Atomic Structure	Introduction to atom and its constituent particles, Bohr's model of atom, Line spectrum of hydrogen, Dual nature of radiation, de Broglie's relationship, Uncertainty principle, Quantum numbers, Shapes of orbitals, Pauli's exclusion principle, Aufbau Energy ranking rule, Hund's rule, Electronic configuration of atoms	08
2. Modern periodic table	Modern periodic table, Periodic properties (ionization potential, electron affinity, atomic and ionic radii), Variation of periodic properties along a period and group, Introduction to s and p-block elements	06
3. Chemical Bonding	Types of chemical bond (ionic, covalent, coordinate), Lewis structure, Valence bond theory, VSEPR theory, Hybridization, Molecular orbital theory of homonuclear diatomic molecules, Vanderwaal forces, Hydrogen bond, Metallic bond	08
4. Chemical and Ionic Equilibrium	Law of chemical equilibrium, Le Chatelier's principle, Law of mass action, Equilibrium constant, Ionic equilibrium – ionization of acids and bases, Strong and weak electrolytes, Degree of ionization, Concept of pH, Hydrolysis of salts, Common Ion effect and Solubility product, Concept of acids and bases, Buffer solutions	09
5. Chemical Thermodynamics	Concepts of extensive and intensive properties, State functions, First law of Thermodynamics: Internal energy, Enthalpy, Heat capacity and Specific heat, Applications of First law of thermodynamics, Hess's law of constant heat summation, Second law of thermodynamics: Entropy, Free energy, Spontaneity of a chemical reaction, Free-energy change and Chemical equilibrium	08
UNIT-II		
6. Organic Chemistry	Classification and IUPAC nomenclature of organic compounds, Inductive effect, Electromeric effect, Resonance and Hyper conjugation, Electrophiles and Nucleophiles Reaction Intermediates - carbocations, carbanions, free radicals, Types of organic reactions, Stereoisomerism: Optical, Geometrical and Conformational	14

7.Environmental chemistry	Environmental pollutants: soil, water and air pollution, Chemical reactions in atmosphere, Kinds of smog, Major atmospheric pollutants, Acid rain, Ozone and its reactions, Effects of the depletion of ozone layer, Green house effect and Global warming – Industrial air pollution, Green chemistry as an alternative tool for reducing pollution	07
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Total

60

Recommended Books:

1. Chemistry for class XI and XII, published by NCERT
2. R. T. Morrison and R. N. Boyd, Organic Chemistry, Prentice Hall, New Delhi
3. F.A. Carey and R.J. Sundberg, Advanced Organic Chemistry, Kluwer Academic and Plenum Publishers, New York
4. G. W. Castellan, Physical Chemistry
5. P.W. Atkins, Physical Chemistry, Oxford University Press, Oxford
6. A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, John Wiley and Sons
7. J. D. Lee, Concise Inorganic Chemistry, Chapman & Hall, London
8. C.N.Swayer, P.L.McCarty and G.F.Parkin, Chemistry for Environmental Engineers, McGraw Hill, Delhi
9. J.C. Kuriacose and J. Rajaram, Chemistry in Engineering, Tata McGraw-Hill Publishing Company Limited, New Delhi

LIST OF PRACTICALS:

CY-111

1. To prepare the standard solution of oxalic acid or potassium dichromate.
2. To determine the strength of given HCl solution by titration against NaOH solution using Phenolphthalein as indicator.
3. To determine the total hardness of water sample in terms of CaCO₃ by EDTA titration method using Eriochrome black-T indicator.
4. To determine the pH of given sample.
5. To analyse inorganic salt for acidic and basic radicals among the following.

A. Basic Radicals:

NH₄⁺, Pb⁺⁺, Cu⁺⁺, Bi⁺⁺⁺, Cd⁺⁺, As⁺⁺⁺, Sb⁺⁺⁺, Sn⁺⁺, Al⁺⁺⁺, Fe⁺⁺⁺, Cr⁺⁺⁺, Mn⁺⁺, Zn⁺⁺, Co⁺⁺, Ni⁺⁺, Ba⁺⁺, Sr⁺⁺, Ca⁺⁺, Mg⁺⁺

B. Acid Radicals:

CO₃⁻, S⁻, SO₃⁻, CH₃COO⁻, NO₂⁻, NO₃⁻, Cl⁻, Br⁻, I⁻, SO₄⁻

Title of the course : **Communication Skills-I**
 Subject Code : **HU-111**
 Weekly load : 2 LTP 2-0-0
 Credit : 2 (Lecture 2; Practical 0)

Course Description	Lecture(s)
Unit- I	
Prescribed Text -Following Chapters only: Chapter 1 (The Judgement-seat of Vikramaditya) Chapter 2 (The Selfish Giant) Chapter 8 (J.C. Bose) Chapter 9 (The Story of the Sea) Chapter 11 (The Escape) Chapter 15 (Self- portrait)	
From the prescribed text: Vocabulary-Understanding meanings of new words, Comprehension- Responding to the questions from the text, Summarizing the themes/ central ideas , Composition Exercises	16
Unit- II	
Application of Grammar	
Tenses, Translation from Vernacular to English, Do as directed (Active/ Passive Voice, Direct/ Indirect Narration, Affirmative/ Negative/ Assertive Sentences, Question Tag, Use of Articles, Prepositions, Conjunctions), Words often confused, Use of synonyms and antonyms, One word substitutes	16

Total=32

Text Book:

4. Menon, K.P.K. *Contemporary English Prose*. Oxford University Press.

Recommended Books:

5. Wren, P.C. & H. Martin. *High School English Grammar & Composition*. S. Chand & Company Ltd.
6. Sinclair, John. *Collins Cobuild English Grammar*. Collins.
7. Ghosh, R.N., K.W. Moody & S. R. Inthira. *A Course in Written English*. NCERT.
8. Best, Wilford D. *The Students' Companion*. Rupa.

Title of the course	: Workshop Practice-1	
Subject Code	: WS-111	
Weekly load	: 4	LTP 0-0-4
Credit	: 2	

Practical: 10-14 jobs from the following list

CARPENTRY SHOP

1. Safety precautions in carpentry shop.
2. Introduction to wood and wood working operations.
3. Demonstration and use of carpentry shop tools and equipment.
4. Exercise on simple operations, viz. hand sawing, marking, planning and chiseling.
5. Cross lap joint, T-lap joint, Corner lap joint, Mortise and tenon joint, Dovetail joint

FITTING SHOP

1. Safety precautions in fitting shop.
2. Demonstration and use of fitting shop tools and equipment.
3. Study and use of instruments in fitting shop, like, vernier calipers, micrometer, height gauge and bevel protractor
4. Exercise on simple operation viz. cutting, chipping, sawing, filing, drilling

FORGING SHOP

1. Safety precautions in carpentry shop.
2. Familiarization with different tools used in forging.
3. Exercise on conversion of round to square with cold forging.
4. Exercise on conversion of round to square with hot forging.
5. Upsetting operation exercise.

FOUNDRY SHOP

1. Safety precautions in foundry shop.
2. Familiarization with different patterns and hand tools.
3. Preparations of green sand mould using single piece pattern three-four exercises.
4. Preparations of green sand mould using split pattern on bench moulding.
5. Preparations of green sand mould using solid pattern by bedded method.

SHEET METAL SHOP

1. Safety precautions in sheet metal shop.
2. Familiarization with different tools and processes in sheet metal shop.
3. Exercise on sheet cutting, development, folding, bending, piercing, punching, parting, notching and slitting.
4. Profile and circle cutting exercise.
5. Different types of joints exercise

ARC WELDING SHOP

1. To familiarize with safety aspects.
2. To familiarize with equipment and tools of the welding shop.
3. To learn about different positions of welding.
4. To practice of bead on plate in flat position
5. To practice making of a butt joint and lap joint on a flat piece

ENGINEERING DRAWING

Subject Code : ME-111
Weekly load : 04
Credit : 02

LTP 0-0-4

Theory

Course Description	Lecture(s)
Unit-I	
Introduction	06
Introduction, Objectives, applications. Fundamentals of engineering drawing, Use and handling of different drawing instruments, title block, sheet sizes, first and third angle projections, orthographic projections.	
Lettering and Dimensioning	08
Free hand sketching of different types of lines in engineering drawing as per IS specifications, Free hand lettering (alphabet and numerals) - lower case and upper case, vertical and inclined at 75° in the ratio of 7:4, Notation of dimensioning, size and location dimensions, aligned and unidirectional systems of dimensioning, general rules for dimensioning, unit of dimensioning.	
Scales	08
Uses of scales, sizes of scale, representative fraction, construction of plain and diagonal scales	
Projection of points, line	10
Introduction on theory of projections and orthographic projections, projection of a point in different quadrants, projection of straight lines in different positions (all possible cases)	
Unit-II	
Projection of Planes	10
Definition of plane, types of planes, traces of plane, projection of planes in different positions	
Projection of Solids	10
Types of solids, projections of solids in simple positions, introduction on sectioning of solids	
Development of surfaces	12
Introduction, Development of a right prism, cylinder, pentagonal prism, and a right pyramid	

Total = 64

Recommended Books

<i>Title</i>	<i>Author(s)</i>	<i>Publisher</i>
Engineering Drawing	P S Gill	Kataria and Sons, New Delhi
Engineering Drawing	R.K.Dhawan	S. Chand & Co, New Delhi
Engineering Drawing	N.D,Bhatt	Charotar Publishing House

Title of the course : **Computer Fundamentals**
 Subject Code : **CS-111**
 Weekly load : 5 LTP 3-0-2
 Credit : 4 (Lecture 3, Practical 1)

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Introduction	Definition of electronic Computer, Generations, Characteristic and Application of Computers, Block diagram of computer.	06
	2. Input/output Devices	Various I/O devices like keyboard, mouse etc. Plotter, Scanner, Printer and its types (Inkjet, Dot matrix, Laser printer etc).	04
	3. Memory	Primary and secondary memory, RAM, Types of RAM,ROM & types of ROM, cache, Registers ,Memory Hierarchy.	06
	4. Basics of Computer	Bootting process, introduction to concepts-bit, nibble, byte, word, hardware, software, operating system, system software, application software.	06
Unit-2	5. Computer Languages	Generation of Language, Translators, Interpreters, Assemblers, Compilers.	06
	6. Number System	Various codes, decimal, binary, octal, hexadecimal, conversion from one number system to another.	06
	7. Internet and its Applications	Internet, Connecting to the internet, Internet services, Applications like E-commerce, entertainment, education etc Threats:- Firewall, Virus, Worm, Trojan Horses.	06
	8. Web Technologies	World Wide Web, URL, Search engines, Web Browsers, Hypertext , Hypertext Marks Language, Gopher, FTP.	08

Total=48

Recommended Books:

1. Yadav DS, Foundations of IT, New Age, Delhi.
2. Curtin, Information Technology: Breaking News, TMH
3. Rajaraman V, Introduction to Computers, Prentice-Hall India.

Title of the course : **Computer Fundamentals Lab**

Subject Code : **CS-111**

LIST OF PRACTICALS

Perform the following Practicals in MS-Word

1. Create a document using functions: Save as, page number, Bullets and numbering.
2. Create a document using fonts, styles and Formatting options.
3. Create a document using Fill effects, Printed water mark under background option and also use Header and Footer.
4. Create a document, using the function page set up, page preview, and then print that document.
5. Use the concept of Mail Merge in MS Word.
6. Use the concept of Macro in MS Word
7. Create a document using table & perform various operations like Insert, delete, select and Table auto Format in it.

Perform the following Practicals in MS-Excel

8. Create Line, XY, Bar and Pie chart in excel sheet and compare the given data using these charts.
9. Implement all formula like addition, subtraction, Multiplication and division etc. in excel.
10. Use the concept of Macro in MS Excel.
11. Use the concept of Sorting, filter and hyperlink in Excel.
12. Use the concept of paste special and paste as hyperlink in Excel
13. Create a excel sheet using fonts, styles, Formatting options, Text wrap different row, column, and cell width.
14. Create a formulae using function to compare the values of two Rows or Columns.

Perform the following Practicals in MS-PowerPoint

15. Create a Power point presentation using slide designing and use Design Templates, Color schemes, and Animation schemes.
16. Create a Presentation using functions: Save as, page number, Bullets and numbering, page setup and take print in layout form.
17. Create a power point presentation using clipart, Word art gallery & then add transition & Animation effects.
18. Use the concept of Macro in Power Point.
19. Use chart, diagram and table in Power Point.
20. Create a Power point presentation and use View show, Setup show, rehearse timing in presentation.

Perform the following Practicals in MS-Access

21. Create forms in MS-ACCESS.
22. Create reports in MS-ACCESS.
23. Create table and queries in MS-ACCESS using design view.
24. Create Data Access page in design view and by using wizard in MS-ACCESS.

Apply different modification schemes using picture manager.

Organize different types of Data available using clip organizer.

Create Resume using various features of Microsoft Word

Title of the course : **Mathematics - II**
 Subject Code : **AM - 121**
 Weekly load : 5 Hrs. LTP 4-1-0
 Credit : 5 (Lecture 4; Tutorial 1; Practical 0)

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Functions	Functions, types of functions, domain and range. Concept of limit. Standard limits. Continuity of a function.	8
	2. Differentiation	Physical & geometrical meaning of derivative of a function, differentiation of x^n , $\sin x$, $\cos x$, $\tan x$, $\sec x$, $\operatorname{cosec} x$, $\cot x$, e^x , a^x and $\log x$ from the first principle. Differentiation of sum, difference, product and quotient of functions. Differentiation of function of a function. (Chain rule), differentiation of inverse trigonometric and hyperbolic functions. Logarithmic and parametric differentiation. Differentiation of implicit functions.	10
	3. Application of Differentiation	Expansion of functions using Taylor and Maclaurin's series. Maxima and minima of a function. Equations of tangent and normal (for explicit function only). Indeterminate forms, L'Hospital's Rule	12
Unit-2	4. Integration	Integration as an anti-derivative, fundamental integrals involving algebraic, trigonometric, exponential and logarithmic functions. Integration by substitution, by parts and by partial fractions. Integration of rational and irrational functions. Four standard cases.	16
	5. Definite Integration	Definite integral. Evaluation of definite integral by substitution. Properties of definite integral (without proof) and simple problems.	6
	6. Application of Integration	Area under a curve. Area between two curves (involving line, circle, parabola and ellipse only).	8

Total=60

Recommended Books:

1. Text books on Mathematics for XII, NCERT, New Delhi.
2. Shanti Narayan, Differential Calculus, S. Chand & Co.
3. Shanti Narayan, Integral Calculus, S. Chand & Co.

Title of the course : **PHYSICS- II**
 Subject Code : **PH-121**
 Weekly load : 6 LTP 4-0-2
 Credit : 5 (Lecture 4; Practical 1)

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	ELECTROSTATICS	Coulomb's law (scalar & vector forms), electric field, electric field due to a point charge, electric dipole and its moment, electric fields along the axial and equatorial lines, concept of dielectric and dielectric constant, Gauss's theorem and its application to find electric field due to an infinite wire and plane sheet of charge. Conductors and insulators, force and torque experienced by a dipole (in uniform electric field), capacitance, parallel plate capacitor with air/dielectric medium between the plates, series and parallel combinations of capacitors, energy of a capacitor. Numerical Problems	10
	CURRENT ELECTRICITY	Resistance, resistivity, combination of resistances in series and parallel, Kirchhoff's laws, principle of potentiometer and its application for comparing e.m.f. of two cells Numerical Problems	06
	MAGNETISM	Magnetic lines of force and magnetic dipole, earth's magnetic field and its source (elementary ideas), concepts and properties of Para, Dia and Ferro-magnetic substances with examples. Numerical Problems	08
	ELECTROMAGNETIC INDUCTION AND ALTERNATING CURRENT	Electromagnetic induction, Faraday's law, Induced e.m.f., Lenz's law, Lorentz magnetic force, self and mutual inductance, alternating current & e.m.f., elementary idea of working of transformer. Numerical Problems.	08
Unit-2	THERMAL AND MAGNETIC EFFECTS OF CURRENT	Electric energy and power, Joule's law of heating, thermoelectricity (Seebeck effect), Biot-Savart's law, magnetic field due to a straight wire and a circular loop. Definition of Ampere, elementary idea of moving coil galvanometer and its conversion into ammeter and voltmeter. Numerical Problems	08
	WAVE OPTICS	Wave front and Huygen's principle, interference of light, Young's	06

		double slit experiment, coherent sources of light, diffraction of light, diffraction due to a single slit, polarization of light (general idea). Numerical Problems	
	MOMENT OF INERTIA	Centre of mass, moment of inertia of rigid body, radius of gyration, theorem of parallel and perpendicular axes, moment of inertia of a straight rod, circular ring, circular disc, cylinder (solid and hollow) sphere, relation between torque and moment of inertia, Kinetic energy and angular momentum , motion of cylinder and sphere rolling without slipping on an inclined plane. Numerical Problems	10
	RAY OPTICS AND OPTICAL INSTRUMENTS	Lens and curved mirrors, lens and curved mirror formula, linear magnification, total internal reflection and its application in optical communication (elementary ideas) Numerical Problems	08

Total=64

Recommended Books:

1. Fundamental Physics Class (XII) by K L Gomber & K L Gogia Pardeep Publications
2. Fundamental of Physics by Haliday & Resnick and Walker John Wiley & Sons

List of Experiments

PH-121

1. To draw magnetic field lines of a bar magnet placed in magnetic meridian with the North Pole towards the south of the earth and to locate the position of the neutral points.
2. To measure the value of resistance by using multimeter and to compare with those written in colour code.
3. To establish current – voltage relationship and to verify Ohm’s Law by using an ammeter and voltmeter and find the value of resistance.
4. a) To study the laws of combination of series and parallel combinations for resistances by using a meter bridge.
b) To find an unknown resistance by using a meter bridge.
5. To determine the resistance of a galvanometer by half deflection method and find it’s figure of merit.

6. To determine the focal length of a concave lens by a telescope using the relation:

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

7. To find the angle of prism and refractive index of prism by using Spectrometer.
8. To study the transverse nature of light using sodium light.
9. To find the height of an accessible object using Sextant.
10. To verify the Newton's law of cooling.
11. To study the seebeck effect of metal coupling.
12. To find the moment of inertia of given flywheel.
13. To find the torque of a Flywheel.
14. To draw the Voltage-current characteristics of P-N junction diode .
15. To draw the characteristics of photo cell.
16. To determine the frequency of AC by electrically maintained tuning fork (Melde's method).
17. To determine the bandgap of a semiconductor diode.
18. To observe the transistor characteristics using transistor apparatus kit.
19. To study the Peltier effect of metal coupling.

Title of the course : **CHEMISTRY-II**
 Subject Code : **CY-121**
 Weekly load : 6 LTP 4-0-2
 Credit : 5 (Lecture 4; Practical 1)

Main Topics	Course Outlines	Lecturers
UNIT-I		
1.Chemical Kinetics	Molecularity, Rate and order of reaction, Factors influencing rates of reaction, Rate equation for first and second order reaction, Pseudo-unimolecular reactions, Temperature dependence of rate of reaction, Activation energy, Arrhenius equation	08
2.Electrochemistry	Electrolysis, Arrhenius theory, Faraday's Laws, Applications of electrolysis such as Electroplating, Electrorefining Electronic concept of Oxidation and Reduction, Balancing chemical equations by Ion-electron method, Electrolytic conduction, Specific and molar conductance, Variation with concentration, Kohlrausch's Law, 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, Electrochemical series and its application. Electrochemical Cells, Primary Cell - Dry Cell, Secondary Cell - Lead storage cell	14
3.Surface Chemistry	Surfaces: physisorption and chemisorptions, Factors affecting adsorption of gases on solids, Preparation of colloids and its general properties-Tyndall effect, Brownian movement, Electrophoresis, Coagulation, Emulsions, Micelles, Catalysis-Homogeneous and heterogeneous	08
UNIT-II		
4.Transition Metals and Coordination Chemistry	General introduction, Electronic configuration, General trends in properties of the first row transition metals – metallic character, ionization enthalpy, oxidation states, ionic radii, colour, catalytic property, magnetic properties, interstitial compounds, alloy formation. Coordination compounds- Nomenclature and bonding	14
5.Organic Chemistry	General introduction to alkane, alkene, alkyne and aromatic compounds-preparation and properties, Halides and hydroxy compounds: Nomenclature of compounds containing halogen atoms and hydroxyl groups: haloalkanes, alcohols and phenols. physical, chemical properties and uses Aldehydes, ketones-Nomenclature, physical, chemical properties	16

	and uses, carboxylic acids and their derivatives-physical, chemical properties and uses Amines-Nomenclature of amino compounds and their methods of preparation, physical, chemical properties and uses	
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Total

60

Recommended Books:

1. Chemistry for class XI and XII, published by NCERT
2. R. T. Morrison and R. N. Boyd, Organic Chemistry, Prentice Hall, New Delhi
3. F.A. Carey and R.J. Sundberg, Advanced Organic Chemistry, Kluwer Academic and Plenum Publishers, New York
4. G. W. Castellan, Physical Chemistry
5. P.W. Atkins, Physical Chemistry, Oxford University Press, Oxford
6. A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, John Wiley and Sons
7. J. D. Lee, Concise Inorganic Chemistry, Chapman & Hall, London
8. C.N.Swayer, P.L.McCarty and G.F.Parkin, Chemistry for Environmental Engineers, McGraw Hill, Delhi
9. J.C. Kuriacose and J. Rajaram, Chemistry in Engineering, Tata McGraw-Hill Publishing Company Limited, New Delhi

LIST OF PRACTICALS:

CY-121

1. To determine Iron content in Mohr's salt by standard $K_2Cr_2O_7$ solution.
2. To study the adsorption of iodine from alcoholic solution by charcoal.
3. To study hydrolysis of methyl acetate in presence of hydrochloric acid.
4. To detect the extra elements (Nitrogen, Sulphur and Halogens) present in the given organic compound.
5. To detect the functional group (any one) Carboxylic acid (-COOH), Phenol, Alcohol (-OH), Aldehyde and Ketone, Ester (-COOR), Acid amide (-CONH₂), amino (-NH₂) present in the given organic compound.

Title of the course : **Communication Skills-II**

Subject Code : **HU-121**

Weekly load : 3 LTP 1-0-2

Credit : 2 (Lecture 1; Practical 2)

Theory

Course Description	Lecture(s)
Unit- I	
Business Communication	
Inviting Quotations, Letters of placing an order, Letters of cancelling an order, Letters of complaint, Drafting an application for job along with a Resume.	08
Unit- II	
Composition Writing	
Paragraph Writing, Précis Writing, Reporting events	04
Correspondence Writing	
Personal Letters, Official Letters, Invitations-Formal and Informal, Acceptance and Refusal	04

Total=16

Recommended Books:

1. Sinclair, John. *Collins Cobuild English Grammar*. Collins.
2. Allan, W. Stannard. *Living English Structure*. Orient Longman.
3. Ghosh, R.N., K.W. Moody & S. R. Inthira. *A Course in Written English*. NCERT.
4. Bhatnagar, Nitin and Mamta Bhatnagar. *Communicative English for Engineers and Professionals*. Pearson.

List of Experiments (10-14):

1. Introducing yourself.
2. Observing and analyzing your environment/ surroundings.
3. Paper Reading on a general topic.
4. Declamation/ Debates.
5. Learning Etiquettes in Social and Official Settings.
6. Summarizing newspaper reports.
7. Preparing a wall newspaper.
8. English Conversation Skills.
9. Translation from English to Vernacular.
10. Dialogue writing and delivery for the given situation.
11. Role Plays.
12. Grammar exercises.
13. Building of Vocabulary.
14. Watching videos/ movies and writing, presenting their summaries.

Title of the course : **Workshop Practice-II**
Subject Code : **WS-121**
Weekly load : 4
Credit : 2

LTP 0-0-4

Practical: 10-14 jobs from the following list

FOUNDRY SHOP

1. Safety precautions in foundry shop.
2. Familiarization with different patterns and hand tools.
3. Preparations of green sand mould using single piece pattern three-four exercises.
4. Preparations of green sand mould using split pattern on bench moulding.
5. Preparations of green sand mould using solid pattern by bedded method.

WELDING SHOP

1. To familiarize with safety aspects.
2. To familiarize with equipment and tools of the welding shop.
3. To learn about different positions of welding.
4. To practice of bead on plate in flat position
5. To practice making of a butt joint and lap joint on a flat piece
6. Identification of various gas flames
7. Practice of gas welding

MACHINE SHOP

1. To familiarize with safety aspects.
2. To familiarize with equipment and tools.
3. Practice of turning operation on lathe
4. Practice of facing operation on lathe
5. Practice of taper turning on lathe
6. Practice of knurling on lathe.
7. Practice of producing rectangular block on milling/shaper/planner m/c.

PATTERN SHOP

1. Safety precautions in pattern shop.
2. Study the layout and different equipment used in pattern shop.
3. Familiarization with different tools and patterns in pattern shop.
4. Exercise on making of solid piece pattern
5. Exercise on making of split piece pattern
6. Exercise on making of cored pattern.

MACHINE DRAWING

Subject Code : ME- 121

Weekly load : 04

Credit : 02

LTP 0-0-4

Theory

Course Description	Lecture(s)
Unit-I	
Basics of Machine Drawing	06
Machining symbols, surface finish characteristics, surface roughness symbols, limits, fits and tolerances.	
Screw Threads	12
Screw thread nomenclature, thread designation, conventional representation of screw threads, different types of threads and their representation.	
Fastenings	12
Nut, bolt and washer; types of nuts, types of bolts, Welding; types of welded joints, representation of a weld, welding symbols according to B.I.S.	
Unit-II	
Keys, Cotters and Joints	12
Introduction, proportions of a key, types of keys and their applications. A Cotter and a Gib with their uses. Types of joints used for connecting rods.	
Rivets and Riveted Joints	10
Types of rivets, types of riveted joints, general terms/rules used for riveted joints.	
Assembly and detail drawings	12
One assembly drawings of a Tail stock, details (drawings of different elements) of a screw jack assembly.	

Total = 64**Recommended Books**

<i>Title</i>	<i>Author(s)</i>	<i>Publisher</i>
Machine Drawing	N D Bhatt	Khanna
Machine Drawing	P S Gill	Standard
Machine Drawing	Goutam Pohit & Goutam Ghosh	Pearson Education

Title of course- **Thermal Engineering**
 Subject code- **ME-122**
 Weekly load- **4**
 Credit **3 (Lecture-2, Practical-1)**

LTP- 202

Theory

Unit	Main Topic	Course out line	Lectures
Unit-I			
	1. Introduction:	Boyle"s Law, Charle"s Law, characteristics gas equation, universal gas constant Properties; intrinsic and extrinsic, system; open, closed and isolated.	4
	2. Laws of thermodynamics:	Thermodynamic equilibrium, Zero th law of thermodynamics, first law of thermodynamics, concepts of enthalpy, internal energy, specific heat, work and heat, concept of entropy, caluses and Kelvin plank statement of second law of thermodynamics, Equivalence of Kelvin plank and clausius statements. Throttling and free expansion, non-flow work done under isothermal, polytropic, adiabatic, isobaric, isochoric processes, simple problems steady flow energy and its applications	5
	3. Formation of Steam	Steam formation, wet steam, dry steam and saturated steam, dryness fraction, superheated steam; degree of superheat, latent heat of vaporization, Enthalpy of steam, entropy; entropy increase during evaporation, temperature entropy diagram mollier diagram (H-S diagram)	5
	4 Steam Boilers	Steam generator, Classifications, comparison of fire tube and water tube boilers, construction and features of Lancashire boiler, locomotive and Babcock and Wilcox Boilers, Introduction to modern boilers. Rankine cycle.	5
Units- II	5.Engine Cycles	Carnot cycle, Otto Cycle, diesel and dual cycle, derivation of efficiency and comparison of these cycles.	4
	6.I.C Engine	Types, classification, CI and SI engines, Mechanical constructional details of two stroke petrol engine and diesel engine, four stroke petrol and diesel engines, valve timing diagrams.	4
	7. Performance of IC engines:	Brake, indicated, frictional powers, brake mean effective pressure ,indicated map, engine efficiencies, air standard, brake, indicated, mechanical, volumetric ,scavenging, efficiency, characteristics of power, fuel consumption with engine speed, calculation of powers, efficiency and SFC for two and four stroke engine. LCV, HCV	5

Total-32

Recommended Books

- | | | |
|----------------------------|---------------------|--------------------|
| 1. Thermal Engineering | RK Rajput | Laxmi publication. |
| 2. Heat and thermodynamics | PL Ballany | Khanna Publisher |
| 3. Thermal Scienc | Domkundwar | S.Chand Publisher |
| 4. Heat Engineering | Kumar and Vasandani | S.Chand Publisher. |
| 5. I.C Engine | Ganesan | McGraw Hill |

List of Experiments

1. Construction Details and Operation of Babcock and Wilcox boiler.
2. Construction Details and Operation of Lanchashire boiler.
3. Construction Details and Operation of mounting and accessories of a boiler.
4. Construction Details and Operation of locomotive boiler.
5. Construction Details and Operation of 2-stroke petrol engine.
6. Construction Details and Operation of 4-stroke petrol engine.
7. Construction Details and Operation of 4-stroke diesel engine.
8. To find the performance parameters of a diesel engine (B.H.P, thermal efficiency, fuel consumption, air consumption.)
9. To find the performance parameters of a petrol engine (B.H.P, thermal efficiency, fuel consumption, air consumption.)

Title of the course : **Applied Mathematics**
 Subject Code : **AM - 211/AM-221**
 Weekly load : 4 Hrs. LTP 3-1-0
 Credit : 4 (Lecture 3; Tutorial 1; Practical 0)

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Determinants	Determinants, minors, cofactors, expansion of a determinant, properties of determinants, solution of linear simultaneous equations upto three variables by Cramer's rule.	7
	2. Matrices	Introduction to matrices; addition; subtraction and multiplication of matrices. Inverse of a matrix by adjoint method. Solution of linear simultaneous equations upto three variables.	7
	3. Rank, eigenvalues	Elementary transformations. Row reduced Echelon forms. Rank of a matrix. Normal form. Linearly dependent and independent vectors. System of linear equations. Linear transformations. Eigen values and eigenvectors. Properties of eigenvalues. Verification of Cayley-Hamilton Theorem and its use for finding inverse of a matrix.	8
Unit-2	4. Solid Geometry	Cartesian co-ordinate system. Distance formula. Section formulae. Direction ratios and direction cosines. Equation of a plane. Equations of a straight line. Condition for a line to lie in a plane. Coplanar lines. Shortest distance between two lines. Intersection of three planes. Equation of a sphere. Tangent plane to a sphere.	14
	5. Differential equations	Ordinary differential equations, its order and degree. Linear and non-linear differential equations. Formation of differential equation. General and particular solution of a differential equation. Solution of a differential equation of first order and first degree - variable separable method, homogeneous differential equation, Solution of linear differential equation.	9

Total=45

Recommended Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern Ltd.
2. Thomas & Finney, Calculus, Pearson Education.
3. B.V. Ramana, Higher Engineering Mathematics, McGraw Hill.

Title of the course : **Basic Electrical Engineering**
Subject Code : **EE-211/EE-221**
Weekly load : **5**
Credit : **4**

L T P: 3 0 2

Theory:

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	Basic Concepts	Electric Charge, Current and Electromotive force, Potential and Potential Difference; Conductor, Semiconductor Insulator and dielectric; Electrical Power and Energy; Ohm's Law, Resistance and color coding; Capacitance and Inductance, their ratings; Effects of Temperature on Resistance, Series and Parallel connection, Kirchoff's Laws and Their Applications	06
	AC Fundamentals	Concept of Alternating Voltage and Alternating Current, Difference between AC and DC, Various Terms Related with AC Waves; RMS and Average Values, Concept of Phase and Phase Difference, Single Phase and Three Phase Supply; 3-ph Star-Delta connections, Inter-Relation between phase voltage/current & line voltage/current; Alternating Voltage applied to Pure Resistance, Pure Inductance, Pure Capacitance and their combinations, Concept of Power and Power Factor in AC Circuit.	08
	Measuring Instruments	Principle and Construction of Instruments used for Measuring Current, Voltage, Power and Energy, Concept and applications of digital multimeters, oscilloscopes, signal generators	03
	Electrical Safety	Electrical Shock, Safety practices to prevent Electric Shock; Concept of Fuses- Classification, Selection and Application; Concept of Earthing ,Types of Earthing, MCBs, ELCBs and their Applications.	04
Unit-2	Electromagnetic Induction	Concept of Magnetic Field, Magnetic Flux, Reluctance, Magneto Motive Force (MMF), Permeability; Self and Mutual Induction, Basic Electromagnetic laws, Effects on a Conductor Moving in a Magnetic Field, various losses in magnetic circuits;	04
	Electrical Machines & Transformers	Elementary concepts and classification of electrical machines, Common features of rotating electrical machines, Basic principle of a motor and a generator, Need of Starters and their classifications. Transformer- Classification, Principle of operation, Construction, Working and applications.	10
	Utilization of Electricity	Concepts of Electricity for electrolysis process e.g., Electroplating, Electro refining etc., Electrochemical Cells & Batteries; Application of Electricity for Heating, Ventilating and air-conditioning, Welding and illumination.	04
	Basic Troublshooting	Basic Testing and faults diagnosis in electrical systems, various tools and their applications, replacement of different passive components e.g. fuses, lamps and lamp holders, switches, cables, cable connectors, electromagnetic relays.	04

Recommended Books:

Title	Author	Publisher
Electrical Technology	Edward Hugh	Pearson Education
Basic Electrical Engineering	D P Kothari & I J Nagrath	TMH
Electrical Machines	D P Kothari & I J Nagrath	TMH
Electrical Machines	S K Bhattacharya	TMH

Practical (EE-211/EE-221)

1. Study of various passive components and measuring instruments and their connections in electrical circuits.
2. Verification of Ohm's Law.
3. Verification of Kirchoff's laws (KCL & KVL).
4. Verification of equivalent resistances in series and parallel connections.
5. Measurement of various characteristic values of a Sinusoidal waveform with the help of CRO.
6. Measurement of voltage, current and power in RL and RLC circuits and Verification of phase angle and power factor concept.
7. Study of various types of earthings.
8. Study of various types of protection devices e.g. fuses, MCBs and ELCBs
9. Verification of Faraday's laws and Lenz's law.
10. Study of various types of DC motors and their starters.
11. Study of various types of AC motors and their starters.
12. Study of various types of transformers and Verification of turns ratio.
13. Starting and reversing various AC and DC motors.
14. Fault diagnosis and removal in general electrical connection /apparatus.

Title of the course : Fundamentals of Electronics Engineering

Subject Code : EC-211/EC-221

Weekly load : 5

LTP 3-0-2

Credit : 4 (Lecture 3 Practical 1)

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1.Introduction	Classification of materials into conducting and insulating materials through a brief reference to atomic structure, Conducting Materials, Insulating Materials, Semi-conductor Materials	6
	2. Active And Passive Components	Introduction to active and passive components; fixed and variable resistances, their various types fixed and variable capacitors, their various types and important specifications and colour codes	4
	3. Voltage and current sources	Concept of constant voltages and constant current sources, symbol and graphical representation, characteristics of ideal and practical sources.	6
	4. Semiconductor Diode:	Atomic structure of Germanium and Silicon semi-conductors; intrinsic and extrinsic semiconductors, PN junction, basic principles of operation and VI characteristics of PN junction diode, static and dynamic resistance of a diode.	8
Unit-2	5.Applications of Diode	Use of a diode in rectifiers, half wave, full wave and bridge rectifier with shunt capacitor filter, series inductor filter, zener diode and its applications, as a voltage regulator, light emitting diode (LED), liquid crystal display (LCD).	6
	6. Transistor	Introduction to a transistor, working of a PNP and NPN transistor, input and output characteristics, transistor configurations	6
	7. Biasing and Configuration of Transistor	Biasing of a transistor, amplifying action of a transistor, comparison of different configurations,	6
	8. Field effect transistor	FET, JFET, MOSFET, their characteristics and applications, unijunction transistor (UJT)	6

Total=48

RECOMMENDED BOOKS

1. Basic Electronics by: VK Mehta , S. Chand
2. Electronic Components and Materials by: Grover, Jamwal , Dhanpat Rai
3. Electronic Components & Materials by: SM Dhir , McGraw Hill
4. Electronic Devices & Linear Circuits by: Bhargava & Gupta , McGraw Hill

List of Experiments: (EC-211/EC-221)

1. To study the various passive components.
2. To study various active components.
3. To study the front panel control of CRO.
4. To test various electronic components using multimeter.
5. To find the value of a resistor using color coding scheme.
6. To plot the V-I characteristics of a diode.
7. To study zener diode as a voltage regulator.
8. To study the use of a diode as a half wave rectifier.
9. To study the use of a diode as a full wave rectifier.
10. To show the amplifying action of a transistor.

MANUFACTURING PROCESSES-I

Subject Code : ME- 211

Weekly load : 05

LTP 3-0-2

Credit : 04

Theory

Course Description	Lecture(s)
Unit-I	
Foundry	12
Introduction to casting, advantages & limitations, sand moulding- materials, properties of moulding sand, sand moulding procedure, Pattern- types & materials, pattern allowances, core prints, cores, elementary & brief description of various melting furnaces, melting of metals, metal solidification, casting defects and their remedies, introduction about moulding processes.	
Welding	12
Welding processes - classification of welding processes, gas welding - tools & equipment, types of flames, arc welding - procedure, equipment, applications, type of electrodes, specification of electrodes, selection of electrodes, welding parameters & equipments. Introduction to submerged arc welding, resistance welding, spot, seam, projection & percussion, pressure, friction welding, soldering and brazing.	
Unit-II	
Turning, Shaping & Planning	06
Principle, description & operations performed on lathe machines, specifications, work holding devices, cutting tools & operations; working principle of shaper, planer and slotter; quick return mechanism, types of tools speed and feed used in above processes, Commonly used cutting tool materials.	
Milling & Drilling	05
Milling principle, types of milling machines, specifications of milling machine, indexing head, types of milling cutters, Principles of drilling operation, cutting parameters, classification of drilling machines, different operations done on drilling machines.	
Boring	04
Principle of boring, classification of boring machines, specification of boring machines, boring tools, boring bars & boring heads.	
Broaching	04
Principles of broaching operation, broach nomenclature, cutting action of broach, Broaching operations and applications.	
Grinding	05
Types and working of cylindrical, surface, centreless grinding. Tool and cutter grinder, various elements of grinding wheel abrasive, grade, structure, bond, codification of grinding wheel, selection of grinding wheel, dressing.	

Total = 48**Recommended Books**

<i>Title</i>	<i>Author(s)</i>	<i>Publisher</i>
Workshop Technology Vol. I & II	Hazra Chowdhry	Media Promotors
Manufacturing materials & process	Lindberg	Prentice Hall
Manufacturing processes	Begeman	John Wiley
Workshop Technology	S.K. Garg	Laxmi Publications

List of Experiments (ME-211)

1. Introduction to electric arc welding (AC &DC), practice in setting current and voltage for striking proper arc, practice electric arc welding application.
2. Introduction to gas welding, study the equipment and tools used in it, practice gas welding application.
3. Study of a lathe machine and its important parts; cutting tools used and different operations performed on it, practice step turning, taper turning and boring operation using lathe.
4. Study of a drilling machine and its important parts; cutting tools used and different operations performed on it, practice drilling and counter boring using drilling machine.
5. Study of a milling machine and its important parts; types of milling cutters used and different operations performed on it, practice milling operations using helical slab milling cutter, end milling cutter.
6. Study of a grinder and its important parts; grinding wheel used and different operations performed on it, practice surface and cylindrical grinding operations.

Note: Two exercises have to be done on each above mentioned experiments.

Title of the course : **TOOL ROOM TECHNIQUES -I**
 Subject Code : **ME-212 A**
 Weekly load : 4
 Credit : 3 (Lecture 2; Practical 1)
Theory

LTP 2-0-2

Course Description	Lecture(s)
Unit-I	
Jigs & Fixtures	08 Hrs
Introduction to jigs & fixtures. Principles of jigs & fixtures design, Location & principles of location, different elements of a jig, locating devices. Clamping, devices. Jig bushes, drilling jigs. Milling fixtures. Turning fixtures.	
Broaching	08 Hrs
Introduction, types of broaches, classification, pull type & push type, horizontal & vertical pull type broaching machines.	
Unit-II	
Powder Metallurgy	08 Hrs
Introduction, process of powder metallurgy, advantages & applications of powder metallurgy.	
Fitting Practice	08 Hrs
Metal chipping & cutting, chipping tools, chipping techniques, Scrapping, filing Operations, cutting of external threads.	

Total=32

Recommended Books:

1. Workshop Technology(Vol-1) Chapman CBS
2. Production Technology R. K. Jain Khanna
3. Jigs & Fixtures Gant TMH
4. Workshop Technology Vol.I & II Hajra Choudhary Media Promoters
5. Workshop Technology Vol.I & II B. S. Raghuvanshi Dhanpat Rai

List of Experiments (ME-212 A)

1. Study of different type of jigs
2. To study the working of milling fixtures.
3. To study the working of turning fixture.
4. To study the different type of broaches.
5. To study the pressing or compacting of metal powders.
6. To study the construction and working of vertical pull type broaching machine.
7. To practise the cutting of external threads.

Title of the course : **Refrigeration and Air Conditioning-I**
 Subject Code : **ME-212 B**
 Weekly load : 4 LTP 2-0-2
 Credit : 3 (Lecture 2; Practical 1)

Theory

Course Description	Lecture(s)
Unit-I	
Air Refrigeration Systems	
Introduction, concept of refrigeration, units of refrigeration, air refrigeration systems, reversed control cycle, Bell Coleman air refrigerator.	8
Refrigeration Systems	
Vapor compression refrigeration system, COP. Performance of VCR, advantages and disadvantages, Methods for improving COP. Introduction, aqua ammonia absorption system.	8
Unit-2	
Refrigerants	
Classifications of refrigerants, properties of ideal refrigerants, anti-freeze solutions, selection of refrigerants, nomenclature of refrigerants. Ozone layer depletion, eco-friendly refrigerants.	8
Psychrometry and Air Conditioning Systems	
Psychrometry, Psychrometric charts, Psychrometry Process, Simple numerical problem. Types of air-conditioning systems, central AC, unitary AC load circulation load calculation.	8
Total-32	

Recommended Books

<i>Title</i>	<i>Author(s)</i>	<i>Publisher</i>
Refrigeration and Air conditioning	C. P. Arora	TMH
Refrigeration and Air conditioning	Domkondwar	Khanna
Refrigeration and Air conditioning	Balleney	Khanna
Ref and Air Conditioning	Gupta & Prakash	New Chand

LIST OF EXPERIMENT (ME-212 B)

1. Study of different type of tools and equipments used in refrigeration and air-conditioning lab.
2. Practice in cutting bending, flaring, swaging and Brazing of copper tube.
4. To demonstrate the working of domestic refrigerator.
5. Study of window-type air-conditioner.
6. Study of split type air-conditioner.
7. Locating leaks in refrigeration system.

Title of the course : **Farm Machinery-I**
Subject Code : ME-212 C
 Weekly load : 4
 Credit : 3 (Lecture 02, Practical 01)

LTP 2-0-2

Theory

Course Description	Lecture(s)
Unit-I	
Introduction	04
Status of farm power in India, sources of farm power, Farm mechanization and its importance in the advancement of agriculture engineering/ technology, Categorization of farm machinery and equipment.	
Shaping and leveling equipments:	07
Introduction, types, working principle, construction, material adjustment, mode of operation, specifications of scraper, riddger, leveller, bund former.	
Ploughing & Tillage equipments:	07
Primary tillage, introduction, types, working, principle, construction, mode of operation, specifications of mould board plough, disc plough, Secondary tillage, Introduction, types, working principle, construction, mode of operation, specifications of Cultivator, Disc Harrow, rotovator.	
Unit-II	
Equipments for land development	07
Mechanical working of soil, mechanical methods land grading, shaping & leveling, planning of operation, earth moving equipments, computerized land leveler.	
Seeding equipments	07
Introduction, types, working principle, construction, material adjustment, mode of operation, specifications of: Indigenous plough, furrow opener, calibration of seed cum fertilizer drill, specification of different types of metering devices.	

Total= 32

Recommended Books:

Title	Author(s)	Publisher
Principles of Farm Machinery	Kepner	C. B. S
Hydraulic Machinery	Abdullah O.P. Singhal	Dhanpat Rai Orient Offset Printers
Farm mechanism & Farm Machinery & Power		

List of Experiments Farm Machinery Lab-I (ME-212C)

1. Study, operation and maintenance of Land Shaping Equipments.
2. Study, operation and maintenance of Mould Board Plough.
3. Study, operation and maintenance of Disc Plough.
4. Study, operation and maintenance of Disc Harrow.
5. Study, maintenance & field operation of a Cultivator.
6. Study about different types of Intercultural Equipment.
7. Study, operation and maintenance of Seed cum Fertilizer Drill.
8. Study and operation of Paddy Peddling Equipment's.
9. Calibration & field operation of seed cum Fertilizer Drill.

Title of the course : **WELDING TECHNOLOGY I**
 Subject Code : **ME-212D**
 Weekly load : 4 LTP 2-0-2
 Credit : 3 (Lecture 2; Practical 1)

Theory

Course Description	Lecture(s)
Unit-I	
Introduction	
Introduction to various fabrication processes, definition of welding, importance of welding as compared to other fabrication techniques, classification of welding and allied processes.	04
Types of welded joints	
Concept of edge preparation & different types of groove design, role of thickness in edge preparation, types of welds and welded joints for various welding processes, welding positions.	06
Shielded metal arc welding	
Principle of SMAW, welding arc and its initiation, static arc characteristics, power sources for SMAW, equipment and accessories required for SMAW process, welding parameters and their effect on weld bead geometry, classification of electrodes and electrode coatings, AWS and BIS codes for the electrodes.	06
Unit-II	
Gas welding	
Principle of gas welding, types of the fuel gases and their properties, equipment detail, cylinders torches and regulators, their constructional features and operational details, types of flames and their characteristics, gas welding techniques, filler material and fluxes.	06
Soldering and brazing	
Basic principle of soldering & brazing, types of solders, soldering and brazing techniques, role of flux and the types of fluxes, applications of soldering and brazing, braze welding. Advantages and limitations of each.	06
Welding of Plastics	
Types of plastics, use of plastic in the fabrication industry, introduction to various techniques used for welding the plastics.	04

Total=32

Recommended Books:

<i>Title</i>	<i>Author(s)</i>	<i>Publisher</i>
	Text	
Welding processes & technology	RS PARMAR	Khanna Publishers
	Reference	
Principles of welding technology	LM GOURD	Edward Arnol
Welding technology	OP KHANNA	Dhanpat Rai
Modern arc welding	SV NADKARNI	Oxford & IBH

List of experiments (ME-212 D)

8-10 experiments from following list

1. To study the effect of welding current on bead geometry.
2. To study the effect of welding speed on bead geometry.
3. To study the effect of welding open circuit/arc voltage on bead profile.
4. To study the effect of polarity on bead geometry
5. To measure moisture contents of electrode coating.
6. To identify various gas flames used in welding.
7. Practice of gas welding in flat position
8. To braze tungsten carbide tip on a single point cutting tool.
9. Practice of soldering of thin sheet/rods
10. Practice of plastic welding

Title of the course : **Foundry Technology-I**
 Subject Code : **ME-212 E**
 Weekly load : 4 LTP 2-0-2
 Credit : 3 (Lecture 2; Practical 1)

Theory

Course Description	Lecture(s)
Unit-I	
Introduction	10
Various foundry processes their capabilities and safety requirements in foundry, concept of mould, constituents of flask equipments, risers, runners , pouring basins, sketching of mould along with its components, type of mould, molding methods, type of patterns, BIS color coding, materials and allowances	
Mould Materials	04
Properties of moulding sand, additives, natural and synthetic binding agents,	
UNIT-II	
Mould Assemblies	06
Assembly of cope and drag, chaplets, mould sealing, preservation of assembles mould, bench life	
Core making	07
Definition and preparation of cores, type of cores, setting of cores, core making and baking, reinforcement of core, painting and venting of cores, core boxes and core prints.	
Gates and risers	05
Introduction to gating systems and their functions, different types of different risers and their functions.	

Total=32

Recommended Books:

1. Principle of foundry technology by PL Jain, Khanna Publishers.
2. Foundry Technology by O P Khanna, Dhanpat rai.
3. Foundry Technology by Srinivasan, Khanna Publishers.
4. Principles of metal casting, Richard W Heine, By TMH Publishers.

List of experiments (ME-212 E)

1. Familiarisation with different patterns, hand tools and safety aspects of foundry shop.
2. To perform various steps of sand conditioning (lump breaking, mulling, water addition and mixing of additives).
3. To find out the permeability of a given sand sample.
4. Find the grain fineness number of given sand sample.
5. To find out the moisture content of given sand sample.
6. To find out the clay content of given sand sample.
7. Study the working and constructional details of Cupola furnace.
8. Study the working and constructional details of Pit furnace.
9. Preparation of green sand mould using single piece pattern, two-three exercise.

Title of the course : **Engineering Materials and Metallurgy**
 Subject Code : **ME-213**
 Weekly load : 4 LTP 2-0-2
 Credit : 3 (Lecture 2; Practical 1)
Theory

Course Description	Lecture(s)
Unit-I	
Introduction:	04
Introduction to engineering materials, physical metallurgy and basic concepts of heat treatment. Industrial importance of common engineering materials-metals, non-metals and alloys, their properties (physical and mechanical) and applications.	
Ferrous metals and non ferrous metals:	08
Classification of iron and steel; cast iron, alloy steel, stainless steel and carbon steels. Aluminium and its alloys; copper and its alloys; nickel and its alloys; their physical and mechanical properties and applications.	
Engineering plastics:	04
Thermosetting and thermo plastics, fabrication techniques of engineering plastics, their properties and applications.	
UNIT-II	
Crystallography:	05
Crystalline nature of solids, Structure of atom, types of solids, space lattice arrangement of atoms in BCC, FCC and HCP crystals, plastic deformation of metals, strengthening mechanism of metals and their effect on mechanical properties.	
Phase diagrams:	06
Phases in metal system, solid solution, Hume-Rothery rules, solidification of pure metals and alloys, phase rule, equilibrium diagrams, Iron-carbon equilibrium diagram and effect of carbon on properties of steel.	
Heat treatment processes:	05
Principle of heat treatment of steels, TTT curves, annealing, normalizing, hardening, Case hardening, tempering, austempering, martempering, flame hardening, induction hardening, carburizing, nitriding, cyaniding of steels, Precipitation hardening with reference to Copper and Aluminum	

Total=32

Recommended Books:

1. Materials and metallurgy by OP Khanna, Published by Dhanpat Rai.
2. Heat treatment principles and techniques by Rajan and Sharma, Published by PHI.
3. Introduction to physical metallurgy by Sidney H Avner, Published by TMH.

List of experiments (ME-213)

1. Visual inspection of various types of engineering materials.
2. Iron carbon equilibrium diagram.
3. To study BCC, FCC and HCP crystals.
4. Specimen preparation for tensile strength testing (round).
5. Specimen preparation for tensile strength testing (flat).
6. Specimen preparation for Izod testing.
7. Specimen preparation for Charpy V-notch testing.
8. Demonstration on universal testing machine (UTM) for tensile test.
9. Demonstration on universal testing machine (UTM) for U-bend test.
10. Demonstration on Impact strength testing machine.
11. To study muffle furnace and carryout hardening and annealing.

List of Experiments (ME-214 A)

L T P : 0 0 4

Credits: 2 (Practicals:2)

1. To draw the geometry of single point cutting tool and its related angles.
2. To draw the geometry of twist drill with its components.
3. To draw various milling cutters.
4. To draw the three and four jaw chucks.
5. To draw the various lathe accessories.
6. To draw the turret and capson head.
7. To draw the various job holding device of drilling machine.
8. To draw the milling arbor, adapter and collets.
9. To draw the various milling cutters.
10. To draw the different types of grinding wheel shapes.
11. To draw various boring and reaming tools.
12. To draw the geometry of broach.

INSTALLATION AND SERVICING OF REFRIGERATION AND AIRCONDITIONING EQUIPMENTS (ME-214 B)

Weekly Load : 4 Hrs.

L T P: 0 0 4

Credits : 2 (Practical:2)

List of experiment

1. To perform the installation of an window type Air- conditioner.
2. To perform the of installation of an Refrigerator.
3. To perform the heat load calculation for a given room.
4. Performing servicing of the Domestic Refrigerator.
5. Performing servicing Window type Air-conditioner.
6. Overhauling of reciprocating compressor.
7. To add oil to compressor.
8. Servicing and installation of Solenoid valve.
9. Understand the points to installation a split type Air-conditioner.

Title of the course : **Repair and maintenance of Auto and Farm Equipments**
Subject Code : **ME-214 C**
Weekly load : 4 LTP 0 -0- 4
Credit : 2 (Lecture 0, Practical 2)

List of Experiments

1. To study about the basic components of an internal combustion Engine.
2. To dismantle, clean and reassemble a dry type of air cleaner.
3. To dismantle, clean and reassemble a wet type air cleaner.
4. Study of fuel supply system and service the fuel tank and fuel lines of an automobile.
5. Greasing the front and rear wheel of an automobile
6. Study and servicing of a carburetor.
7. General check up of electrical/lighting/horn system of an automobile.
8. To repair a punctured tube of an automobile
9. Study about the wheel replacing and wheel rotation of a car.
10. Routine servicing of the tractor.
11. To remove, inspect and reinstall clutch assembly of an automobile.
12. To study the various methods of changing the tines of the cultivator.
13. Method for oiling/greasing of the bearing of a disc harrow
14. To arrange the Industrial visit of an automobile shop/ farm equipments industry time to time.

Title of the course : **WELDING PRACTICES**
Subject Code : **ME-214 D**
Weekly load : 4 LTP 0-0-4
Credit : 2

10 – 14 Jobs from following list

1. Practice of laying stringer beads on plate in flat position.
2. Practice of welding in vertical position using shielded metal arc welding process.
3. Practice of under water welding process.
4. Practice of joining strips in flat position using butt joint
5. Practice of laying bead on plate using submerged arc welding process.
6. Practice of operating tungsten inert gas welding machine.
7. Practice of MIG/MAG process.
8. Practice of spot welding process
9. Practice of projection welding
10. Practice of flash butt welding
11. Practice of gas welding in flat position
12. Practice of brazing
13. Practice of soldering
14. Practice of forge welding

Title of the course	: Pattern Drawing		
Subject Code	: ME 214 E		
Weekly load	: 4	LTP	0-0-4
Credit	: 2 (Practical 2)		

List of Experiments

1. Introduction
 - a. Types of Patterns
 - b. Pattern allowances
 - c. Pattern colour code
2. Pattern drawing for Duck foot Bend
3. Pattern drawing for DF Taper
4. Pattern drawing for DF Taper $\frac{1}{8}$ "
5. Pattern drawing for Air Radius Arm
6. Pattern drawing for Bearing Bracket
7. Pattern drawing for Stop Valve Body
8. Pattern drawing for Pump End Cover
9. Pattern drawing for Master Rod
10. Pattern drawing for Valve Body

Title of the course : **FUNDAMENTAL OF TOOL AND DIE DESIGN**
 Subject Code : **ME- 221A**
 Weekly load : 5 LTP 3-0-2
 Credit : 4 (Lecture 3; Practical 1)

Theory

Course Description	Lecture(s)
Unit-I	
Press working operations	12 Hrs
Blanking, Piercing, Bending, Crimping, Notching, Coining, Punching, Slitting, Lancing, Nibbling, Drawing, Applications of press working operations.	
Types of presses	12 Hrs
Mechanical Press, Pneumatic Press, Knuckle-joint Press, Hydraulic Press, Fine blanking Press, Forging Press Hammers, specifications and their applications.	
Unit-II	
Types of dies	12 Hrs
Progressive, combination, compound dies; their constructional features and Specific applications, Strip layout concept.	
Parts of die Punch and die	12 Hrs
Basic construction and parts of die, Die block , Punch plate, Blank punch, Pierce punch, Stripper plate, Pilot, Dowel, Back gage, Finger stops. Punch and die clearance, angular clearance and their material.	

Total=48

Recommended Books:

1. Production Engineering P. C. Sharma S. Chand
2. Tool design Donaldson TMH
3. Workshop Technology Vol.I & II Hazra Choudhary Media Promoters

List of Experiments (ME-221 A

1. To study the geometry of single point cutting tool.
2. To study the different type of cutting tool materials.
3. To understand basic elements of Jigs and fixtures.
4. To study various types of holding devices for cutter and workpieces.
5. To study the factors influencing tool life.
6. To study the different methods for calculating tool life.
7. Identifying the various parts of centre lathe and use of its control.

Title of the course : **Refrigeration and Air Conditioning-II**
 Subject Code : **ME-221 B**
 Weekly load : 5 LTP 3-0-2
 Credit : 4 (Lecture 3; Practical 1)

Course Description	Lectures
Unit-I	
Food Preservation	
Need of refrigeration in <i>food</i> preservation, Equipment used for food preservation in: Domestic Applications: Refrigerator. Specifications and features of various refrigerators. Commercial Applications: Introduction and application of deep freezers, display controls, ice cube machines. breweries dispensing machines etc. Industrial Applications: Introduction and application of cold Storage, ice plants, ice cream machines, milk and vegetable storage cold room.	10
Comfort Air Conditioning	
Requirements <i>for</i> comfort air conditioning (internal design conditions) applications of: -Desert cooler; its working and uses -Window air conditioner: its working and uses -Split air conditioner; its working and uses -Package air conditioner; its working and uses -Central air conditioning plant; its working and uses	10
Unit-2	
Portable Air Conditioning	
Car air conditioner Bus air conditioner Train air conditioner	10
Installation of Refrigerator & Air Conditioner	
Selection of type and capacity of Room air conditioner, location of A/C- window, indoor unit. Split A/C. arability of power. location of outdoor unit, piping layout, consideration of slope in window/split A/Cs, draining in indoor unit of split A/C, installation of piping.	10
Fans and Blowers	
Types, fiction and application of fans and blowers, fan rating and selection.	8

Total-48

Recommended Books

<i>Title</i>	<i>Author(s)</i>	<i>Publisher</i>
Refrigeration and Air conditioning	C. P. Arora	TMH
Refrigeration and Air conditioning	Domkondwar	Khanna
Refrigeration and Air conditioning	Balleney	Khanna
Ref and Air Conditioning	Gupta & Prakash	New Chand

List of experiments (ME-221B)

1. Study of different type of tools and equipments used in refrigeration and air conditioning lab
2. Study of different type of evaporators
3. Study of a window type air-conditioner
4. To demonstrate the working of domestic refrigerator
5. Practice in cutting, bending, flaring, swaging and brazing of copper tube
6. To study and sketch of various types of condensers
7. Locating leaks in a refrigeration system
8. Study of trouble shooting in refrigeration and air conditioning
9. To demonstrate the working of water cooler
10. To demonstrate the working of cooling tower

Title of the course : **Advanced Agricultural Equipments**
 Subject Code : **ME-221 C**
 Weekly load : 5
 Credit : 4 (Lecture 3 & Practical 01)

LTP 3-0-2

Theory

Course Description	Lecture(s)
Unit-I	
Field machinery	12
Definition, general classification of farm machinery, specification & sizes of field machinery, field capacity & field efficiency, methods of increasing field efficiency, selection of farm machinery, operations. Care & maintenance, estimation of cost of operation.	
Tractor	12
Development of the tractors and functions of farm tractor, introduction to special feature of tractors such as: Body cooling system, steering system, transmission, final drive, clutch, PTO, hydraulic system, brake, hitching system tyre and front axle, starting and operation of tractor, repair, maintenance, common defects, few causes and their remedial measures.	
Unit-II	
Advanced Plant Protection Equipments	08
Introduction, types, working principle, construction, mode of operation of sprayer and duster: hand operated, power operated, hydraulic tractor drawn.	
Standardization in agricultural engineering	08
Raw materials, components & ancillary items, tractor testing, power tillers, agriculture equipments & machinery, agricultural processing equipment, standardization of international level.	
Testing & Evaluation of Irrigation Pumps	08
Efficiency of pumps, testing procedure; testing parameters, calculation of performance parameters, case studies.	

Total=48

Recommended Books:

<i>Title</i>	<i>Author(s)</i>	<i>Publisher</i>
Farm mechanization & farm machinery & power	Dr. O. P. Signal	Naresh Chander Aggarwal
Principles of Farm Machinery	Kepner	C. B. S
Testing and Evaluation of Agricultural Machinery	Mehta, Verma & others	NATIC

List of Experiments (ME-221 C)

1. Practice of Tractor Driving in the field with safety precautions.
2. Study, operation of Hydraulic System in the Tractor.
3. Servicing of the Tractor as per servicing schedule.
4. To determine the speed of Tractor in the field with Low/High Gear.
5. To practice towing of Tractor with trolley & farm equipments.
6. Study, operation and maintenance of Sprayers cum Duster.
7. Study, operations of Irrigation pump, dismantling and checking.
8. Study, operations of Submersible pump, dismantling and checking.

Title of the course : **Inspection and Testing of Weldments**

Subject Code : **ME-221 D**

Weekly load : 5 LTP 3-0-2

Credit : 4 (Lecture 3; Practical 1)

Theory

Course Description	Lecture(s)
Unit-I	
Welding Symbols and Requirement for Welding Inspectors	06
Welding symbols and location of weld on drawing as per BIS codes, Ethical and essential requirement for welding inspector	
Weld Related Discontinuities	10
Discontinuities and defects, reasons of weld related discontinuities and their remedies.	
Welding Procedure Specifications	08
Description and details of WPS, WPS form, and qualification of welding procedure specifications.	
UNIT-II	
Qualification of Welders and Welding Operators	06
Weld performance qualification requirement, testing of qualification weld, qualification records.	
Destructive Testing of Welds	09
Mechanical tests and standard test specimen as per BIS codes, tensile bend tests, impact tests, hardness tests.	
Non Destructive Testing of Welds	09
Brief description and scope of application of various NOT techniques, visual inspections, die penetrate testing, magnetic particle testing, ultrasonic and radiographic testing techniques.	

Total=48

Recommended Books

Title	Author(s)	Publisher
Welding Engineering & Technology	R. S. Parmar	Khanna Publications
Modern Arc Welding Technology	S. V. Nadkarni	Oxford & IBH.
AWS Welding Handbook, Volume-1	Leonard. P. Connor	AWS
Statistical Quality Control	Juran	McGraw Hill.
Quality Control	Mahajan	Dhanpat Rai & Sons
Method of Testing Fusion Welded Joints and Weld Metals in Steel	IS-3600 (Part-I & II)	BIS, New Delhi
ASME Boiler and Pressure Vessel Code Section IX.		ASME
Welding Technology	O P Khanna	Dhanpat Rai

List of experiments (ME-221 D)

1. Introduction to destructive testing facilities in the lab.
2. Introduction to non-destructive testing facilities in the lab.
3. Demonstration for the working of muffle furnace.
4. Study and demonstration of tensile test.
5. Study and demonstration of impact strength (Charpy V-notch) test.
6. Study and demonstration of impact strength (Izod) test.
7. To perform visual inspection of a given weld specimen.
8. To perform die penetrant test on a given weld specimen
9. Hardness test.

Title of the course : **Foundry Technology-II**

Subject Code : **ME-221 E**

Weekly load : 5 LTP 3-0-2

Credit : 4 (Lecture 3; Practical 1)

Theory

Course Description	Lecture(s)
Unit-I	
Introduction	06
Review of moulding materials and assemblies, core making, gating and rising of castings.	
Melting and pouring	
Classification of melting furnaces, handling of molten metal and metal pouring, uses of fluxes.	06
Cleaning of castings	06
Shake out, cleaning of sand from casting, shot blasting, burnishing, trimming of gates and risers, controls of fins.	
Special casting techniques	06
Die casting, shell moulding, centrifugal casting, investment casting, slush casting, continuous casting, vacuum casting and vibration casting.	
UNIT-II	
Solidification and casting Defects	06
Directional solidification, Chills, padding and exothermic compounds. Various casting defects, causes and their remedies.	
Inspection of castings	06
Visual inspection, dimensional inspection, non-destructive testing, pressure testing, radiographic inspection, inspection and repair of cracks by use of fillers and welding.	
Casting design considerations	06
Function design-mechanical strength, columnar solidification. Dimensional design factors-minimum section thickness, surface finish, flanges, ribs and junctions.	
Mechanization of moulding processes	06
Squeezer, jolt machines, jot squeeze machine, slingers, blowers.	

Total=48

Recommended Books:

1. Principle of foundry technology by PL Jain, Khanna Publishers.
2. Foundry Technology by O P Khanna, Dhanpat rai.
3. Foundry Technology by Srinivasan, Khanna Publishers.
4. Principles of metal casting, Richard W Heine, By TMH Publishers.

List of Experiments (ME-221 E)

1. To Practice making of simple mould using solid pattern on bench moulding.
2. To practice making of two piece pattern moulding.
3. To practice making self cored pattern moulding.
4. To practice aluminum casting using oil fired tilting furnace.
5. To practice fettling and cleaning of casting.
6. To practice making of mould using molasses sand.
7. Shake out, removal of gates and runners and physical examination of castings.
8. To familiarize with different casting defects.
9. To perform stress relieving of castings.

Title of the course : **TOOL ROOM TECHNIQUES -II**
 Subject Code : **ME-222 A**
 Weekly load : 6
 Credit : 4 (Lecture 3; Practical 1)
Theory

LTP 2-0-4

Course Description	Lecture(s)
Unit-I	
Processing of Plastics	08 Hrs
Introduction, Plastics materials: thermoplastics & thermosetting plastics. Processing techniques like injection molding, blow molding, compression & extrusion process.	
Rubber Processing	08 Hrs
Introduction to rubber materials, rubber molding processes, applications of rubber products.	
Unit-II	
Machining processes	08 Hrs
Jig boring machine, jig grinding, sawing machine, working principle, types of tools used, job setting & accessories for these machines, super finishing processes.	
Basic concepts of New manufacturing processes	08 Hrs
Electro discharge machining (EDM), operating principle, surface finish & machining accuracy, wire cut EDM, applications of EDM, electrochemical machining (ECM), principle, working & construction of ECM.	

Total=32

Recommended Books:

1. Production technology R.K. Jain Khanna
2. Tool engineering & Design G. R. Nagpal Khanna
3. Manufacturing processes Begeman John Wiley
4. Production Engineering Pandey & Singh S. Chand

List of Experiments (ME-222A)

1. Identification of various parts of milling machine and its control.
2. Identification of various parts of shaper machine and its control.
3. To study the construction and working mechanism of shaper machine.
4. To perform turning and facing operation on lathe machine.
5. To study different types of milling cutters.
6. To perform blanking and piercing operation on press machine.
7. To study the working of compound die.
8. To study the working of progressive die.
9. To study the construction and working mechanism of planer.
10. To study the construction and working of tool and cutter grinder.
11. To study the working of surface grinder.
12. To perform the various milling operations on milling machine.

Title of the course : **Heat and Mass Transfer**
 Subject Code : **ME-222B**
 Weekly load : 6 LTP 2-0-4
 Credit : 4 (Lecture 2; Practical 2)

Theory

Course Description	Lecture(s)
Unit-I	
Introduction	
Different modes of heat transfer: conduction, convection, radiation.	4
Conduction	
Fourier's law of heat conduction, thermal Conductivity, effect of temperature and pressure on thermal conductivity of solid, liquid. Electrical analogy for solving 1-D steady state conduction problem for slab, cylinder, sphere and influence of variable thermal Conductivity.	4
Application of conduction	
Straight fins of rectangular cross-section, efficiency of fin, fin effectiveness for rectangular and circular cross section fins. Critical radius of insulation for pipes and electrical cables.	4
Convection	
Free and forced convection, derivation, mass, momentum and energy equations. Concept of boundary layer, boundary layer thickness. Dimensional analysis for forced and free convection	4
Unit-2	
Boiling and Condensation	
Introduction, boiling phenomena, pool boiling regimes, condensation drop-wise and film-wise.	4
Heat Exchangers	
Overall coefficient of heat transfer, different design criterion of heat exchangers (LMTD & NTU methods), calculation of number, diameter & length of tubes, mean temperature difference for parallel & counter flow heat exchangers.	4
Radiation	
Laws of radiation, definition of- emissivity, absorbitivty, reflectivity and transmissivity. Concept of black and grey bodies Planck's law monochromatic radiation, Kirchoff's law and the geometric factor. Lambert's cosine law, definition of intensity of radiation, radiation exchange between simple bodies.	4
Mass Transfer	
Mass transfer process: classification, Concentrations, velocities and fluxes, Fick's law, Steady state diffusion through a plain membrane.	4

Total-32

Recommended Books

<i>Title</i>	<i>Author(s)</i>	<i>Publisher</i>
Heat and Mass Transfer	R. K. Rajput	S. Chand
Heat Transfer	J.P. Holman	TMH
Heat and Mass Transfer	R.C. Sachdeva	New Age International
Heat and Mass Transfer	R. Yadav	Central Publishing House
Heat Transfer	P.K.Nag	TMH
Heat Transfer	Domkundwar	Dhanpat Rai

LIST OF EXPERIMENT (ME- 222B)

1. To determine the Thermal Conductivity of a Metal Bar.
2. To determine the total Thermal resistance and thermal conductivity of a composite wall.
3. To find out the convective heat transfer coefficient in a vertical cylinder in nature convection mode and also compare the results while using suitable empirical relation for the given configuration.
4. To find out heat transfer coefficient in forced convection mode and also compare the results while using suitable empirical relation for the given configuration. _
5. To study the parallel & counter type heat exchanger & find out overall heat transfer coefficient and effectiveness of the heat exchanger for both parallel and counter type flow of heat exchanger.
6. To verify the Stefan Boltzmann constant help or the given experimental setup.
7. To find out the emissivity of the test plate at various surface temperatures

Title of the course : **Farm Machinery-II**
 Subject Code : ME-222 C
 Weekly load : 2
 Credit : 4 (Lecture 2, Practical 2)

LTP 2-0- 4

Theory

Course Description	Lecture(s)
Unit-I	
Planting Equipment	06
Introduction, types, working, construction, material adjustment, operation, maintenance, specifications of: Potato planters (semi auto and automatic), Sugarcane planter, Multi-crop planter, Paddy trans-planter. Safety precautions in handling these equipments.	
Harvesting equipment:	06
Introduction, types, working, construction, material adjustment, operation, maintenance, repair & specifications of Reaper and Harvesting Combine: Self operated combine & tractor operated.	
Threshing Equipment:	06
Introduction, types, working, construction, material adjustment, operation, and specifications of: wheat thresher, groundnut decorticator.	
Unit-II	
Processing equipment	08
Introduction, type, working, construction, material adjustment, and operation, specification of: chaff cutter, hammer mill, sugarcane crusher, and rice huller.	
Pumps:	08

<p>Introduction, types, working, construction, operation, installation (Location, foundation, grouting), power requirement, troubleshooting, piping. Specifications of: Reciprocating (single and double acting), Centrifugal, Submersible pump, Introduction to Sprinkler and Drip irrigation.</p>	
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Total=34

Recommended Books:

<i>Title</i>	<i>Author(s)</i>	<i>Publisher</i>
Principles of Farm Machinery	Kepner	C. B. S
Hydraulic Machinery	Abdullah	Dhanpat Rai
Farm mechanism & Farm Machinery & Power	O.P. Singhal	Orient Offset Printers

List of Experiments Farm Machinery Lab-II

1. Study and operation of Paddy Transplanter.
2. Study and field operation, maintenance of Potato Planter.
3. Study and field operation of Sugarcane Planter.
4. Study and field operation, maintenance of Multi-crop Planter.
5. Study, operation, care and maintenance of Harvester Combine.
6. Study, operation and maintenance of Maize Sheller.
7. To study about Groundnut Decorticator.
8. To arrange the industrial visit at the nearby rice sheller / sugar mill / combine manufacturing unit.

Title of the course : WELDING TECHNOLOGY II

Subject Code : ME-222 D

Weekly load : 6

LTP 2-0-4

Credit : 4 (Lecture 2; Practical 2)

Theory

Course Description	Lecture(s)
Unit-I	
Gas Tungsten Arc Welding	
Introduction of the process, basic principle of operation, consumables for the process, equipment study and the working procedure of the equipment, electrodes used for GTAW process, variants of the process, application and scope of the GTAW process.	06
Plasma Arc Welding	
Principle of plasma arc welding, difference between transferred and non transferred arc, comparison of plasma arc welding with GTAW process, application and scope of the plasma arc welding.	04
Gas Metal Arc Welding	
Introduction of the process, basic principle of operation, consumables for the process, equipment study and the working procedure of the equipment, selection of shielding gases for various materials, edge preparations, metal transfer in GMAW process, working parameters for dip, globular and spray modes of metal transfer, variants of the GMAW process, application and scope of the process.	06
Unit-II	
Submerged Arc Welding	
Power sources used for SAW, principle of the submerged arc welding, electrode wires used in SAW, types of fluxes and their respective applications, edge preparations and the welded joints, scope and application of the process.	06
Electro Slag Welding & Electro gas Welding	
Introduction of the electro slag and electro gas welding process, difference between the two, study of the equipment and working procedure for the electro slag and electro gas welding processes, applications and scope.	05
Resistance Welding	
Basic principle, brief introduction to spot, seam, projection and flash butt welding, welding variables, resistance welding equipments, heat balance, applications, process capabilities.	05

Total=32

Recommended Books:

Title	Author(s)	Publisher
	Text	
Welding processes & technology	RS PARMAR	Khanna Publishers
	Reference	
Principles of welding technology	LM GOURD	Edward Arnol
Welding technology	OP KHANNA	Dhanpat Rai
Modern arc welding	SV NADKARNI	Oxford & IBH

List of Experiments (ME-222D)

1. Introduction to safety in the welding lab and the facilities available in it.
2. Practice of bead on plate experiments in flat position using
 - I. GMAW process.
 - II. GTAW process.
 - III. SAW process.
3. Practice of spot welding.
4. Practice of projection welding.
5. Practice of flash butt welding.
6. To perform nugget testing to check the quality of spot welded specimens.
7. Practice of welding of plastics.
8. Practice of soldering.
9. Practice of brazing.
10. Demonstration of plasma arc welding.

Title of the course : **Forging Technology**
 Subject Code : **ME-222 E**
 Weekly load : 2 LTP 2-0-4
 Credit : 4 (Lecture 2; Practical 2)

Theory

Course Description	Lecture(s)
Unit-I	
Introduction	04
Various forging processes and their limitations, characteristics of forged components, concept of flow lines, computation of stroke size, weight and loss, role of yield and economics, safety requirements in forging.	
Hand and close die forging	07
Bending, cold and hot forging, role of heat and energy, hand forging equipments, heating, effect of heat in hand forging process. Hand forging applications. Components and construction of closed die forging, advantages and disadvantages of closed die forging, type of loading, hammer and press forging.	
Forging processes and equipments	05
Drop forging, mechanism of loading; (mechanical, hydraulic, pneumatic forgings hammers). Press forging, forging die, concept of constancy of volume, shape, role of flash gutter. Special forging processes (roll forging, swaging, and roll forming).	
UNIT-II	
Forging operations	08
Various forging operations (forging, forge welding, punching, shearing, fullering, drawing, upsetting, blocking, bending and trimming). Forging die materials and properties, type of joints and dies, past forging operations (coining, straightening, repair and stress relieving etc.)	
Forging defects and losses	04
Mismatch, cracking, fire cracks, scaling and oxidation, hand care, tongue mark, scale loss, shear waste	
Forging inspection	
Visual inspection, magna flux and ultrasonic testing, real time radiography.	04

Total=32

Recommended Books:

1. Workshop Technology-I, by B S Raghuwanshi, Publisher Dhanpat Rai.
2. Workshop Technology-I, by Hazara chaudhary, Publisher Media Promoters.
3. Manufacturing Technology, by Kalpat Jain, Publisher TMH.
4. Metal Forming, by Nagpal, Publisher Khanna.

List of experiments

ME-222 E

10. To study the various forging tools and equipments.
11. To study and check the various defects in forged components.
12. Properties of the various types of fuels used in forging furnaces.
13. To demonstrate the working of spring and pneumatic hammers.
14. To study the various hot working processes.
15. To study the various cold working processes.
16. To demonstrate practically the basic forging operations.
17. To prepare a job on any hammer available in the shop.
18. To make a round rod into a hexagonal headed shape.
19. To convert a round rod to square rod.
20. Making a hook.
21. To prepare a tong.

Title of the course : **Metrology & Mechanical Measurements**
 Subject Code : **ME-223**
 Weekly load : 5 LTP 3-0-2
 Credit : 4 (Lecture 3; Practical 1)

Theory

Course Description	Lecture(s)
Unit-I	
Introduction	
Metrology and its objectives, need of inspection, physical measurement, precision and accuracy, accuracy and cost, trace- ability, selection of instruments, sources of errors, calibration, sensitivity, and readability, classification of methods of measurements.	07
Standard of Measurements	
Introduction, standards and line standard, yard, meter, end standards, end bars, transfer from line standard to end standards.	05
Linear measurements	
Introduction, non- precision measurements, steel rule, calipers, outside inside, surface plate, angle plate, v-block, straight edges, combination set, precision linear measurements, vernier instruments, micrometer, depth and height gauge, thread micrometer, caliper, slip gauges and their uses.	07
Measurements of work properties	
Straightness, flatness, squareness, parallelism, circularity, surface finish, their tests and measurements.	05
Unit-II	
Limits, fits and tolerances	
Introduction, tolerances, concept of inter change ability, limits of sizes, Indian standard tolerance zone shaft, hole, basic shaft, basic hole, clearance, interference, commonly used fits, Taylor’s principle, “ Go “ and “ No Go “ gauges, plug gauges, ring gauges, snap gauges, limit gauges, gauges for tapers.	08
Comparators	

Introduction, mechanical and electrical comparator, their uses, advantages and disadvantages.	06
Metrology of screw thread	
Introduction , screw terminology, pitch errors in screw threads, aggressive pitch error, measurement of elements of screw threads, major meter, minor diameter, thread micrometer, two wire method, three wire method.	05
Measurement of gears	
Introduction, terminology of gear tooth, concentricity of teeth, good alignment of each tooth, measurement of profile, spacing pitch, thickness of tooth, backlash.	05

Total=48

Recommended Books:

1. I.C. Gupta, Engineering Metrology, Dhanpat Rai Publication
2. R. K. Rajput, Engineering Metrology and Instrumentation, Katson Books
3. Nakra & Chaudhary, Instrumentation, Measurement & Analysis; Tata McGraw Hill
4. T. G. Beckwith, L.N. Buck and R. D. Marangoi, Mechanical Measurements; Addison Wesley Reading

List of Experiments

- 1) Study and measurement using surface plate, angle plate, V-block, try square, surface gauge, marking gauge, telescopic gauge, engineering scale.
- 2) Study and use of micrometer.
- 3) Study and use of vernier calliper.
- 4) Study and use of vernier height gauge.
- 5) Study and use of the bore gauge.
- 6) Study and uses of the dial indicator.
- 7) Finding out the angle of given job by using sine bar and slip gauge.
- 8) Find out the angle of given job by using universal bevel protector.
- 9) Finding the angle of small object as well as linear measurement by using tool maker microscope.
- 10) Finding the angle of small object as well as linear measurement by using profile projector.
- 11) To check the surface roughness of given surface by using surface roughness testing machine.
- 12) To check circulation of given job by using V-block and dial indicator.

Title of the course : **Estimation and costing**
 Subject Code : **ME-224**
 Weekly load : 2 LTP 2-0-0
 Credit : 2 (Lecture 2; Practical 0)

Theory

Course Description	Lecture(s)
Unit-I	
Introduction	
Definition of estimation, cost accounting, purpose of estimating and costing, advantages of costing, difference between costing and cost accounting, methods of costing, functions of cost estimating, estimating procedures.	08
Elements of costing	
Cost structure, Components of cost, overheads, types of overheads, methods of computing overheads, depreciation, methods of computing depreciation	08
Unit-II	
Estimation of Material cost	
Review of basic formulae for computation of area and volume of standard 3-d objects, Estimation of volume, weight and cost of materials for various products	05
Estimation of Machine Shop	
Set up time, operation time, handling time, machining time, tear down time, allowances: personal, fatigue, tool checking/sharpening/changing, unit operation time, cutting speed for various operations for different tool materials and product materials, feed , depth of cut, estimation of time for various machining operations- turning, milling, drilling, boring, tapping, shaping, grinding, planning	06
Estimation of other shops	
Estimation of cost of different products produced in foundry, forging and welding shops	05

Total=32

Recommended Books

<i>Title</i>	<i>Author(s)</i>	<i>Publisher</i>
Text		
Mechanical Estimating and Costing	B P Sinha	Tata McGraw Hill, New Delhi
Reference		
Mechanical estimating and Costing	TTTI, Madras	Tata McGraw Hill
Production Engineering, Estimating and Costing	M Adithan and B S Pabla	Konark Publishers, New Delhi

MANUFACTURING PROCESSES-II

Subject Code : ME-225

Weekly load : 05

Credit : 04

LTP 3-0-2

Theory

Course Description	Lecture(s)
Unit-I	
Metal Forming	08
Metal forming Processes. Die Stamping, Drawing, Spinning and Tube drawing. Rolling, extruding and forging	
Press Working	08
Types of presses, press working operations; shearing, blanking, piercing, coining, swaging, embossing and upsetting. Types of dies. punches. punch holders & strip Layout	
Metal Finishing and Coating	08
Purpose of super finishing, surface roughness. Introduction of Honing, Lapping Polishing, Buffing and super-finishing. Metal Spraying. Metal Coating; galvanizing, electro-plating and anodizing.	
Unit-II	
Powder Metallurgy	08
Principle. Methods of making powder from metal. Processes involved; Compacting, Sintering and finishing operations. Advantages and Disadvantages of powder metallurgy	
Jigs and Fixtures	08
Considerations in Jigs and Fixtures design. Main elements of jigs and fixture. Principle of location. Locating and clamping devices. Jig bushes	
Non-Conventional Machining	08
Concept of non-conventional machining. Principle and Working of EDM, wire cut EDM. Introduction to other non-conventional machining methods; ECM, LBM and explosive forming.	

Total = 48

Recommended Books

Title

Manufacturing Science
Production Engineering Science
Metal cutting Theory
Publishers

Author(s)

Malik & Ghosh
Pandey & Singh
A.Bhattacharya

Publisher

EWP
Standard Publishers
Central Book

List of Experiments (ME-225)

1. Introduction to press working operations; shearing, blanking, piercing, coining, swaging, embossing and upsetting. Study of different machine to perform these operations. Fabrication of a useful component using cutting, bending and shearing operations.
2. Introduction to grinding, honing, lapping and buffing operations. Practice these operations.
3. Study of a EDM machine and its important parts; cutting tool used and different operations performed on it, practice EDM operations.
4. Study of Jigs & Fixtures and their applications. Design a jig and a fixture for the practical purpose to make useful products.

Note: Two exercises have to be done on each above mentioned experiments.

Title of the course : **Engineering Mechanics**
 Subject Code : **ME-226**
 Weekly load : 6
 Credit : 5 (Lecture 3; Tutorial 1; Practical 1)

LTP 3-1-2

Theory

Course Description	Lecture(s)
Unit-I	
Fundamentals of Mechanics	
Fundamental concept of mechanics and applied mechanics, idealization of mechanics, Basic dimensions and units of measurements, concept of rigid bodies, Laws of Mechanics	04
Laws for Forces	
Control Scalars and Vectors, Vector operations, Vector addition of forces, Force and its effects, characteristics of force vector, Bow's notation Force systems: Coplanar and space force systems. Coplanar concurrent and non-concurrent forces. Free body diagrams,	04
Resultant and components of forces	
concept of equilibrium; parallelogram law of forces, equilibrium of two forces; super position and transmissibility of forces, Newton's third law, triangle law of forces, different cases of concurrent, coplanar two forces systems, extension of parallelogram law and triangle law to many forces acting at one point	04
Polygon law of forces	
Triangle law to many forces acting at one point - polygon law of forces, method of resolution into orthogonal components for finding the resultant, graphical methods, special case of three concurrent, coplanar forces, Lami's theorem	04
Moments & Couples	
Concept of moment, Varignon's theorem, Principle of moments, Moment of forces about a specified axis, concept of couple - properties and effect, Moment of couple, Movement of force on rigid body, Resultant of force and couple system, Reduction of force and couple system, Parallel forces - like and unlike parallel forces, calculation of their resultant	03
Trusses	
Simple trusses, analysis of simple truss, Method of Joints, Method of sections	05
UNIT II	
Friction	
Concept of friction, Characteristics of Dry friction, Laws of Coulomb friction, limiting friction, coefficient of friction; sliding friction and rolling friction, Belt friction, Ladder friction.	05
Centre of Gravity	
Concept of gravity, gravitational force, centroid and centre of gravity, centroid for regular lamina and centre of gravity for regular solids. Position of centre of gravity of compound bodies and centroid of composite area. CG of bodies with portions removed.	06
Simple Lifting Machines	
Concept of machine, mechanical advantage, velocity ratio and efficiency of a machine, their relationship, law of machine, Simple machines : lever, wheel and axle, differential wheel & axle, pulley systems, simple screw jacks, winch crab (single & double	06

Kinetics of particle	
Types of motion, linear motion with uniform velocity, uniform & varying acceleration, motion under gravity, motion of projectiles, relative motion of a particle. Newton's laws of motion, equation of motion, equation of motion for system of particles, D' Alembet's Principle, Motion of connecting bodies. Concept of momentum, Impulse momentum principle, Conservation of momentum, Principle of work and energy.	07

Total=48

Recommended Books:

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1. J. L. Mariam & L. G. Kraige , Engineering Mechanics. John Wiley & Sons
 2. R. C. Hibbeler, Engineering Mechanics (Static & Dynamics), Prentice Hall
 3. Beer & Johnston, Engineering Mechanics (Static & Dynamics), McGraw Hill
 4. Boresi & Schmidt, Engineering Mechanics (Static & Dynamics), Cengage Learning
 5. R. K. Rajput, Engineering Mechanics, Dhanpat Rai Publication, New Delhi
 6. S. Rajshekharan, Engineering Mechanics, Vikas Publishing House , New Delhi
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List of Experiments: (ME-226)

1. To verify parallelogram law of forces addition.
2. To verify triangular law of forces addition.
3. To verify Lamis theorem.
4. To determine efficiency of screw jack.
5. To determine coefficient of friction on horizontal surface.
6. To determine coefficient of friction on inclined plane.
7. To determine efficiency of wheel and Axle.

Title of the course : **Moral Values and Professional Ethics**
 Subject Code : **MC-211/ MC-221**
 Weekly load : 01 Hr LTP 1-0-0
 Credit : 0

Course Description	Lecture(s)
Unit-I	
Moral Values and Self Development	
Social values and individual attitudes, Work ethics, Moral and non moral valuation, Standards and principles, Value judgments. Importance of cultivation of values, Sense of duty, Devotion, Self reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National unity, Patriotism, Love for nature, Discipline.	04
Personality and Behavior Development	
Soul and scientific attitude, Positive thinking, Integrity and discipline, Punctuality, Love and kindness, Avoiding fault finding, Free from anger, Dignity of labor, Happiness vs. suffering , Aware of self destructive habits, Association and cooperation, Doing best, Saving nature.	04
Unit-II	
Character and Competence	
Science vs. God, Holy books vs. blind faith, Self management and good health, Science of reincarnation, Equality, Nonviolence, Humility, Role of women, All religions and same message, Mind your mind, Self control, Honesty, Studying effectively.	04
Competence in professional ethics	
Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems	04

Total=16

Recommended Books:

- 1) M Govindrajran, S Natrajan, V.S. Senthil Kumar, Engineering Ethics(including Human Values); Eastern Economy Edition, Prentice Hall of India Ltd.
- 2) S.K.Chakraborty, Values and Ethics for Organizations Theory and Practice; Oxford University Press, New Delhi,2001.
- 3) S.K. Kapoor, Human rights under International Law and Indian Law; Prentice Hall of India, New Delhi, 2002.
- 4) D.D. Basu, Indian Constitution; Oxford University Press, New Delhi, 2002.
- 5) R. R. Gaur, R. Sangal, G. P. Bagaria, A Foundation Course in Value Education. 2009

Title of the course : **Power Plant Engineering**
 Subject Code : **ME-311**
 Weekly load : 5 LTP 3-0-2
 Credit :4 (Lecture 3;Tutorial 0; Practical 2)

Theory

Course Description	Lecture(s)
Unit-I	
Introduction	
Energy resources and their availability, Types of power plants, selection of the plants, review of basic thermodynamic cycles used in power plants.	03
HYDRO ELECTRIC POWER PLANTS	
Power plants design, Power house and turbine setting, construction and operation of different components of hydro-electric power plants, site selection, specific speed and draft tube, Advantages and comparison with other types of power plants.	05
STEAM POWER PLANTS	
Classification of turbine, their working and governing. Condenser, Cooling ponds, cooling towers, Feed water treatment, site selection, coal storage, preparation, coal handling systems, feeding and burning of pulverized fuel, ash handling systems, dust collection.	08
GAS AND STEAM TURBINE COMBINED CYCLES	
Constant pressure gas turbine power plants, Arrangements of combined plants (steam & gas turbine power plants), parameters affecting thermodynamic efficiency and performance of combined cycles.	08
UNIT II	
NUCLEAR POWER PLANTS	
Principles of nuclear energy, basic nuclear reactions, nuclear reactors-PWR, BWR, CANDU, Gas-cooled reactors, liquid –metal cooled reactors, fast breeder reactor, Advantages and limitations.	07
POWER PLANT ECONOMICS	
Load curve, different terminology and definitions, cost of electrical energy, tariff methods of electrical energy, input-output curves, efficiency, heat rate, economic load sharing.	06
NON-CONVENTIONAL POWER GENERATION	
Solar radiation , solar energy collectors, low, medium & high temperature power plants, wind power plants, tidal power plants, geothermal power plants.	07
DIRECT ENERGY CONVERSION SYSTEMS	
Fuel cell, MHD power generation-principle, open & closed cycle systems, thermoelectric power generation, and thermionic power generation	02
Pollution and its control	
Introduction, land, air and water pollution by thermal power plants, Noise pollution, Radioactive pollution of environment by nuclear power plants, Methods for controlling pollution.	02

Total=48

Recommended Books:

1. Power Plant Engineering
2. Power Plant Engineering
3. Power Plant Engineering
4. Power Plant Engineering

P.K. Nag
 P.C. Sharma
 M. Wakil
 ARORA.S.DOMKUNDWAR

List of Experiments (ME-311)

1. To draw flow chart of a hydroelectric power plant.
2. To draw flow chart of a thermal power plant.
3. Study of power plant instruments.
4. To determine efficiency of pelton wheel turbine.
5. To determine efficiency of steam turbine.
6. To determine efficiency of a solar cooker.
7. Study of environmental impact of power plant.
8. Study of a cooling tower.

Title of the course : **Theory of Machines**
 Subject Code : **ME-312**
 Weekly load : 7
 Credit : 5 (Lecture 2; Tutorial 1; Practical 2)

LTP 2-1-4

Theory

Course Description	Lecture(s)
Unit-I	
Basic Concept	
Links, Kinematics pairs and their types, Degree of freedom, Kinematics chain and their types, Constrained motion and mechanisms, Classification of mechanisms, Equivalent mechanism, Laws of inversion of mechanisms Single slider crank chain and its inversions, Quick return mechanism and IC engine mechanism, Double slider crank chain mechanism and its inversions like scotch yoke mechanism, Indicator mechanism, pantograph	04
Velocity in mechanism	
Velocity diagrams of four bars and single slider crank mechanism by instantaneous center method. Kennedy Theorem.	04
Power Transmission	
Introduction to Belt and Rope drives, Types of belt drives and types of pulleys, Concept of velocity ratio, slip and creep; crowning of pulleys. Flat belt drive: Ratio of driving tensions, power transmitted, centrifugal tension, and condition for maximum horse power. Gear terminology, types of gears and their applications; Gear train; simple and compound gear trains; power transmitted by simple spur gear.	05
Cams	
Classification, types of motion curves, graphical construction of cam profiles for different motion with knife edge and roller followers.	03
Unit-II	
Dynamics of reciprocating parts	
Analytical method for velocity and acceleration of piston, piston effort, crank pin effort, turning moment diagram, fluctuation of energy and speed, energy of a flywheel, calculation of weight of flywheel.	04
Friction	
Friction of collars and pivots, friction clutches; plate clutch, conical clutch and Centrifugal clutch.	04
Governors	
Types of governors-dead weight; watt, porter governor and Proell Governors, spring loaded governors; Hartnell governor, concept of sensitiveness', stability, isochronisms and hunting.	04
Balancing	
Static and dynamic balancing. balancing of single rotating mass by a single mass in the same plane, by two masses rotating in different planes, balancing of several masses rotating in the same plane, balancing of several masses rotating in different parallel planes.	04

Total=32

Recommended Books:

1. Vicker, J.J., Shigley, J.E., and Pennock, G.R., "Theory of Machines and Mechanisms", 3rd Ed., Oxford University Press, 2003.
2. Vinogradov, O., "Fundamentals of Kinematics and Dynamics of Machines and Mechanisms", CRC Press, 2000.
3. Massie, H.H., and Reinholtz, C.F., "Mechanisms and Dynamics of Machinery", 4th Ed., John Wiley & Sons, 1987.
4. Grover, G.K., "Mechanical Vibrations", 7th Ed., Nem Chand and Brothers, 2003.
5. Thomson, W.T., "Theory of Vibration with Applications", 3rd Ed., CBS Publishers, 2003.
6. Rattan S.S., "Theory of Machines", TMH, New Delhi, 2010.

List of Experiments (ME-312)

11. Study of kinematic pairs, kinematic chain.
12. Study of different kind of planar mechanism; four bar mechanism, single slider crank mechanism, double slider mechanism.
13. Demonstration of different kinds of CAM and Follower arrangements.
14. Construction of CAM with different types of followers for various kind of motion.
 - a. Knife edge follower with various kind of motion.
 - b. Roller follower with various kind of motion.
15. Demonstration of different types of Gears.
16. Demonstration of different types of Gear train.
17. Determination of moment of inertia for flywheel.
18. Demonstration of different types of Governors.
19. Determination of height of Governor for varied spindle speed.
20. Determination of position and orientation of masses for balancing in different planes.

Title of the course : **FLUID MECHANICS & MACHINERY**

Subject Code : **ME-313**

Weekly load : 6

LTP 2-0-4

Credit :4 (Lecture 2;Tutorial 0; Practical 2)

Theory

Course Description	Lecture(s)
Unit-I	
Fluid Mechanics & Fluid Properties	
Concept of fluid, fluid mechanics and hydraulics, properties of fluid i.e. viscosity, specific weight, specific volume, specific gravity and their measurement	02
Static Pressure	
Pascal's law, concept of static pressure, intensity of pressure and pressure head, total pressure on a plane surface and centre of pressure	02
Measurement of pressure	
Concept of atmospheric pressure, gauge pressure, absolute pressure, vacuum, Measurement of pressure, Gauges: Piezometer, simple manometer, differential manometer, U-tube manometer, inverted U-tube manometer, micro manometer and Bourdon pressure gauge.	04
Flow of fluids	
Types of flow, laminar and turbulent, rate of discharge, law of continuity, energy of fluid - potential, pressure and kinetic, Bernoulli's theorem and its applications, discharge measurement by venturimeter and orifices, pitot tube and pitot static tube.	04
Impact of jet	
Impact of jet, Impulse momentum principle, Force exerted on fixed and moving flat plate and curved vanes under different orientation of jet.	04
UNIT II	
Hydraulic turbines	
Classification of turbines, Impulse & Reaction turbines; Constructional details, working principle, Power, efficiency of Pelton wheel, Francis and Kaplan turbines	06
Pumps	
Classification of pumps, Working principle, Discharge, work done and power requirement of reciprocating & Centrifugal pump, Effect of air vessels, Cavitation	06
Hydraulic Machines	
Working principles, description and application of hydraulic accumulator, hydraulic intensifier, hydraulic lift, hydraulic jack, hydraulic ram, hydraulic press, hydraulic crane.	04

Total=32

Recommended Books

Title	Author(s)	Publisher
	Text	
Fluid Mechanics & Hydraulic Machines	R.K.Bansal	Laxmi Publications
	Reference	
Hydraulics & Fluid Mechanics Hydraulic Machines	Modi & Seth	Standard Publishers
Fluid Mechanics & Hydraulic Machines	R.K Rajput	S.Chand & Company
Fluid Mechanics & Fluid Machinery	D. S. Kumar	S.K Kataria & Sons
Hydraulics & Hydraulic Machines	Jagadish Lal	Metropolitan
Fluid Mechanics	A.K Jain	Khanna Publishers
Theory & problems of Fluid Mechanics	K Subramanya	Tata McGrawHill

List of Experiments (ME-313)

1. To determine Viscosity of a Liquid by Redwood viscometer.
2. To Verify Bernoulli's Theorem.
3. To determine Coefficient of Discharge of Venturimeter.
4. To determine Coefficient of Discharge of orifice meter.
5. To determine Coefficient of Discharge of Weir.
6. To Determine Pressure by Bourdons Pressure Gauge.
7. To determine meta-centric height of a given model.
8. To study different components of centrifugal pump in dismantled condition.
9. To determine the efficiency of a Gear oil pump.
10. To find efficiency of a Hydraulic Ram.

Title of the course : **Production Management**

Subject Code : ME-314

Weekly load : 04

Credit : 03

LTP 2-0-2

Theory

Course Description	Lecture(s)
Unit-I	
Quality Control	06
Introduction, statistical control of processes, control charts for variables X & R Charts, X & s Charts ,properties of control charts, control charts for attributes – p chart, np chart, 100p chart, c chart.	
Quality assurance and acceptance control	06
Objectives of acceptance control, hypothesis testing in acceptance control, lot-by-lot acceptance sampling by attributes, acceptance procedures based on AQL.	
Total Quality Management	05
Evolution of quality improvement techniques, ISO standards, TQM approach,	
Unit-II	
Sales Management and Forecasting	05
Introduction, types of forecasting, importance of demand planning, methods of sales forecasting, Qualitative and Quantitative methods of demand planning	
Materials Handling and management	05
Principles of material handling, material handling equipments, material requirement planning, objectives of materials management, purchasing, vendor selection, JIT in purchasing, supply chain management.	
Business Organization and forms of Ownership	05
Introduction, Organization structure, good organization design, types of organizations, sole proprietorship, partnership.	

Total = 32

Recommended Books

<i>Title</i>	<i>Author(s)</i>	<i>Publisher</i>
Industrial Engineering	Ravi Shankar	Galgotia
Industrial Engineering & Management	O.P.Khanna	Khanna
Production Management	Ronald Mayer	TMH
Industrial Engineering & Management	Telesang	S.Chand

List of Experiments(ME-314)

1. Study & practices of various types control charts
2. Study of productivity improvement techniques
3. Value Analysis assessment of the products
4. To study the system of dispatching and scheduling of company/organisation.
5. To study Purchase Procedure for any equipment/instrument in any company/organisation.
6. Study and Preparation of Assembly Chart and Product Structure
7. STOP watch TIME study of a Drill Press Operation/any other operation.
8. Study of Learning curve.
9. To study the Inventory System of any Store.

Title of the course : **Strength of Materials**
 Subject Code : **ME-315**
 Weekly load : 3
 Credit : 3 (Lecture 2; Practical 1)

LTP 2-0-2

Theory

Course Description	Lecture(s)
Unit-I	
Stress and Strain & Properties of Materials	
Mechanical properties of materials Ductility, Tenacity, Brittleness, Toughness, Hardness, Factor of safety. Different types of loads and stresses, Normal stress and strain, shear stress and strain, concept of bearing stress, strain in a stepped bar .Hooke's law and Poisson's ratio, Modulus of elasticity in tension, compression, shear. Bulk modulus. Stress-strain diagrams for ductile and brittle materials, Extension of axial loaded members : uniform bars, Extension due to self weight, Composites section, Concept of temperature stress, relation between elastic constant E, G, and K, Concept of strain energy	04
Principal Stresses	
Stresses in two perpendicular planes. Determination of normal and shear stress components on any plane passing through a point. Concept of principal stresses and principal planes and their importance. Derivation of equations for principal stresses and determination of normal and shear stress components on a plane with Mohr's Circle construction. Concept of pure shear and complementary shear.	06
Bending Moment and Shear force	
Types of beams, Loads and reactions, Concept of Bending moment and shear force, Bending moment and shear force diagrams for determinate beams and different loads, Concept of point of Contraflexure, Relation between loads, shear forces and bending moments. Loading and bending moment diagrams from shear force diagrams. (Simple cases)	06
Bending Stresses in Beams	
Concept of pure bending, derivation of straight beam formula, section modulus, determination of bending stresses under different loads for different section of beams, Shear stress.	04
Unit-II	
Torsion	
Torsion of circular straight shafts,(Solid & hollow), derivation of torsion equation, Power transmitted by solid and hollow shaft, comparison of solid and hollow shaft	04
Springs	
Helical springs, Close coiled helical spring subjected with axial load and axial twist, Determination of spring stiffness for series and parallel combinations.	04
Columns and Struts	
Definition of long column, short column and slenderness ratio. Equivalent length, Critical load, Collapsing load, End conditions of columns. Euler's theory for long columns and its limitations , Euler's formula and Rankine Gordon formula for different end conditions (No Derivation) Slenderness ratio, factors effecting strength of a column,	04

Total=32

Recommended Books:

Strength of Materials	R.K. Rajput	S. Chand
Strength of Materials	Sadhu Singh	Khanna Publishers
Strength of Materials	R.S Kurmi	S. Chand
Mechanics of Materials	R.C. Hibbeler	Pearsons Education
Mechanics of Materials	Fardinard P. Beer and E. Russell Johnston	McGraw Hill

List of Experiments (ME-315)

1. Study and demonstration of Universal Testing Machine & its attachments.
2. Tension Test on mild steel, Aluminum & compression test on cast iron on Universal Testing Machine.
3. Study of Direct Shear Test of mild steel on Universal Testing Machine.
4. Study of Brinell hardness Test.
5. Study of Rockwell hardness Test.
6. Study of Impact testing machine
7. Study of Torsion Testing Machine.

Title of the course : **Industrial Engineering**
 Subject Code : **ME-316**
 Weekly load : 4
 Credit : 3 (Lecture 2, Practical 1)

LTP 2-0-2

Theory

Course Description	Lecture(s)
Unit-I	
Introduction	8
Definition, applications, history and development, techniques of Industrial Engineering. Production and productivity, its importance, waste management, work method design, ergonomics.	
Work Study	8
Definition and scope of work study, role of work study in improving productivity, Objectives and procedure for method study, human aspects of work study. Objectives and procedures to conduct work measurement. Principles to design work place layout. Calculation of normal time and standard time, cycle graph and Chrono-Cyclograph.	
Unit-II	
Inventory control and material handling	6
Introduction, types, inventory models, economic order quantity. Functions and principles of material handling, types and maintenance of material handling equipment.	
Plant location and layout	6
Introduction, Need for selecting a suitable location, Plant location problem, Importance and system view of location, Location factors, Comparison between Urban, Suburban and rural locations, Factors effecting plant location, Concept of plant layout, types of layout: process, product & combination.	
Environment pollution	4
Factors causing the pollution, effects, air-pollution and control, solid waste management	

Total=32

Recommended Books

Title	Author(s)	Publisher
Industrial engineering	S. K Sharma	Kataria
Industrial Engineering and Production Management	Martand Telsang	S Chand
Industrial Engineering	Ravi Shankar	Galgotia
Industrial Engineering & Management	O.P.Khanna	Khanna

List of Experiments (ME-316)

1. Study and construct an operation Process chart of a given work
2. Study and construct an Flow Process chart of a given work
3. Study and construct a two handed Process operation chart of a given work
4. To obtain practice in Rating Performance in walking
5. To obtain practice in rating Performance in card dealing
6. Brain storming on a book , a steel Glass, coin or any thing
7. To study a Reaction Timer Model
8. To determine the standard time Reassemble and Assembly of different bolts by using Dexterity ring apparatus
9. To determine the standard time Reassemble and Assembly of different Bolts by Hand Tool Dexterity Apparatus
10. Work sampling exercises

Title of the course : **Entrepreneurship**
Subject : **HU-311/ HU-321**

Weekly Load : 2

LTP 2- 0 -0

Credit : 2 (Lecture 2)

Course Description	Lectures
UNIT- I	
Introduction	
Entrepreneurship, meaning, concept, scope of entrepreneurship, Qualities of an entrepreneur, problems faced by Indian entrepreneur.	03
SSI	
Role of banks & financial institutes in the development of small scale industries, Role of DIC in the development of MSMEs, Preparation of Project Report & feasibility analysis.	06
Motivation & Industrial laws	
Meaning, Motivating & demotivating factors, Theories of Motivation: Abraham Maslow's need hierarchy model, Theory X & Theory Y of motivation, Mc Clelland's theory, Introduction to Factories Act 1948 & Industrial Dispute Act 1947, Grievance Handling Procedure.	07
UNIT- II	
Marketing and Communication	
Definition & key elements of Marketing, PLC (Product Life Cycle), Marketing Mix, Definition, Process, Barriers to effective communication & communication channels	06
Management	
Responsibilities of a Professional Manager, Basic functions of Management viz. planning, organizing, directing & controlling.	03
Leadership	
Definition, qualities of a successful leader, Leadership types, Managerial Grid.	03
Business Excellence	
TQM, Six Sigma	04

Recommended Books:

1. Dynamics of entrepreneurial development & Management, Vasant Desai/Himalaya Pub.House
2. Entrepreneurship New venture creation, David H.Holt, PHI
3. Entrepreneurship & Small Business Management, Nicholas, Siropolis Houghton Mifflin company, Boston-Newyork
4. Industrial Law, N.D.Kapoor/Sultan chand & sons
5. Entrepreneurship development in India, C.B.Gupta/Sultan Chand & Sons
6. Management, Stephen P. Robbins, Mary(Pearson education Asia)
7. Entrepreneurship and innovation in corporation, Micheal.H.Morris , Donald.F.Kuratko

Title of the course : **Environmental Studies**

Subject Code : **MC-311/MC-321**

Weekly load : 2 LTP 2-0-0

Credit : 2 (Lecture 2)

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Contemporary environmental issues	Human population growth and environmental challenge. Deforestation, desertification, global warming and climate change. Role of individual in environmental conservation.	08
	2. Natural resource management	Equitable use of resources. Overutilization and wasteful utilization of natural resources. Conservation of wildlife and biodiversity.	08
Unit-2	3. Environmental pollution	Vehicular pollution, industrial pollution, municipal wastes, noise pollution. Introductory ideas of water and air pollution control. Nuclear hazards.	10
	4. Environmental Regulations	Water Act, Air Act, Forest Conservation Act.	06

Total=32

Recommended Books:

1. E. Bharucha, Textbook for Environmental Studies; UGC Publication.
2. K.D. Wanger, Environmental Management; W.B. Saunders Publication.
3. T.G. Miller, Environmental Science; Wadsworth Publishing Co.
4. Pollution Control Acts, Rules and Notifications; CPCB Publication.

Title of course- Automobile and IC Engines

Subject code- ME-321

Weekly load- 6

Credit 4 (Lecture-2, Practical-2)

LTP- 2 0 4

Theory

Unit	Main Topic	Course out line	Lectures
Unit-I			
	Introduction:	Introduction to I.C. Engines and their classification, Engine components, Nomenclature, comparison of SI and CI Engines, comparison of 2-stroke,4stroke engines	4
	I.C. Engines:	Working of 2-stroke & 4-stroke petrol engines and their indicator diagrams, working of 4-stroke diesel engine and its indicator diagram.	5
	Performance of IC Engine	Measurement of BHP & IHP, measurement of IHP of multi cylinder engine by morse test. Measurements of various engine efficiencies i.e Brake thermal efficiency, mechanical efficiency, and Indicated efficiency.	5
Units- II	Automotive chassis	Suspension system of a truck, car and motor cycle. Steering system, Automotive brake system.	4
	Automotive transmission	Power transmission system from engine to wheel of a truck. Power transmission system from engine to wheel of motor cycle.	5
	Cooling and Lubrication systems	Types of Cooling systems. Various lubricating systems used in automobile.	4
	Automotive electrical and electronics system	Automotive battery, central point ignition system for SI Engine, Automotive electrical system, starting system of engines	5

Total-32

Recommended Books

Title	Author	Publisher
1. Automobile engineering	Nakra	Standard
2. Automobile engineering	Kirpal Singh	Standard
3. A Tex book of IC Engine	Mathur & Sharma	Dhanpat Rai

List of Experiments (ME-321)

1. Study of 2-stroke petrol engine.
2. Disassembling and assembling an engine of a scooter.
3. Cleaning and tuning of carburetor.
4. Braking system of a car.
5. Suspension system of a truck.
6. Steering system of a car.
7. Study of ignition system of a petrol engine.
8. Study of cooling systems used in automobile.
9. Study of lubricating system used in automobile.
10. Study of starting system of a car.

Title of the course : **Computer Aided Design and Manufacturing**
 Subject Code : **ME-322**
 Weekly load : 6
 Credit : 4 (Lecture 2; Practical 2)

LTP 2-0-4

Course description	Lectures
Unit I	
Introduction to CAD	
Introduction to CAD concepts; Basic design process and application of computer at different stages in the design process; CAD/CAM database; Benefits of CAD; Configuration of graphics system; Functions of a Graphic system.	4
CAD Hardware	
CAD workstations and their historical development; CPU; input devices; output devices.	2
AutoCAD	
Introduction to AutoCAD; Installation and starting AutoCAD; Types of co-ordinate systems; Introduction to screen area; menu bars and tool bars; Set the drawing space; Procedure for making, saving a drawing.	6
Introduction to CAM	
Basic concepts of NC system; NC Procedure; NC co-ordinate systems; Problems of conventional NC systems; CNC and DNC systems, their advantages and applications	4
Unit II	
NC Machines	
Components of CNC system: machine control unit, machine tool, different types of NC control systems and their applications; Classification of NC machines.	4
Construction details of NC machines	
Introduction; Machine structure; Slideways/Guideways; Spindle; Drive unit; Automatic tool changes, Multiple pallets; Swarf removal mechanism; Safety provisions; Introductions sensors and feedback mechanism;	4
Maintenance of NC machines	
Types of maintenance of NC machines; Maintenance practices; Problems related to mechanical, electronic and pneumatic systems;	2
Part programming	
Basic concepts of part programming; NC words; Part programming formats; Simple programming for rotational and prismatic components; Canned cycles; Sub routines and do loops, tool off-sets; Cutter radius compensation.	6
Total lectures	32

Recommended Books

<i>Title</i>	<i>Author(s)</i>	<i>Publisher</i>
CNC Machines	Pabla BS and Adithan	New Age Publishers (P) Ltd, New Delhi
CAD/CAM	Grover and Zimmers	Prentice Hall of India; New Delhi
Computer-Aided Engineering Drawing	S. Trymbaka Murthy	I.K. International, New Delhi
Mechatronics	HMT	Tata McGraw Hill

List of experiments (ME-322)

Exp. No.	Title
1.	Introduction to AutoCAD
2.	Draw the 2D drawings of components using line command and write the procedure.
3.	Draw the 2D drawings of components using line command and write procedure of the same
4.	Draw the 2D drawing of the given parts using appropriate modify commands
5.	Draw the 2D drawing of the given parts using appropriate modify commands
6.	Draw front view full section and top view of the given drawings
7.	To study about the general instruction of CAD/CAM lab and safety precautions of CNC both lathe and milling M/C.
8.	To study the constructional details of CNC lathe machine
9.	Study of lathe bed & slide ways
10.	To study the construction and working of (a) Automatic Tool changer (b) Pallets
11.	To study the constructional details of CNC milling machine
12.	Write a programme of turning / step turning using G-codes M-codes for a given job on CNC lathe machine
13.	Write a program for threading operation using G& M-codes on lathe machine of a given job.
14.	Write a program on CNC Milling Machine using G & M Code for the given drawing

Title of the course : **Design of Machine Elements**
 Subject Code : **ME-323**
 Weekly load : 5 LTP 3-2-0
 Credit : 5 (Lecture 3; Tutorial 2)

Course Description	Lectures
Unit-I	
Introduction	
Introduction to design procedure, design requirements, review of force analysis concepts, factor of safety, concept stress concentration and mechanical Properties. General design considerations like fatigue, creep, fabrication methods, economic considerations, material selection and ergonomics. (Introduction Only)	02
Riveted and Welded Joints	
Type of riveted joints. Possible failure of riveted joints. Strength and efficiency of Butt (Single plate & double cover plate) and Lap riveted joints. Design of Longitudinal butt joint for Boiler. Common types of welded joints. Simple design for V-butt welded joints. Transverse fillet and parallel fillet welded joint for simple loading.	08
Screwed Joints	
Introduction to term screw and various definitions of screw threads. Advantages and Disadvantages of screwed joints. Form of screw threads. Common types of screw fastening; through bolt, tap bolt, stud, cap screw, machine screw and set screw. Designation of screw threads. Stresses in screw fastening. Design of bolts for cylindrical cover.	06
Shafts	
Design for static loading; stresses in shaft, design of shaft subjected to bending moment or torsion moment and combined bending and torsion moments. Failure theories; Design of shaft on the basis of rigidity.	08
Unit-II	
Keys and Couplings	
Definition of term “key” & its various types. Splines. Forces acting on sunk keys. Shaft couplings and its various types Design of flange shaft coupling; protected and unprotected.	08
Brakes	
Introduction, heat generation equation, design of shoe, band-brake and combination of shoe and band brake.	06
Springs	
Design of Helical Springs.	04
Gears	
Design of spur gear.	06

Total=48

Recommended Books:

1. Shigley, J.E., and Mischke, C.R., “Mechanical Engineering Design (in S.I. Units)”, 6th Ed., Tata McGraw-Hill, 2006.
2. Juvinall, R.C., and Marshek, K.M., “Fundamentals of Machine Component Design”, 4th Ed., John Wiley & Sons, 2006.
3. Sharma & Aggarwal, “A Text book of Machine Design” , Katson.
4. Machine Design-An Integrated Approach, Norton, Pearson Education.
5. Mahadevan, K., and B., Reddy, “Design Data Hand Book”, CBS Publishers, 2003.
6. P. S. G, “Design data handbook”, P. S. G., Coimbatore.

Title of the course : **Industrial Automation & Control**
 Subject Code : **ME-324**
 Weekly load : 6 LTP 2-0-4
 Credit : 4 (Lecture 2; Practical 2)

Course Description	Lecture(s)
Unit-I	
Introduction	
Definition, need of Automation, Automation strategies, advantages of automation	02
Fundamentals of Digital Electronics	
Number systems: Binary, Octal, Hexadecimal, Boolean Algebra, Logic Gates: Basic Gates and Derived Gates	06
Fundamentals of Robotics	
Definition, Link, Joint, Work space, Fine Motion, Gross Motion, Degrees of Freedom Basic configurations, End-effectors, applications, Introduction to position and force control	07
Sensors	
Strain Gauge, Linear variable differential transformer(LVDT), Piezoelectric, Proximity sensor, Resistance Temperature Detector(RTD), Thermistors, Thermocouple, Hall effect sensor	03
Unit-II	
Pneumatics	
Pneumatic power supplies, Components of basic Pneumatic system, selection of pipeline , Direction control valves: Types, Nomenclature, actuation systems, Pressure control valves: Pressure limiting, pressure relief and pressure sequence valves, Speed control valves, Check valves, Air Compressor, Types of Air Compressors, FRL unit Time delay valves, shuttle valve, Pilot operation	09
Computer based process control	
Characteristics of manufacturing process data, process data input/output, interface hardware,, computer process monitoring, types of computer process control, Direct Digital control, supervisory computer control	03
Conveyor System	
Components of conveyor systems, types of conveyor systems, quantitative relationship and analysis of conveyor systems	02

Total=32

Recommended Books:

1. W. Bolten, Mechatronics, Pearson Education
2. Andrew Parr, Pneumatic Systems, TMH
3. A.P. Malvino, Digital Principles and Applications, McGraw Hill

List of Experiments (ME-324)

1. Familiarization with Automation Studio: Study of Pneumatics and Hydraulic Modules
2. Draw and Simulation of Simple Pneumatic Circuits using Automation Studio
 - (a) Control of single acting cylinder using 3/2 DC valve
 - (b) Control of double acting Cylinder using 3/2 and 5/2 DC valves
 - (c) Speed Control of double acting cylinder: Throttle- in and Throttle-out
 - (d) Demonstration of Pilot Operation
3. Draw and Simulation of Logic Gates using Automation Studio
4. Study and Performance on Pneumatic Trainer.
5. Study of Resistance, capacitance, Variable Resistance, Multimeter, Oscilloscope
6. Practice for making simple Circuits.