PAPER CODE - 102101

BSC	PHYSICS (ELECTROMAGNETISM)	L:3	T:1	P:3	CREDIT:5.5

INTRODUCTION TO ELECTROMAGNETIC THEORY [L: 3; T: 1; P: 0 (4 CREDITS)]

PRE-REQUISITES (IF ANY) MATHEMATICS COURSE WITH VECTOR CALCULUS

DETAILED CONTENTS:

MODULE 1: ELECTROSTATICS IN VACUUM (8 LECTURES)

CALCULATION OF ELECTRIC FIELD AND ELECTROSTATIC POTENTIAL FOR A CHARGE DISTRIBUTION; DIVERGENCE AND CURL OF ELECTROSTATIC FIELD; LAPLACE'S AND POISSON'S EQUATIONS FOR ELECTROSTATIC POTENTIAL AND UNIQUENESS OF THEIR SOLUTION AND CONNECTION WITH STEADY STATE DIFFUSION AND THERMAL CONDUCTION; PRACTICAL EXAMPLES LIKE FARADY'S CAGE AND COFFEE-RING EFFECT; BOUNDARY CONDITIONS OF ELECTRIC FIELD AND ELECTROSTATIC POTENTIAL; METHOD OF IMAGES; ENERGY OF A CHARGE DISTRIBUTION AND ITS EXPRESSION IN TERMS OF ELECTRIC FIELD.

MODULE 2: ELECTROSTATICS IN A LINEAR DIELECTRIC MEDIUM (4 LECTURES)

ELECTROSTATIC FIELD AND POTENTIAL OF A DIPOLE. BOUND CHARGES DUE TO ELECTRIC POLARIZATION; ELECTRIC DISPLACEMENT; BOUNDARY CONDITIONS ON DISPLACEMENT; SOLVING SIMPLE ELECTROSTATICS PROBLEMS IN PRESENCE OF DIELECTRICS – POINT CHARGE AT THE CENTRE OF A DIELECTRIC SPHERE, CHARGE IN FRONT OF A DIELECTRIC SLAB, DIELECTRIC SLAB AND DIELECTRIC SPHERE IN UNIFORM ELECTRIC FIELD.

MODULE 3: MAGNETOSTATICS (6 LECTURES)

BIO-SAVART LAW, DIVERGENCE AND CURL OF STATIC MAGNETIC FIELD; VECTOR POTENTIAL AND CALCULATING IT FOR A GIVEN MAGNETIC FIELD USING STOKES' THEOREM; THE EQUATION FOR THE VECTOR POTENTIAL AND ITS SOLUTION FOR GIVEN CURRENT DENSITIES.

MODULE 4: MAGNETOSTATICS IN A LINEAR MAGNETIC MEDIUM (3 LECTURES)

MAGNETIZATION AND ASSOCIATED BOUND CURRENTS; AUXILIARY MAGNETIC FIELD; BOUNDARY CONDITIONS ON AND. SOLVING FOR MAGNETIC FIELD DUE TO SIMPLE MAGNETS LIKE A BAR MAGNET; MAGNETIC SUSCEPTIBILITY AND FERROMAGNETIC, PARAMAGNETIC AND DIAMAGNETIC MATERIALS; QUALITATIVE DISCUSSION OF MAGNETIC FIELD IN PRESENCE OF MAGNETIC MATERIALS.

MODULE 5: FARADAY'S LAW (4 LECTURES)

FARADAY'S LAW IN TERMS OF EMF PRODUCED BY CHANGING MAGNETIC FLUX; EQUIVALENCE OF FARADAY'S LAW AND MOTIONAL EMF; LENZ'S LAW; ELECTROMAGNETIC

BREAKING AND ITS APPLICATIONS; DIFFERENTIAL FORM OF FARADAY'S LAW EXPRESSING CURL OF ELECTRIC FIELD IN TERMS OF TIME-DERIVATIVE OF MAGNETIC FIELD AND CALCULATING ELECTRIC FIELD DUE TO CHANGING MAGNETIC FIELDS IN QUASI-STATIC APPROXIMATION; ENERGY STORED IN A MAGNETIC FIELD.

MODULE 6: DISPLACEMENT CURRENT, MAGNETIC FIELD DUE TO TIME-DEPENDENT ELECTRIC FIELD AND MAXWELL'S EQUATIONS (5 LECTURES)

CONTINUITY EQUATION FOR CURRENT DENSITIES; MODIFYING EQUATION FOR THE CURL OF MAGNETIC FIELD TO SATISFY CONTINUITY EQUATION; DISPLACE CURRENT AND MAGNETIC FIELD ARISING FROM TIME- DEPENDENT ELECTRIC FIELD; CALCULATING MAGNETIC FIELD DUE TO CHANGING ELECTRIC FIELDS IN QUASI- STATIC APPROXIMATION. MAXWELL'S EQUATION IN VACUUM AND NON-CONDUCTING MEDIUM; ENERGY IN AN ELECTROMAGNETIC FIELD; FLOW OF ENERGY AND POYNTING VECTOR WITH EXAMPLES. QUALITATIVE DISCUSSION OF MOMENTUM IN ELECTROMAGNETIC FIELDS.

MODULE 7: ELECTROMAGNETIC WAVES (8 LECTURES)

THE WAVE EQUATION; PLANE ELECTROMAGNETIC WAVES IN VACUUM, THEIR TRANSVERSE NATURE AND POLARIZATION; RELATION BETWEEN ELECTRIC AND MAGNETIC FIELDS OF AN ELECTROMAGNETIC WAVE; ENERGY CARRIED BY ELECTROMAGNETIC WAVES AND EXAMPLES. MOMENTUM CARRIED BY ELECTROMAGNETIC WAVES AND RESULTANT PRESSURE. REFLECTION AND TRANSMISSION OF ELECTROMAGNETIC WAVES FROM A NON-CONDUCTING MEDIUM-VACUUM INTERFACE FOR NORMAL INCIDENCE.

SUGGESTED TEXT BOOKS

- 🕮 *DAVID GRIFFITHS, INTRODUCTION TO ELECTRODYNAMICS*

SUGGESTED REFERENCE BOOKS:

- 🕮 *HALLIDAY AND RESNICK, PHYSICS*
- 🕮 *W. SASLOW, ELECTRICITY, MAGNETISM AND LIGHT*

LABORATORY - INTRODUCTION TO ELECTROMAGNETIC THEORY [L:0;T:0;P:3 (1.5 CREDITS)]

CHOICE OF EXPERIMENTS FROM THE FOLLOWING:

- ❖ EXPERIMENTS ON ELECTROMAGNETIC INDUCTION AND ELECTROMAGNETIC BREAKING;
- ❖ LC CIRCUIT AND LCR CIRCUIT;
- ❖ RESONANCE PHENOMENA IN LCR CIRCUITS;
- ❖ MAGNETIC FIELD FROM HELMHOLTZ COIL;
- ❖ MEASUREMENT OF LORENTZ FORCE IN A VACUUM TUBE

PAPER CODE – 102102

BSC	MATHEMATICS –I (CALCULUS & LINEAR ALGEBRA)	L:3	T:1	P:0	CREDIT:4

DETAILED CONTENTS

MODULE 1: CALCULUS: (6 LECTURES)

EVOLUTES AND INVOLUTES; EVALUATION OF DEFINITE AND IMPROPER INTEGRALS; BETA AND GAMMA FUNCTIONS AND THEIR PROPERTIES; APPLICATIONS OF DEFINITE INTEGRALS TO EVALUATE SURFACE AREAS AND VOLUMES OF REVOLUTIONS.

MODULE 2: CALCULUS: (6 LECTURES)

ROLLE'S THEOREM, MEAN VALUE THEOREMS, TAYLOR'S AND MACLAURIN THEOREMS WITH REMAINDERS; INDETERMINATE FORMS AND L'HOSPITAL'S RULE; MAXIMA AND MINIMA.

MODULE 3: SEQUENCES AND SERIES: (10 LECTURES)

CONVERGENCE OF SEQUENCE AND SERIES, TESTS FOR CONVERGENCE; POWER SERIES, TAYLOR'S SERIES, SERIES FOR EXPONENTIAL, TRIGONOMETRIC AND LOGARITHM FUNCTIONS; FOURIER SERIES: HALF RANGE SINE AND COSINE SERIES, PARSEVAL'S THEOREM.

MODULE 4: MULTIVARIABLE CALCULUS (DIFFERENTIATION): (8 LECTURES)

LIMIT, CONTINUITY AND PARTIAL DERIVATIVES, DIRECTIONAL DERIVATIVES, TOTAL DERIVATIVE; TANGENT PLANE AND NORMAL LINE; MAXIMA, MINIMA AND SADDLE POINTS; METHOD OF LAGRANGE MULTIPLIERS; GRADIENT, CURL AND DIVERGENCE.

MODULE 5: MATRICES (10 LECTURES)

INVERSE AND RANK OF A MATRIX, RANK-NULLITY THEOREM; SYSTEM OF LINEAR EQUATIONS; SYMMETRIC, SKEW-SYMMETRIC AND ORTHOGONAL MATRICES; DETERMINANTS; EIGENVALUES AND EIGENVECTORS; DIAGONALIZATION OF MATRICES; CAYLEY-HAMILTON THEOREM, AND ORTHOGONAL TRANSFORMATION.

SUGGESTED TEXT/REFERENCE BOOKS

- *G.B. THOMAS AND R.L. FINNEY, CALCULUS AND ANALYTIC GEOMETRY, 9TH EDITION, PEARSON, REPRINT, 2002.*
- *ERWIN KREYSZIG, ADVANCED ENGINEERING MATHEMATICS, 9TH EDITION, JOHN WILEY & SONS, 2006.*
- *VEERARAJAN T., ENGINEERING MATHEMATICS FOR FIRST YEAR, TATA MCGRAW-HILL, NEW DELHI, 2008.*
- *RAMANA B.V., HIGHER ENGINEERING MATHEMATICS, TATA MCGRAW HILL NEW DELHI, 11TH REPRINT, 2010.*

- *D. POOLE, LINEAR ALGEBRA: A MODERN INTRODUCTION, 2ND EDITION, BROOKS/COLE, 2005.*
- *N.P. BALI AND MANISH GOYAL, A TEXT BOOK OF ENGINEERING MATHEMATICS, LAXMI PUBLICATIONS, REPRINT, 2008.*
- *B.S. GREWAL, HIGHER ENGINEERING MATHEMATICS, KHANNA PUBLISHERS, 36TH EDITION, 2010.*

COURSE OUTCOMES

THE OBJECTIVE OF THIS COURSE IS TO FAMILIARIZE THE PROSPECTIVE ENGINEERS WITH TECHNIQUES IN CALCULUS, MULTIVARIATE ANALYSIS AND LINEAR ALGEBRA. IT AIMS TO EQUIP THE STUDENTS WITH STANDARD CONCEPTS AND TOOLS AT AN INTERMEDIATE TO ADVANCED LEVEL THAT WILL SERVE THEM WELL TOWARDS TACKLING MORE ADVANCED LEVEL OF MATHEMATICS AND APPLICATIONS THAT THEY WOULD FIND USEFUL IN THEIR DISCIPLINES.

THE STUDENTS WILL LEARN:

- TO APPLY DIFFERENTIAL AND INTEGRAL CALCULUS TO NOTIONS OF CURVATURE AND TO IMPROPER INTEGRALS. APART FROM SOME OTHER APPLICATIONS THEY WILL HAVE A BASIC UNDERSTANDING OF BETA AND GAMMA FUNCTIONS.
- THE FALLOUTS OF ROLLE'S THEOREM THAT IS FUNDAMENTAL TO APPLICATION OF ANALYSIS TO ENGINEERING PROBLEMS.
- THE TOOL OF POWER SERIES AND FOURIER SERIES FOR LEARNING ADVANCED ENGINEERING MATHEMATICS.
- TO DEAL WITH FUNCTIONS OF SEVERAL VARIABLES THAT ARE ESSENTIAL IN MOST BRANCHES OF ENGINEERING.
- THE ESSENTIAL TOOL OF MATRICES AND LINEAR ALGEBRA IN A COMPREHENSIVE MANNER

PAPER CODE – 102202

BSC	MATHEMATICS –II (ODE & COMPLEX VARIABLES)	L:3	T:1	P:0	CREDIT:4

DETAILED CONTENTS

MODULE 1: MULTIVARIABLE CALCULUS (INTEGRATION): (10 LECTURES)

MULTIPLE INTEGRATION: DOUBLE INTEGRALS (CARTESIAN), CHANGE OF ORDER OF INTEGRATION IN DOUBLE INTEGRALS, CHANGE OF VARIABLES (CARTESIAN TO POLAR), APPLICATIONS: AREAS AND VOLUMES, CENTER OF MASS AND GRAVITY (CONSTANT AND VARIABLE DENSITIES); TRIPLE INTEGRALS (CARTESIAN), ORTHOGONAL CURVILINEAR COORDINATES, SIMPLE APPLICATIONS INVOLVING CUBES, SPHERE AND RECTANGULAR PARALLELEPIPEDS; SCALAR LINE INTEGRALS, VECTOR LINE INTEGRALS, SCALAR SURFACE INTEGRALS, VECTOR SURFACE INTEGRALS, THEOREMS OF GREEN, GAUSS AND STOKES.

MODULE 2: FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS: (6 LECTURES)

EXACT, LINEAR AND BERNOULLI'S EQUATIONS, EULER'S EQUATIONS, EQUATIONS NOT OF FIRST DEGREE: EQUATIONS SOLVABLE FOR P, EQUATIONS SOLVABLE FOR Y, EQUATIONS SOLVABLE FOR X AND CLAIRAUT'S TYPE.

MODULE 3: ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDERS: (8 LECTURES)

SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS WITH VARIABLE COEFFICIENTS, METHOD OF VARIATION OF PARAMETERS, CAUCHY-EULER EQUATION; POWER SERIES SOLUTIONS; LEGENDRE POLYNOMIALS, BESSEL FUNCTIONS OF THE FIRST KIND AND THEIR PROPERTIES.

MODULE 4: COMPLEX VARIABLE – DIFFERENTIATION: (8 LECTURES)

DIFFERENTIATION, CAUCHY-RIEMANN EQUATIONS, ANALYTIC FUNCTIONS, HARMONIC FUNCTIONS, FINDING HARMONIC CONJUGATE; ELEMENTARY ANALYTIC FUNCTIONS (EXPONENTIAL, TRIGONOMETRIC, LOGARITHM) AND THEIR PROPERTIES; CONFORMAL MAPPINGS, MOBIUS TRANSFORMATIONS AND THEIR PROPERTIES.

MODULE 5: COMPLEX VARIABLE – INTEGRATION: (8 LECTURES)

CONTOUR INTEGRALS, CAUCHY-GOURSAT THEOREM (WITHOUT PROOF), CAUCHY INTEGRAL FORMULA (WITHOUT PROOF), LIOUVILLE'S THEOREM AND MAXIMUM-MODULUS THEOREM (WITHOUT PROOF); TAYLOR'S SERIES, ZEROS OF ANALYTIC FUNCTIONS, SINGULARITIES, LAURENT'S SERIES; RESIDUES, CAUCHY RESIDUE THEOREM (WITHOUT PROOF), EVALUATION OF DEFINITE INTEGRAL INVOLVING SINE AND COSINE, EVALUATION OF CERTAIN IMPROPER INTEGRALS USING THE BROMWICH CONTOUR.

SUGGESTED TEXT/REFERENCE BOOKS

- *G.B. THOMAS AND R.L. FINNEY, CALCULUS AND ANALYTIC GEOMETRY, 9TH EDITION, PEARSON, REPRINT, 2002.*
- *ERWIN KREYSZIG, ADVANCED ENGINEERING MATHEMATICS, 9TH EDITION, JOHN WILEY & SONS, 2006.*
- *W. E. BOYCE AND R. C. DIPRIMA, ELEMENTARY DIFFERENTIAL EQUATIONS AND BOUNDARY*
- *VALUE PROBLEMS, 9TH EDITION, WILEY INDIA, 2009.*
- *S. L. ROSS, DIFFERENTIAL EQUATIONS, 3RD ED., WILEY INDIA, 1984.*
- *E. A. CODDINGTON, AN INTRODUCTION TO ORDINARY DIFFERENTIAL EQUATIONS, PRENTICE HALL INDIA, 1995.*
- *E. L. INCE, ORDINARY DIFFERENTIAL EQUATIONS, DOVER PUBLICATIONS, 1958.*
- *J. W. BROWN AND R. V. CHURCHILL, COMPLEX VARIABLES AND APPLICATIONS, 7TH ED., MC- GRAW HILL, 2004.*
- *N.P. BALI AND MANISH GOYAL, A TEXT BOOK OF ENGINEERING MATHEMATICS, LAXMI PUBLICATIONS, REPRINT, 2008.*
- *B.S. GREWAL, HIGHER ENGINEERING MATHEMATICS, KHANNA PUBLISHERS, 36TH EDITION, 2010.*

COURSE OUTCOMES

- THE OBJECTIVE OF THIS COURSE IS TO FAMILIARIZE THE PROSPECTIVE ENGINEERS WITH TECHNIQUES IN
- MULTIVARIATE INTEGRATION, ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES. IT AIMS TO EQUIP THE STUDENTS TO DEAL WITH ADVANCED LEVEL OF MATHEMATICS AND APPLICATIONS THAT WOULD BE ESSENTIAL FOR THEIR DISCIPLINES.

THE STUDENTS WILL LEARN

- THE MATHEMATICAL TOOLS NEEDED IN EVALUATING MULTIPLE INTEGRALS AND THEIR USAGE.
- THE EFFECTIVE MATHEMATICAL TOOLS FOR THE SOLUTIONS OF DIFFERENTIAL EQUATIONS THAT MODEL PHYSICAL PROCESSES.
- THE TOOLS OF DIFFERENTIATION AND INTEGRATION OF FUNCTIONS OF A COMPLEX VARIABLE THAT ARE USED IN VARIOUS TECHNIQUES DEALING ENGINEERING PROBLEMS

PAPER CODE – 100101 || 100201

ESC	BASIC ELECTRICAL ENGINEERING	L:3	T:1	P:2	CREDIT:5

MODULE 1: DC CIRCUITS (8 LECTURES)

ELECTRICAL CIRCUIT ELEMENTS (R, L AND C), VOLTAGE AND CURRENT SOURCES, KIRCHHOFF CURRENT AND VOLTAGE LAWS, ANALYSIS OF SIMPLE CIRCUITS WITH DC EXCITATION. STAR-DELTA CONVERSION, NETWORK THEOREMS (SUPERPOSITION, THEVENIN, NORTON AND MAXIMUM POWER TRANSFER THEOREMS). TIME-DOMAIN ANALYSIS OF FIRST-ORDER RL AND RC CIRCUITS

MODULE 2: AC CIRCUITS (8 LECTURES)

REPRESENTATION OF SINUSOIDAL WAVEFORMS, PEAK, RMS AND AVERAGE VALUES (FORM FACTOR AND PEAK FACTOR), IMPEDANCE OF SERIES AND PARALLEL CIRCUIT, PHASOR REPRESENTATION, REAL POWER, REACTIVE POWER, APPARENT POWER, POWER FACTOR, POWER TRIANGLE. ANALYSIS OF SINGLE-PHASE AC CIRCUITS CONSISTING OF R, L, C, RL, RC, RLC COMBINATIONS (SERIES AND PARALLEL), RESONANCE. THREE-PHASE BALANCED CIRCUITS, VOLTAGE AND CURRENT RELATIONS IN STAR AND DELTA CONNECTIONS.

MODULE 3: MAGNETIC CIRCUITS: (4 LECTURES)

INTRODUCTION, SERIES AND PARALLEL MAGNETIC CIRCUITS, ANALYSIS OF SERIES AND PARALLEL MAGNETIC CIRCUITS.

MODULE 4: TRANSFORMERS (6 LECTURES)

MAGNETIC MATERIALS, BH CHARACTERISTICS, IDEAL AND PRACTICAL TRANSFORMER, EMF EQUATION, EQUIVALENT CIRCUIT, LOSSES IN TRANSFORMERS, REGULATION AND EFFICIENCY. AUTO-TRANSFORMER AND THREE-PHASE TRANSFORMER CONNECTIONS.

MODULE 5: ELECTRICAL MACHINES (10 LECTURES)

CONSTRUCTION, WORKING, TORQUE-SPEED CHARACTERISTIC AND SPEED CONTROL OF SEPARATELY EXCITED DC MOTOR. GENERATION OF ROTATING MAGNETIC FIELDS, CONSTRUCTION AND WORKING OF A THREE-PHASE INDUCTION MOTOR, SIGNIFICANCE OF TORQUE-SLIP CHARACTERISTIC. LOSS COMPONENTS AND EFFICIENCY, STARTING AND SPEED CONTROL OF INDUCTION MOTOR. CONSTRUCTION AND WORKING OF SYNCHRONOUS GENERATORS.

MODULE 6: ELECTRICAL INSTALLATIONS (6 LECTURES)

COMPONENTS OF LT SWITCHGEAR: SWITCH FUSE UNIT (SFU), MCB, ELCB, MCCB, TYPES OF WIRES AND CABLES, EARTHING. TYPES OF BATTERIES, IMPORTANT

CHARACTERISTICS FOR BATTERIES. ELEMENTARY CALCULATIONS FOR ENERGY CONSUMPTION, POWER FACTOR IMPROVEMENT AND BATTERY BACKUP.

SUGGESTED TEXT / REFERENCE BOOKS

- *D. P. KOTHARI AND I. J. NAGRATH, "BASIC ELECTRICAL ENGINEERING", TATA MCGRAW HILL, 2010.*
- *D. C. KULSHRESHTHA, "BASIC ELECTRICAL ENGINEERING", MCGRAW HILL, 2009.*
- *L. S. BOBROW, "FUNDAMENTALS OF ELECTRICAL ENGINEERING", OXFORD UNIVERSITY PRESS, 2011.*
- *E. HUGHES, "ELECTRICAL AND ELECTRONICS TECHNOLOGY", PEARSON, 2010.*
- *V. D. TORO, "ELECTRICAL ENGINEERING FUNDAMENTALS", PRENTICE HALL INDIA, 1989.*
- *BASIC ELECTRICAL ENGINEERING BY FITZERALD, ET AL, TATA MCGRAW HILL*
- *FUNDAMENTALS OF ELECTRICAL ENGG. BY R. PRASAD, PHI PUBLICATION*
- *BASIC ELECTRICAL ENGINEERING BY V.K. MEHTA AND ROHIT MEHTA, S.CHAND PUBLICATION*

COURSE OUTCOMES

- TO UNDERSTAND AND ANALYZE BASIC ELECTRIC AND MAGNETIC CIRCUITS
- TO STUDY THE WORKING PRINCIPLES OF ELECTRICAL MACHINES AND POWER CONVERTERS.
- TO INTRODUCE THE COMPONENTS OF LOW VOLTAGE ELECTRICAL INSTALLATIONS

LABORATORY

LIST OF EXPERIMENTS/DEMONSTRATIONS

- BASIC SAFETY PRECAUTIONS. INTRODUCTION AND USE OF MEASURING INSTRUMENTS – VOLTMETER, AMMETER, MULTI-METER, OSCILLOSCOPE. REAL-LIFE RESISTORS, CAPACITORS AND INDUCTORS.
- MEASURING THE STEADY-STATE AND TRANSIENT TIME-RESPONSE OF R-L, R-C, AND R-L-C CIRCUITS TO A STEP CHANGE IN VOLTAGE (TRANSIENT MAY BE OBSERVED ON A STORAGE OSCILLOSCOPE). SINUSOIDAL STEADY STATE RESPONSE OF R-L, AND R-C CIRCUITS – IMPEDANCE CALCULATION AND VERIFICATION. OBSERVATION OF PHASE DIFFERENCES BETWEEN CURRENT AND VOLTAGE. RESONANCE IN R-L-C CIRCUITS.
- TRANSFORMERS: OBSERVATION OF THE NO-LOAD CURRENT WAVEFORM ON AN OSCILLOSCOPE (NON- SINUSOIDAL WAVE-SHAPE DUE TO B-H CURVE NONLINEARITY SHOULD BE SHOWN ALONG WITH A DISCUSSION ABOUT HARMONICS). LOADING OF A TRANSFORMER: MEASUREMENT OF PRIMARY AND SECONDARY VOLTAGES AND CURRENTS, AND POWER.
- THREE-PHASE TRANSFORMERS: STAR AND DELTA CONNECTIONS. VOLTAGE AND CURRENT RELATIONSHIPS (LINE-LINE VOLTAGE, PHASE-TO-NEUTRAL VOLTAGE, LINE AND PHASE CURRENTS). PHASE-SHIFTS BETWEEN THE PRIMARY AND SECONDARY SIDE. CUMULATIVE THREE-PHASE POWER IN BALANCED THREE-PHASE CIRCUITS.
- DEMONSTRATION OF CUT-OUT SECTIONS OF MACHINES: DC MACHINE (COMMUTATOR-BRUSH ARRANGEMENT), INDUCTION MACHINE (SQUIRREL CAGE ROTOR), SYNCHRONOUS MACHINE (FIELD WINGING - SLIP RING ARRANGEMENT) AND SINGLE-PHASE INDUCTION MACHINE.
- TORQUE SPEED CHARACTERISTIC OF SEPARATELY EXCITED DC MOTOR.
- SYNCHRONOUS SPEED OF TWO AND FOUR-POLE, THREE-PHASE INDUCTION MOTORS. DIRECTION REVERSAL BY CHANGE OF PHASE-SEQUENCE OF CONNECTIONS. TORQUE-

SLIP CHARACTERISTIC OF AN INDUCTION MOTOR. GENERATOR OPERATION OF AN INDUCTION MACHINE DRIVEN AT SUPER- SYNCHRONOUS SPEED.

- SYNCHRONOUS MACHINE OPERATING AS A GENERATOR: STAND-ALONE OPERATION WITH A LOAD. CONTROL OF VOLTAGE THROUGH FIELD EXCITATION.
- DEMONSTRATION OF (A) DC-DC CONVERTERS (B) DC-AC CONVERTERS – PWM WAVEFORM (C) THE USE OF DC-AC CONVERTER FOR SPEED CONTROL OF AN INDUCTION MOTOR AND (D) COMPONENTS OF LT SWITCHGEAR.

LABORATORY OUTCOMES

- GET AN EXPOSURE TO COMMON ELECTRICAL COMPONENTS AND THEIR RATINGS.
- MAKE ELECTRICAL CONNECTIONS BY WIRES OF APPROPRIATE RATINGS.
- UNDERSTAND THE USAGE OF COMMON ELECTRICAL MEASURING INSTRUMENTS.
- UNDERSTAND THE BASIC CHARACTERISTICS OF TRANSFORMERS AND ELECTRICAL MACHINES.
- GET AN EXPOSURE TO THE WORKING OF POWER ELECTRONIC CONVERTERS

PAPER CODE – 100102 || 100202

ESC	ENGINEERING GRAPHICS & DESIGN	L:1	T:0	P:4	CREDIT:3

TRADITIONAL ENGINEERING GRAPHICS:

PRINCIPLES OF ENGINEERING GRAPHICS; ORTHOGRAPHIC PROJECTION; DESCRIPTIVE GEOMETRY; DRAWING PRINCIPLES; ISOMETRIC PROJECTION; SURFACE DEVELOPMENT; PERSPECTIVE; READING A DRAWING; SECTIONAL VIEWS; DIMENSIONING & TOLERANCES; TRUE LENGTH, ANGLE; INTERSECTION, SHORTEST DISTANCE.

COMPUTER GRAPHICS:

ENGINEERING GRAPHICS SOFTWARE; -SPATIAL TRANSFORMATIONS; ORTHOGRAPHIC PROJECTIONS; MODEL VIEWING; CO-ORDINATE SYSTEMS; MULTI-VIEW PROJECTION; EXPLODED ASSEMBLY; MODEL VIEWING; ANIMATION; SPATIAL MANIPULATION; SURFACE MODELLING; SOLID MODELLING, INTRODUCTION TO BUILDING INFORMATION MODELLING (BIM).

(EXCEPT THE BASIC ESSENTIAL CONCEPTS, MOST OF THE TEACHING PART CAN HAPPEN CONCURRENTLY IN THE LABORATORY)

MODULE 1: INTRODUCTION TO ENGINEERING DRAWING

PRINCIPLES OF ENGINEERING GRAPHICS AND THEIR SIGNIFICANCE, USAGE OF DRAWING INSTRUMENTS, LETTERING, CONIC SECTIONS INCLUDING THE RECTANGULAR HYPERBOLA (GENERAL METHOD ONLY); CYCLOID, EPICYCLOID, HYPOCYCLOID AND INVOLUTE; SCALES – PLAIN, DIAGONAL AND VERNIER SCALES

MODULE 2: ORTHOGRAPHIC PROJECTIONS

PRINCIPLES OF ORTHOGRAPHIC PROJECTIONS-CONVENTIONS -PROJECTIONS OF POINTS AND LINES INCLINED TO BOTH PLANES; PROJECTIONS OF PLANES INCLINED PLANES - AUXILIARY PLANES

MODULE 3: PROJECTIONS OF REGULAR SOLIDS

THOSE INCLINED TO BOTH THE PLANES- AUXILIARY VIEWS; DRAW SIMPLE ANNOTATION, DIMENSIONING AND SCALE. FLOOR PLANS THAT INCLUDE: WINDOWS, DOORS, AND FIXTURES SUCH AS WC, BATH, SINK, SHOWER, ETC.

MODULE 4: SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS

COVERING, PRISM, CYLINDER, PYRAMID, CONE – AUXILIARY VIEWS; DEVELOPMENT OF SURFACES OF RIGHT REGULAR SOLIDS- PRISM, PYRAMID, CYLINDER AND CONE; DRAW THE SECTIONAL ORTHOGRAPHIC VIEWS OF GEOMETRICAL SOLIDS, OBJECTS FROM INDUSTRY AND DWELLINGS (FOUNDATION TO SLAB ONLY)

MODULE 5: ISOMETRIC PROJECTIONS

PRINCIPLES OF ISOMETRIC PROJECTION – ISOMETRIC SCALE, ISOMETRIC VIEWS, CONVENTIONS; ISOMETRIC VIEWS OF LINES, PLANES, SIMPLE AND COMPOUND SOLIDS; CONVERSION OF ISOMETRIC VIEWS TO ORTHOGRAPHIC VIEWS AND VICE-VERSA, CONVENTIONS

MODULE 6: OVERVIEW OF COMPUTER GRAPHICS

LISTING THE COMPUTER TECHNOLOGIES THAT IMPACT ON GRAPHICAL COMMUNICATION, DEMONSTRATING KNOWLEDGE OF THE THEORY OF CAD SOFTWARE [SUCH AS: THE MENU SYSTEM, TOOLBARS (STANDARD, OBJECT PROPERTIES, DRAW, MODIFY AND DIMENSION), DRAWING AREA (BACKGROUND, CROSSHAIRS, COORDINATE SYSTEM), DIALOG BOXES AND WINDOWS, SHORTCUT MENUS (BUTTON BARS), THE COMMAND LINE (WHERE APPLICABLE), THE STATUS BAR, DIFFERENT METHODS OF ZOOM AS USED IN CAD, SELECT AND ERASE OBJECTS.; ISOMETRIC VIEWS OF LINES, PLANES, SIMPLE AND COMPOUND SOLIDS]

MODULE 7: CUSTOMISATION& CAD DRAWING

CONSISTING OF SET UP OF THE DRAWING PAGE AND THE PRINTER, INCLUDING SCALE SETTINGS, SETTING UP OF UNITS AND DRAWING LIMITS; ISO AND ANSI STANDARDS FOR COORDINATE DIMENSIONING AND TOLERANCING; ORTHOGRAPHIC CONSTRAINTS, SNAP TO OBJECTS MANUALLY AND AUTOMATICALLY; PRODUCING DRAWINGS BY USING VARIOUS COORDINATE INPUT ENTRY METHODS TO DRAW STRAIGHT LINES, APPLYING VARIOUS WAYS OF DRAWING CIRCLES.

MODULE 8: ANNOTATIONS, LAYERING & OTHER FUNCTIONS

COVERING APPLYING DIMENSIONS TO OBJECTS, APPLYING ANNOTATIONS TO DRAWINGS; SETTING UP AND USE OF LAYERS, LAYERS TO CREATE DRAWINGS, CREATE, EDIT AND USE CUSTOMIZED LAYERS; CHANGING LINE LENGTHS THROUGH MODIFYING EXISTING LINES (EXTEND/LENGTHEN); PRINTING DOCUMENTS TO PAPER USING THE PRINT COMMAND; ORTHOGRAPHIC PROJECTION TECHNIQUES; DRAWING SECTIONAL VIEWS OF COMPOSITE RIGHT REGULAR GEOMETRIC SOLIDS AND PROJECT THE TRUE SHAPE OF THE SECTIONED SURFACE; DRAWING ANNOTATION, COMPUTER-AIDED DESIGN (CAD) SOFTWARE MODELING OF PARTS AND ASSEMBLIES. PARAMETRIC AND NON-PARAMETRIC SOLID, SURFACE, AND WIREFRAME MODELS. PART EDITING AND TWO-DIMENSIONAL DOCUMENTATION OF MODELS. PLANAR PROJECTION THEORY, INCLUDING SKETCHING OF PERSPECTIVE, ISOMETRIC, MULTIVIEW, AUXILIARY, AND SECTION VIEWS. SPATIAL VISUALIZATION EXERCISES. DIMENSIONING GUIDELINES, TOLERANCING TECHNIQUES; DIMENSIONING AND SCALE MULTI VIEWS OF DWELLING.

MODULE 9: DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT THAT ILLUSTRATES

GEOMETRY AND TOPOLOGY OF ENGINEERED COMPONENTS: CREATION OF ENGINEERING MODELS AND THEIR PRESENTATION IN STANDARD 2D BLUEPRINT FORM AND AS 3D WIRE-FRAME AND SHADED SOLIDS; MESHED TOPOLOGIES FOR ENGINEERING ANALYSIS AND TOOL-PATH GENERATION FOR COMPONENT MANUFACTURE; GEOMETRIC DIMENSIONING AND TOLERANCING; USE OF SOLID-MODELING SOFTWARE FOR CREATING ASSOCIATIVE MODELS AT THE COMPONENT AND ASSEMBLY LEVELS. FLOOR PLANS THAT INCLUDE: WINDOWS, DOORS, AND FIXTURES SUCH AS WC, BATH, SINK, SHOWER, ETC. APPLYING COLOUR CODING

ACCORDING TO BUILDING DRAWING PRACTICE; DRAWING SECTIONAL ELEVATION SHOWING FOUNDATION TO CEILING; INTRODUCTION TO BUILDING INFORMATION MODELLING (BIM).

SUGGESTED TEXT/REFERENCE BOOKS:

- *BHATT N.D., PANCHAL V.M. & INGLE P.R., (2014), ENGINEERING DRAWING, CHAROTAR PUBLISHING HOUSE*
- *SHAH, M.B. &RANA B.C. (2008), ENGINEERING DRAWING AND COMPUTER GRAPHICS, PEARSON EDUCATION*
- *AGRAWAL B. & AGRAWAL C. M. (2012), ENGINEERING GRAPHICS, TMH PUBLICATION*
- *NARAYANA, K.L. & P KANNAIAH (2008), TEXT BOOK ON ENGINEERING DRAWING, SCITECHPUBLISHERS*
- *(CORRESPONDING SET OF) CAD SOFTWARE THEORY AND USER MANUALS*

COURSE OUTCOMES

ALL PHASES OF MANUFACTURING OR CONSTRUCTION REQUIRE THE CONVERSION OF NEW IDEAS AND DESIGN CONCEPTS INTO THE BASIC LINE LANGUAGE OF GRAPHICS. THEREFORE, THERE ARE MANY AREAS (CIVIL, MECHANICAL, ELECTRICAL, ARCHITECTURAL AND INDUSTRIAL) IN WHICH THE SKILLS OF THE CAD TECHNICIANS PLAY MAJOR ROLES IN THE DESIGN AND DEVELOPMENT OF NEW PRODUCTS OR CONSTRUCTION. STUDENTS PREPARE FOR ACTUAL WORK SITUATIONS THROUGH PRACTICAL TRAINING IN A NEW STATE-OF-THE-ART COMPUTER DESIGNED CAD LABORATORY USING ENGINEERING SOFTWARE

THIS COURSE IS DESIGNED TO ADDRESS:

- TO PREPARE YOU TO DESIGN A SYSTEM, COMPONENT, OR PROCESS TO MEET DESIRED NEEDS WITHIN REALISTIC CONSTRAINTS SUCH AS ECONOMIC, ENVIRONMENTAL, SOCIAL, POLITICAL, ETHICAL, HEALTH AND SAFETY, MANUFACTURABILITY, AND SUSTAINABILITY
- TO PREPARE YOU TO COMMUNICATE EFFECTIVELY
- TO PREPARE YOU TO USE THE TECHNIQUES, SKILLS, AND MODERN ENGINEERING TOOLS NECESSARY FOR ENGINEERING PRACTICE

THE STUDENT WILL LEARN:

- INTRODUCTION TO ENGINEERING DESIGN AND ITS PLACE IN SOCIETY
- EXPOSURE TO THE VISUAL ASPECTS OF ENGINEERING DESIGN
- EXPOSURE TO ENGINEERING GRAPHICS STANDARDS
- EXPOSURE TO SOLID MODELLING
- EXPOSURE TO COMPUTER-AIDED GEOMETRIC DESIGN
- EXPOSURE TO CREATING WORKING DRAWINGS
- EXPOSURE TO ENGINEERING COMMUNICATION

PAPER CODE – 100103 || 100203

BSC	CHEMISTRY	L:3	T:1	P:3	CREDIT 5.5

MODULE 1: ATOMIC AND MOLECULAR STRUCTURE (10 LECTURES)

FAILURE OF CLASSICAL NEWTONIAN AND MAXWELL WAVE MECHANICS TO EXPLAIN PROPERTIES OF PARTICLES AT ATOMIC AND SUB-ATOMIC LEVEL; ELECTROMAGNETIC RADIATION, DUAL NATURE OF ELECTRON AND ELECTROMAGNETIC RADIATION, PLANK'S THEORY, PHOTOELECTRIC EFFECT AND HEISENBERG UNCERTAINTY PRINCIPLE. FAILURE OF EARLIER THEORIES TO EXPLAIN CERTAIN PROPERTIES OF MOLECULES LIKE PARAMAGNETIC PROPERTIES. PRINCIPLES FOR COMBINATION OF ATOMIC ORBITALS TO FORM MOLECULAR ORBITALS. FORMATION OF HOMO AND HETERO DIATOMIC MOLECULES AND PLOTS OF ENERGY LEVEL DIAGRAM OF MOLECULAR ORBITALS. COORDINATION NUMBERS AND GEOMETRIES, ISOMERISM IN TRANSITIONAL METAL COMPOUNDS, CRYSTAL FIELD THEORY AND THE ENERGY LEVEL DIAGRAMS FOR TRANSITION METAL IONS AND THEIR MAGNETIC PROPERTIES.

MODULE 2: SPECTROSCOPIC TECHNIQUES AND APPLICATIONS (8 LECTURES)

PRINCIPLES OF VIBRATIONAL AND ROTATIONAL SPECTROSCOPY AND SELECTION RULES FOR APPLICATION IN DIATOMIC MOLECULES. ELEMENTARY IDEA OF ELECTRONIC SPECTROSCOPY. UV-VIS SPECTROSCOPY WITH RELATED RULES AND ITS APPLICATIONS. FLUORESCENCE AND ITS APPLICATIONS IN MEDICINE. BASIC PRINCIPLE OF NUCLEAR MAGNETIC RESONANCE AND ITS APPLICATION. BASICS OF MAGNETIC RESONANCE IMAGING.

MODULE 3: INTERMOLECULAR FORCES AND PROPERTIES OF GASES (4 LECTURES)

IONIC, DIPOLAR AND VAN DER WAALS INTERACTIONS. EQUATIONS OF STATE OF IDEAL AND REAL GASES, DEVIATION FROM IDEAL BEHAVIOUR. VANDER WAAL GAS EQUATION.

MODULE 4: USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA & WATER CHEMISTRY (8 LECTURES)

THERMODYNAMIC FUNCTIONS: ENERGY, ENTHALPY ENTROPY AND FREE ENERGY. EQUATIONS TO INTERRELATE THERMODYNAMIC PROPERTIES. FREE ENERGY, EMF. AND CELL POTENTIALS, THE NERNST EQUATION AND APPLICATIONS. CORROSION. USE OF FREE ENERGY CONSIDERATIONS IN METALLURGY THROUGH ELLINGHAM DIAGRAMS. SOLUBILITY EQUILIBRIA.

WATER CHEMISTRY, HARD AND SOFT WATER. PARAMETERS OF QUALITY OF WATER TO BE USED IN DIFFERENT INDUSTRIES AS FOR DRINKING WATER. CALCULATION OF HARDNESS OF WATER IN ALL UNITS. ESTIMATION OF HARDNESS USING EDTA AND ALKALINITY METHOD. REMOVAL OF HARDNESS BY SODA LIME AND ION EXCHANGE METHOD INCLUDING ZEOLITE METHOD

MODULE 5: PERIODIC PROPERTIES (4 LECTURES)

EFFECTIVE NUCLEAR CHARGE, PENETRATION OF ORBITALS, VARIATIONS OF S, P, D AND F ORBITAL ENERGIES OF ATOMS IN THE PERIODIC TABLE, ELECTRONIC CONFIGURATIONS,

ATOMIC AND IONIC SIZES, IONIZATION ENERGIES, ELECTRON AFFINITY AND ELECTRONEGATIVITY, POLARIZABILITY, ACID, BASE, PRINCIPLE OF HSAB THEORY, OXIDATION STATES, HYBRIDIZATION AND MOLECULAR GEOMETRIES.

MODULE 6: STEREOCHEMISTRY (4 LECTURES)

REPRESENTATIONS OF 3-D STRUCTURES, STRUCTURAL ISOMERS AND STEREOISOMERS, CONFIGURATIONS AND SYMMETRY AND CHIRALITY, ENANTIOMERS, DIASTEREOMERS, OPTICAL ACTIVITY, ABSOLUTE CONFIGURATIONS AND CONFORMATIONAL ANALYSIS.

MODULE 7: ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULE (4 LECTURES)

INTRODUCTION TO INTERMEDIATES AND REACTIONS INVOLVING SUBSTITUTION, ADDITION, ELIMINATION, OXIDATION- REDUCTION, DIELS ELDER CYCLIZATION AND EPOXIDE RING OPENINGS REACTIONS. SYNTHESIS OF A COMMONLY USED DRUG MOLECULE LIKE ASPIRIN.

SUGGESTED TEXT BOOKS

- 🕮 *UNIVERSITY CHEMISTRY, BY B. H. MAHAN*
- 🕮 *CHEMISTRY: PRINCIPLES AND APPLICATIONS, BY M. J. SIENKO AND R. A. PLANE*
- 🕮 *FUNDAMENTALS OF MOLECULAR SPECTROSCOPY, BY C. N. BANWELL*
- 🕮 *ENGINEERING CHEMISTRY (NPTEL WEB-BOOK), BY B. L. TEMBE, KAMALUDDIN AND M. S. KRISHNAN*
- 🕮 *PHYSICAL CHEMISTRY, BY P. W. ATKINS*
- 🕮 *ORGANIC CHEMISTRY: STRUCTURE AND FUNCTION BY K. P. C. VOLHARDT AND N. E. SCHORE, 5TH EDITION*
- 🕮 *HTTP://BCS.WHFREEMAN.COM/VOLLHARDTSCHORE5E/DEFAULT.ASP*

COURSE OUTCOMES

THE CONCEPTS DEVELOPED IN THIS COURSE WILL AID IN QUANTIFICATION OF SEVERAL CONCEPTS IN CHEMISTRY THAT HAVE BEEN INTRODUCED AT THE 10+2 LEVELS IN SCHOOLS. TECHNOLOGY IS BEING INCREASINGLY BASED ON THE ELECTRONIC, ATOMIC AND MOLECULAR LEVEL MODIFICATIONS.

QUANTUM THEORY IS MORE THAN 100 YEARS OLD AND TO UNDERSTAND PHENOMENA AT NANOMETER LEVELS, ONE HAS TO BASE THE DESCRIPTION OF ALL CHEMICAL PROCESSES AT MOLECULAR LEVELS. THE COURSE WILL ENABLE THE STUDENT TO: ANALYSE MICROSCOPIC CHEMISTRY IN TERMS OF ATOMIC AND MOLECULAR ORBITALS AND INTERMOLECULAR FORCES. RATIONALISE BULK PROPERTIES AND PROCESSES USING THERMODYNAMIC CONSIDERATIONS. DISTINGUISH THE RANGES OF THE ELECTROMAGNETIC SPECTRUM USED FOR EXCITING DIFFERENT MOLECULAR ENERGY LEVELS IN VARIOUS SPECTROSCOPIC TECHNIQUES RATIONALISE PERIODIC PROPERTIES SUCH AS IONIZATION POTENTIAL, ELECTRONEGATIVITY, OXIDATION STATES AND ELECTRONEGATIVITY.LIST MAJOR CHEMICAL REACTIONS THAT ARE USED IN THE SYNTHESIS OF MOLECULES.

CHEMISTRY LABORATORY

CHOICE OF 10-12 EXPERIMENTS FROM THE FOLLOWING

- ❖ DETERMINATION OF SURFACE TENSION AND VISCOSITY
- ❖ THIN LAYER CHROMATOGRAPHY
- ❖ ION EXCHANGE COLUMN FOR REMOVAL OF HARDNESS OF WATER
- ❖ DETERMINATION OF CHLORIDE CONTENT OF WATER

- COLLIGATIVE PROPERTIES USING FREEZING POINT DEPRESSION
- DETERMINATION OF THE RATE CONSTANT OF A REACTION
- DETERMINATION OF CELL CONSTANT AND CONDUCTANCE OF SOLUTIONS
- POTENTIOMETRY - DETERMINATION OF REDOX POTENTIALS AND EMFS
- SYNTHESIS OF A POLYMER/DRUG
- SAPONIFICATION/ACID VALUE OF AN OIL
- CHEMICAL ANALYSIS OF A SALT
- LATTICE STRUCTURES AND PACKING OF SPHERES
- MODELS OF POTENTIAL ENERGY SURFACES
- CHEMICAL OSCILLATIONS- IODINE CLOCK REACTION
- DETERMINATION OF THE PARTITION COEFFICIENT OF A SUBSTANCE BETWEEN TWO IMMISCIBLE LIQUIDS
- ADSORPTION OF ACETIC ACID BY CHARCOAL
- USE OF THE CAPILLARY VISCOSIMETERS TO THE DEMONSTRATE OF THE ISOELECTRIC POINT AS THE PH OF MINIMUM VISCOSITY FOR GELATIN SOLS AND/OR COAGULATION OF THE WHITE PART OF EGG.

LABORATORY OUTCOMES

THE CHEMISTRY LABORATORY COURSE WILL CONSIST OF EXPERIMENTS ILLUSTRATING THE PRINCIPLES OF CHEMISTRY RELEVANT TO THE STUDY OF SCIENCE AND ENGINEERING. THE STUDENTS WILL LEARN TO: ESTIMATE RATE CONSTANTS OF REACTIONS FROM CONCENTRATION OF REACTANTS/PRODUCTS AS A FUNCTION OF TIME MEASURE MOLECULAR/SYSTEM PROPERTIES SUCH AS SURFACE TENSION, VISCOSITY, CONDUCTANCE OF SOLUTIONS, REDOX POTENTIALS, CHLORIDE CONTENT OF WATER, ETC SYNTHESIZE A SMALL DRUG MOLECULE AND ANALYSE A SALT SAMPLE

PAPER CODE – 100104 || 100204

ESC	PROGRAMMING FOR PROBLEM SOLVING	L:3	T:0	P:4	CREDIT:5

MODULE 1: INTRODUCTION TO PROGRAMMING (6 LECTURES)

INTRODUCTION TO COMPONENTS OF A COMPUTER SYSTEM (DISKS, MEMORY, PROCESSOR, WHERE A PROGRAM IS STORED AND EXECUTED, OPERATING SYSTEM, COMPILERS ETC). IDEA OF ALGORITHM: STEPS TO SOLVE LOGICAL AND NUMERICAL PROBLEMS. REPRESENTATION OF ALGORITHM: FLOWCHART/PSEUDO CODE WITH EXAMPLES. FROM ALGORITHMS TO PROGRAMS; SOURCE CODE, VARIABLES (WITH DATA TYPES) VARIABLES AND MEMORY LOCATIONS, TYPE CASTING/TYPE CONVERSION, RUN TIME ENVIRONMENT (STATIC, DYNAMIC LOCATION), STORAGE CLASSES (AUTO, REGISTER, STATIC, EXTERN), SYNTAX AND LOGICAL ERRORS IN COMPILATION, OBJECT AND EXECUTABLE CODE.

MODULE 2: OPERATORS (3 LECTURES)

ARITHMETIC EXPRESSIONS/ARITHMETIC OPERATORS/RELATIONAL OPERATORS/LOGICAL OPERATORS/BITWISE OPERATORS AND PRECEDENCE

MODULE 3: CONDITIONAL BRANCHING AND LOOPS (5 LECTURES)

WRITING AND EVALUATION OF CONDITIONALS AND CONSEQUENT BRANCHING, ITERATION AND LOOPS

MODULE 4: ARRAYS (4 LECTURES)

ARRAY DECLARATION & INITIALIZATION, BOUND CHECKING ARRAYS (1-D, 2-D), CHARACTER ARRAYS AND STRINGS.

MODULE 5: BASIC ALGORITHMS (6 LECTURES)

SEARCHING (LINEAR SEARCH, BINARY SEARCH ETC.), BASIC SORTING ALGORITHMS (BUBBLE, INSERTION AND SELECTION), FINDING ROOTS OF EQUATIONS, NOTION OF ORDER OF COMPLEXITY THROUGH EXAMPLE PROGRAMS (NO FORMAL DEFINITION REQUIRED)

MODULE 6: FUNCTION (4 LECTURES)

INTRODUCTION & WRITING FUNCTIONS, SCOPE OF VARIABLES FUNCTIONS (INCLUDING USING BUILT IN LIBRARIES), PARAMETER PASSING IN FUNCTIONS, CALL BY VALUE, PASSING ARRAYS TO FUNCTIONS: IDEA OF CALL BY REFERENCE

MODULE 7: RECURSION (5 LECTURES)

RECURSION, AS A DIFFERENT WAY OF SOLVING PROBLEMS. EXAMPLE PROGRAMS, SUCH AS FINDING FACTORIAL, FIBONACCI SERIES, REVERSE A STRING USING RECURSION, AND GCD OF TWO NUMBERS, ACKERMAN FUNCTION ETC. QUICK SORT OR MERGE SORT.

MODULE 8: STRUCTURE/UNION (3 LECTURES)

STRUCTURES, ACCESSING STRUCTURE ELEMENTS, WAY OF STORAGE OF STRUCTURE ELEMENT, DEFINING STRUCTURES AND ARRAY OF STRUCTURES, BASIC DEFINITION OF UNION, COMPARISON B/W STRUCTURE & UNION WITH EXAMPLE

MODULE 9: POINTERS (5 LECTURES)

IDEA OF POINTERS, DEFINING POINTERS, USE OF POINTERS IN SELF-REFERENTIAL STRUCTURES, NOTION OF LINKED LIST (NO IMPLEMENTATION), POINTER TO POINTER, POINTER TO ARRAY, POINTER TO STRINGS, ARRAY OF POINTER, POINTER TO FUNCTION, POINTER TO STRUCTURE.

MODULE 10: FILE HANDLING

(ONLY IF TIME IS AVAILABLE, OTHERWISE SHOULD BE DONE AS PART OF THE LAB)

SUGGESTED TEXT BOOKS

- 🕮 *BYRON GOTTFRIED, SCHAUM'S OUTLINE OF PROGRAMMING WITH C, MCGRAW-HILL*
- 🕮 *E. BALAGURUSWAMY, PROGRAMMING IN ANSI C, TATA MCGRAW-HILL*

SUGGESTED REFERENCE BOOKS

- 🕮 *BRIAN W. KERNIGHAN AND DENNIS M. RITCHIE, THE C PROGRAMMING LANGUAGE, PRENTICE HALL OF INDIA*
- 🕮 *YASHWANT KANETKAR, LET US C, BPB PUBLICATION*

THE STUDENT WILL LEARN

- TO FORMULATE SIMPLE ALGORITHMS FOR ARITHMETIC AND LOGICAL PROBLEMS.
- TO TRANSLATE THE ALGORITHMS TO PROGRAMS (IN C LANGUAGE).
- TO TEST AND EXECUTE THE PROGRAMS AND CORRECT SYNTAX AND LOGICAL ERRORS.
- TO IMPLEMENT CONDITIONAL BRANCHING, ITERATION AND RECURSION.
- TO DECOMPOSE A PROBLEM INTO FUNCTIONS AND SYNTHESIZE A COMPLETE PROGRAM USING DIVIDE AND CONQUER APPROACH.
- TO USE ARRAYS, POINTERS AND STRUCTURES TO FORMULATE ALGORITHMS AND PROGRAMS.
- TO APPLY PROGRAMMING TO SOLVE MATRIX ADDITION AND MULTIPLICATION PROBLEMS AND SEARCHING AND SORTING PROBLEMS.
- TO APPLY PROGRAMMING TO SOLVE SIMPLE NUMERICAL METHOD PROBLEMS, NAMELY ROT FINDING OF FUNCTION, DIFFERENTIATION OF FUNCTION AND SIMPLE INTEGRATION.

LABORATORY PROGRAMMING FOR PROBLEM SOLVING

[THE LABORATORY SHOULD BE PRECEDED OR FOLLOWED BY A TUTORIAL TO EXPLAIN THE APPROACH OR ALGORITHM TO BE IMPLEMENTED FOR THE PROBLEM GIVEN.]

TUTORIAL 1: PROBLEM SOLVING USING COMPUTERS:
LAB1: FAMILIARIZATION WITH PROGRAMMING ENVIRONMENT

TUTORIAL 2: VARIABLE TYPES AND TYPE CONVERSIONS:
LAB 2: SIMPLE COMPUTATIONAL PROBLEMS USING ARITHMETIC EXPRESSIONS

TUTORIAL 3: BRANCHING AND LOGICAL EXPRESSIONS:
LAB 3: PROBLEMS INVOLVING IF-THEN-ELSE STRUCTURES

TUTORIAL 4: LOOPS, WHILE AND FOR LOOPS:

LAB 4: ITERATIVE PROBLEMS E.G., SUM OF SERIES

TUTORIAL 5: 1D ARRAYS: SEARCHING, SORTING:
LAB 5: 1D ARRAY MANIPULATION

TUTORIAL 6: 2D ARRAYS AND STRINGS
LAB 6: MATRIX PROBLEMS, STRING OPERATIONS

TUTORIAL 7: FUNCTIONS, CALL BY VALUE:
LAB 7: SIMPLE FUNCTIONS

TUTORIAL 8: NUMERICAL METHODS (ROOT FINDING, NUMERICAL DIFFERENTIATION, NUMERICAL INTEGRATION):
LAB 8: PROGRAMMING FOR SOLVING NUMERICAL METHODS PROBLEMS

TUTORIAL 9: RECURSION, STRUCTURE OF RECURSIVE CALLS
LAB 9: RECURSIVE FUNCTIONS

TUTORIAL 10: POINTERS, STRUCTURES AND DYNAMIC MEMORY ALLOCATION
LAB 10: POINTERS AND STRUCTURES

TUTORIAL 11: FILE HANDLING:
LAB 11: FILE OPERATIONS

LABORATORY OUTCOMES

- TO FORMULATE THE ALGORITHMS FOR SIMPLE PROBLEMS
- TO TRANSLATE GIVEN ALGORITHMS TO A WORKING AND CORRECT PROGRAM
- TO BE ABLE TO CORRECT SYNTAX ERRORS AS REPORTED BY THE COMPILERS
- TO BE ABLE TO IDENTIFY AND CORRECT LOGICAL ERRORS ENCOUNTERED AT RUN TIME
- TO BE ABLE TO WRITE ITERATIVE AS WELL AS RECURSIVE PROGRAMS
- TO BE ABLE TO REPRESENT DATA IN ARRAYS, STRINGS AND STRUCTURES AND MANIPULATE THEM THROUGH A PROGRAM
- TO BE ABLE TO DECLARE POINTERS OF DIFFERENT TYPES AND USE THEM IN DEFINING SELF- REFERENTIAL STRUCTURES.
- TO BE ABLE TO CREATE, READ AND WRITE TO AND FROM SIMPLE TEXT FILES.

PAPER CODE – 100105 || 100205

ESC	WORKSHOP MANUFACTURING PRACTICES	L:1	T:0	P:4	CREDIT:3

LECTURES & VIDEOS: (10 HOURS) [L: 1; T: 0; P: 0 (1 CREDIT)]

DETAILED CONTENTS:

1. MANUFACTURING METHODS-CASTING, FORMING, MACHINING, JOINING, ADVANCED MANUFACTURING METHODS (3 LECTURES)
2. CNC MACHINING, ADDITIVE MANUFACTURING (1 LECTURE)
3. FITTING OPERATIONS & POWER TOOLS (1 LECTURE)
4. CARPENTRY (1 LECTURE)
5. PLASTIC MOULDING, GLASS CUTTING (1 LECTURE)
6. METAL CASTING (1 LECTURE)
7. WELDING (ARC WELDING & GAS WELDING), BRAZING, SOLDERING (2 LECTURE)

SUGGESTED TEXT/REFERENCE BOOKS:

- 🕮 *HAJRA CHOUDHURY S.K., HAJRA CHOUDHURY A.K. AND NIRJHAR ROY S.K., "ELEMENTS OF WORKSHOP TECHNOLOGY", VOL. I 2008 AND VOL. II 2010, MEDIA PROMOTERS AND PUBLISHERS PRIVATE LIMITED, MUMBAI.*
- 🕮 *KALPAKJIAN S. AND STEVEN S. SCHMID, "MANUFACTURING ENGINEERING AND TECHNOLOGY", 4TH EDITION, PEARSON EDUCATION INDIA EDITION, 2002.*
- 🕮 *GOWRI P. HARIHARAN AND A. SURESH BABU,"MANUFACTURING TECHNOLOGY – I" PEARSON EDUCATION, 2008.*
- 🕮 *ROY A. LINDBERG, "PROCESSES AND MATERIALS OF MANUFACTURE", 4TH EDITION, PRENTICE HALL INDIA, 1998.*
- 🕮 *RAO P.N., "MANUFACTURING TECHNOLOGY", VOL. I AND VOL. II, TATA MCGRAWHILL HOUSE, 2017.*

COURSE OUTCOMES:

- ❖ *UPON COMPLETION OF THIS COURSE, THE STUDENTS WILL GAIN KNOWLEDGE OF THE DIFFERENT MANUFACTURING PROCESSES WHICH ARE COMMONLY EMPLOYED IN THE INDUSTRY, TO FABRICATE COMPONENTS USING DIFFERENT MATERIALS.*

WORKSHOP PRACTICE: (60 HOURS) [L: 0; T: 0; P: 4 (2 CREDITS)]

1. MACHINE SHOP (10 HOURS) AND FITTING SHOP (8 HOURS)
2. CARPENTRY (6 HOURS)
3. WELDING SHOP (8 HOURS) (ARC WELDING 4 HRS + GAS WELDING 4 HRS)
4. CASTING (8 HOURS) AND SMITHY (6 HOURS)
5. PLASTIC MOULDING & GLASS CUTTING (6 HOURS)
6. 3-D PRINTING OF DIFFERENT MODELS (8 HOURS)

EXAMINATIONS COULD INVOLVE THE ACTUAL FABRICATION OF SIMPLE COMPONENTS, UTILIZING ONE OR MORE OF THE TECHNIQUES COVERED ABOVE.

LABORATORY OUTCOMES

- ❖ UPON COMPLETION OF THIS LABORATORY COURSE, STUDENTS WILL BE ABLE TO FABRICATE COMPONENTS WITH THEIR OWN HANDS.
- ❖ THEY WILL ALSO GET PRACTICAL KNOWLEDGE OF THE DIMENSIONAL ACCURACIES AND DIMENSIONAL TOLERANCES POSSIBLE WITH DIFFERENT MANUFACTURING PROCESSES.
- ❖ BY ASSEMBLING DIFFERENT COMPONENTS, THEY WILL BE ABLE TO PRODUCE SMALL DEVICES OF THEIR INTEREST. BY ASSEMBLING DIFFERENT COMPONENTS, THEY WILL BE ABLE TO PRODUCE SMALL DEVICES OF THEIR INTEREST.

PAPER CODE – 100106 || 100206

HSMC	ENGLISH	L:2	T:0	P:2	CREDIT:3

DETAILED CONTENTS

1. VOCABULARY BUILDING
- A. THE CONCEPT OF WORD FORMATION
- B. ROOT WORDS FROM FOREIGN LANGUAGES AND THEIR USE IN ENGLISH
- C. ACQUAINTANCE WITH PREFIXES AND SUFFIXES FROM FOREIGN LANGUAGES IN ENGLISH TO FORM DERIVATIVES.
- D. SYNONYMS, ANTONYMS, AND STANDARD ABBREVIATIONS.
- E. AFFIXES, ACRONYMS

2. BASIC WRITING SKILLS
- A. SENTENCE STRUCTURES
- B. USE OF PHRASES AND CLAUSES IN SENTENCES
- C. IMPORTANCE OF PROPER PUNCTUATION
- D. KINDS OF SENTENCES
- E. USE OF TENSE, USE IN CONTEXT AND COHERENCE OF TENSE IN WRITING
- F. USE OF VOICE – ACTIVE/PASSIVE IN SENTENCES
- G. USE OF SPEECH – DIRECT AND INDIRECT SPEECH
- H. FRAMING QUESTIONS- DIRECT, USING MODAL VERBS

3. IDENTIFYING COMMON ERRORS IN WRITING
- A. SUBJECT-VERB AGREEMENT
- B. NOUN-PRONOUN AGREEMENT
- C. MISPLACED MODIFIERS
- D. ARTICLES
- E. PREPOSITIONS
- F. REDUNDANCIES
- G. CLICHÉS
- H. COMMON ENGLISH ERRORS

4. NATURE AND STYLE OF SENSIBLE WRITING
- A. DESCRIBING
- B. DEFINING
- C. CLASSIFYING
- D. PROVIDING EXAMPLES OR EVIDENCE
- E. WRITING INTRODUCTION AND CONCLUSION
- F. ORGANISING PRINCIPLE OF PARAGRAPHS IN DOCUMENTS
- G. ARGUMENT, DESCRIBING/ NARRATING/ PLANNING, DEFINING,CLASSIFYING
- H. LEXICAL RESOURCES, USING SUITABLE LANGUAGE REGISTER
- I. COHERENCE, WRITING INTRODUCTION, BODY AND CONCLUSION, TECHNIQUES FOR WRITING PRECISELY,GRAMMAR AND ACCURACY

5. WRITING PRACTICES
- A. COMPREHENSION
- B. FORMAL LETTER WRITING/ APPLICATION/ REPORT WRITING/ WRITING MINUTES OF MEETINGS
- C. ESSAY WRITING
- D. FORMAL EMAIL WRITING
- E. RESUME/ CV WRITING, COVER LETTER,
- F. STATEMENT OF PURPOSE

6. ORAL COMMUNICATION

(THIS UNIT INVOLVES INTERACTIVE PRACTICE SESSIONS IN LANGUAGE LAB)

A. LISTENING COMPREHENSION
B. PRONUNCIATION, INTONATION, STRESS AND RHYTHM
C. COMMON EVERYDAY SITUATIONS: CONVERSATIONS AND DIALOGUES
D. COMMUNICATION AT WORKPLACE
E. INTERVIEWS
F. FORMAL PRESENTATIONS
G. ACQUAINTING STUDENTS WITH IPA SYMBOLS
H. PHONETICS (BASIC)
I. SOUNDS – VOWELS, CONSONANTS
J. CLEARING MOTHER TONGUE INFLUENCE
K. CLEARING REDUNDANCIES AND COMMON ERRORS RELATED TO INDIANISMS
L. GROUP DISCUSSION
M. EXPRESSING OPINIONS
N. COHERENCE AND FLUENCY IN SPEECH

7. READING SKILLS

A. READING COMPREHENSION,
B. PARAGRAPH READING BASED ON PHONETIC SOUNDS/ INTONATION

8. PROFESSIONAL SKILLS

A. TEAM BUILDING
B. SOFT SKILLS AND ETIQUETTES

9. ACQUAINTANCE WITH TECHNOLOGY-AIDED LANGUAGE LEARNING

A. USE OF COMPUTER SOFTWARE (GRAMMARLY, GINGER…)
B. USE OF SMARTPHONE APPLICATIONS (DUOLINGO, BUSUU…)

10. ACTIVITIES

A. NARRATIVE CHAIN
B. DESCRIBING/ NARRATING
C. WRITING ESSAYS IN RELAY
D. PEER/ GROUP ACTIVITIES
E. BRAINSTORMING VOCABULARY
F. CUE / FLASH CARDS FOR VOCABULARY
G. DEBATES

SUGGESTED READINGS:

- 🕮 *PRACTICAL ENGLISH USAGE. MICHAEL SWAN. OUP. 1995.*
- 🕮 *REMEDIAL ENGLISH GRAMMAR. F.T. WOOD. MACMILLAN.2007*
- 🕮 *ON WRITING WELL. WILLIAM ZINSSER. HARPER RESOURCE BOOK. 2001*
- 🕮 *STUDY WRITING. LIZ HAMP-LYONS AND BEN HEASLY. CAMBRIDGE UNIVERSITY PRESS. 2006.*
- 🕮 *COMMUNICATION SKILLS. SANJAY KUMAR AND PUSHPLATA. OXFORD UNIVERSITY PRESS. 2011.*
- 🕮 *EXERCISES IN SPOKEN ENGLISH. PARTS. I-III. CIEFL, HYDERABAD. OXFORD UNIVERSITY PRESS*

COURSE OUTCOMES

THE STUDENT WILL ACQUIRE BASIC PROFICIENCY IN ENGLISH INCLUDING READING AND LISTENING COMPREHENSION, WRITING AND SPEAKING SKILLS.

28. Business & Personal Law. Chapter 7. "How Contracts Arise", http://yucaipahigh.com/schristensen/lawweb/lawch7.ppt
29. Types of Contracts, http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt
30. IV. TYPES OF CONTRACTS AND IMPORTANT PROVISIONS, http://www.worldbank.org/html/opr/consult/guidetxt/types.html Contract Types/Pricing Arrangements Guideline- 1.4.G (11/04/02), http://www.sandia.gov/policy/14g.pdf

102 ME

BSC202	**Mathematics III (PDE, Probability & Statistics)**	**3L:1T:0P**	**4 credits**

Objectives:

1. To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering
2. To provide an overview of probability and statistics to engineers

Contents:

Module 1: **(14 lectures)**

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables.

Module 2: **(12 lectures)**

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality. Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities. Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

Module 3: **(12 lectures)**

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances - Chi- square

test for goodness of fit and independence of attributes.

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9thEdition, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
3. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall.
4. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India,2002.

Course Outcomes:

Upon completion of this course, students will be able to solve field problems in engineering involving PDEs. They can also formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data.

BSC203	**Biology** 2 (one hour) lectures and one (one hour) tutorial per week. Only lecture hours are shown	**2L:1T:0P**	**3 credits**

Module 1: Introduction **(2 lectures)**

Purpose: *To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry*

Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

Module 2: Classification **(3 lectures)**

Purpose: *To convey that classification per seis not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted*.

Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilisation -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E. coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus

Module 3: Genetics **(4 lectures)**

Purpose: *To convey that "Genetics is to biology what Newton's laws are to Physical Sciences*"

Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

Module 4: Biomolecules **(4 lectures)**

Purpose: *To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine*

Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.

Module 5: Enzymes **(4 lectures)**

Purpose: *To convey that without catalysis life would not have existed on eart*h.

Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyze reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

Module 6: Information Transfer **(4 lectures)**

Purpose: *The molecular basis of coding and decoding genetic information is universal*

Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

Module 7: Macromolecular analysis **(5 lectures)**

Purpose: *How to analyse biological processes at the reductionist level*

Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

Module 8: Metabolism **(4 lectures)**

Purpose: *The fundamental principles of energy transactions are the same in physical and biological world.*

Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keqand its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge

Module 9: Microbiology **(3 lectures)**

Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.

References:

1. Biology: A global approach: Campbell, N. A. ; Reece, J. B.; Urr y, Lisa; Cain, M, L.; Wasser man, S. A. ; Minorsk y, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

Course Outcomes:

After studying the course, the student will be able to:

Describe how biological observations of 18th Century that lead to major discoveries. Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine Classify enzymes and distinguish between different mechanisms of enzyme action. Identify DNA as a genetic material in the molecular basis of information transfer. Analyse biological processes at the reductionistic level Apply thermodynamic principles to biological systems. Identify and classify microorganisms.

ESC 201	Basic Electronic Engineering	3L:1T:0P	4 credits

Objectives:

To provide an overview of electronic device components to Mechanical engineering students

Contents:

Module 1: **(10 lectures)**

Semiconductor Devices and Applications: Introduction to P-N Junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.

Module 2: **(8 lectures)**

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

Module 3: **(6 lectures)**

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

Module 4: **(10 lectures)**

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

Module 5: **(8 lectures)**

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

Text /Reference Books:

1. Floyd ," Electronic Devices" Pearson Education 9th edition, 2012.
2. R.P. Jain , "Modern Digital Electronics", Tata Mc Graw Hill, 3rd Edition, 2007.
3. Frenzel, "Communication Electronics: Principles and Applications", Tata Mc Graw Hill, 3rd Edition, 2001

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Understand the principles of semiconductor devices and their applications.

2. Design an application using Operational amplifier.

3. Understand the working of timing circuits and oscillators.

4. Understand logic gates, flip flop as a building block of digital systems.

5. Learn the basics of Electronic communication system.

ESC 202	Engineering Mechanics	3L:0T:2P	4 credits

Objectives:

The primary purpose of the study of engineering mechanics is to develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering.

Contents:

Module 1: **(7 lectures)**

Statics: Force System, Moment of a force about a point and an axis; Equivalent force and moment

Module 2: **(6 lectures)**

Equilibrium: Free body diagram; equations of equilibrium; problems in two and three dimension; plane frames and trusses.

Module 3: **(8 lectures)**

Friction: Laws of Coulomb friction, impending motion problems involving large and small contact surfaces; square threaded screw; principle of virtual work and stability.

Module 4: **(6 lectures)**

Dynamics: Kinematics and kinetics of particles dynamics in rectangular coordinates cylindrical coordinates and in terms of path variables.

Module 5: (8 lectures)

Properties of areas: Center of mass; Moments of inertia; kinematics of rigid bodies;Chasle's Theorem, concept of fixed vector, velocity and acceleration of particles in different frames of references. General plane motion.

Module 6: (7 lectures)

Work & Energy and impulse and Momentum methods for particles and rigid bodies: Conservation of momentum, coefficient of restitution, moment of momentum equation.

Text /Reference Books:

1. Engineering Mechanics by Shames, Pearson's Education.

2. Mechanics for Engineers. Beer, F.P. and Johnston. Tata McGraw Hill. New Delhi

3. Engineering mechanics. Meriam Wiley pub.

4. Engineering Mechanics. Timoshenko. McGraw Hill lnc.

Practical:

1. Practical based on mechanical advantage of different machines.
2. Verification of triangle law & parallelogram law of forces
3. Verification of polygon law of forces
4. Determination of moment of inertia of a flywheel
5. Crank Lever apparatus
6. Verification of support reactions of a simply supported beam
7. Verification of condition of equilibrium of a system of forces
8. Verification of axial forces in the members of a truss
9. Verification of equilibrium of three dimensional forces.
10. Determination of coefficient of friction between two surfaces
11. Verification of centroid of different laminae
12. Verification of Newton's laws of motion

*** At least 6 experiments should be performed from above list.**

Course outcomes:

Students will be able to articulate and describe:

1. Relative motion. Inertial and non-inertial reference frames.
2. Parameters defining the motion of mechanical systems and their degrees of freedom.
3. Study of the interaction of forces between solids in mechanical systems.

4. Centre of mass and inertia tensor of mechanical systems.
5. Application of the vector theorems of mechanics and interpretation of their results.
6. Newton's laws of motion and conservation principles.

PCC-ME 201	Thermodynamics	3L:1T:0P	4 credits

Objectives:

1. To learn about work and heat interactions, and balance of energy between system and its
2. Surroundings
3. To learn about application of 1st law to various energy conversion devices
4. To evaluate the changes in properties of substances in various processes
5. To understand the difference between high grade and low grade energies and 2nd law limitations on energy conversion

Contents:

Module 1: **(5 lectures)**

Fundamentals - System & Control volume; Property, State & Process; Exact & Inexact differentials; Work-Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work.

Module 2: **(5 lectures)**

Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy E; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy.

Module 3: **(8 lectures)**

Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam tables; Saturation tables; Superheated tables; Identification of states & determination of properties, Mollier's chart.

Module 4: **(5 lectures)**

First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady I law applications for system and control volume.

Module 5: **(5 lectures)**

Second law - Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale.

Module 6: **(8 lectures)**

Clausius inequality; Definition of entropy S ; Demonstration that entropy S is a property; Evaluation of Entropy for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of entropy from steam tables-Principle of increase of entropy; Illustration of processes in T-s coordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles- Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume. Exergy balance equation and Exergy analysis.

Module 7: **(4 lectures)**

Properties of dry and wet air, use of psychometric chart, processes involving heating/cooling and humidification/dehumidification, dew point.

Text Books:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.
2. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India
3. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.
4. Yunus A. Cengel; Michael A. Boles, Thermodynamics: An Engineering Approach, McGraw-Hill.
5. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.

Course Outcomes:

1. After completing this course, the students will be able to apply energy balance to systems and control volumes, in situations involving heat and work interactions
2. Students can evaluate changes in thermodynamic properties of substances
3. The students will be able to evaluate the performance of energy conversion devices
4. The students will be able to differentiate between high grade and low grade energies.

PCC-ME202	Machine Drawing	0L:0T:4P	2 Credits

Objective:

The student will acquire a knowledge of fastening arrangements such as welding, riveting the different styles of attachment for shaft. The student also is enabled to prepare the assembly of various machine or engine components and miscellaneous machine components.

Module 1: **(2 Lectures)**

Introduction to full section, half section, revolved-section off-set section.

Module 2: **(3 Lectures)**

Nut Bolts, Riveted joints, Thread profiles, Screw jack.

Module3: **(3 Lectures)**

Bushed bearing, pedestal, bearing, foot step bearing.

Module 4: **(2 Lectures)**

Flanged coupling, flexible coupling, solid coupling.

Module5: **(2 Lectures)**

Engine parts - Stuffing box, Connecting rod, Atomizer, spark plug, etc.

Module 6: **(2 Lectures)**

Eccentric.

Module 7: **(2 Lectures)**

Cross Head.

Module 8: **(2 Lectures)**

Assembly of dissembled parts. disassembly of assembly parts.

Text Books:

1. Dhawan, R.K., A Text Book of Machine Drawing, S. Chand & Company, 1996.
2. Ostrowsky, O., Engineering Drawing with CAD Applications, ELBS, 1995.
3. Engineering Drawing Practice for Schools and Colleges SP: 46- 19
4. Engineering Drawing by ND Bhatt

Course Outcomes:

On successful completion of the course, the student will be able to,

1. Identify the national and international standards pertaining to machine drawing.
2. Apply limits and tolerances to assemblies and choose appropriate fits.
3. Recognize machining and surface finish symbols.
4. Explain the functional and manufacturing datum.

14. Cavill S., Sohail M. (2003) Accountability in the provision of urban services. Proc. ICE. Municipal Engineer 156. Issue ME4 paper 13445, p235-244.
15. Centre for Water Sensitive Cities (2012) Blueprint for a water sensitive city. Monash University.
16. Charles J A. (2009) Robert Rawlinson and the UK public health revolution. Proc ICE Eng History and Heritage. 162 Nov. Issue EH4. p 199-206

Mechanical Engineering

IV Semester

Branch Code - 102

PCC-ME 203	Fluid Mechanics	3L:0T:3P	4.5 Credits

Objectives:

1. To learn about the application of mass and momentum conservation laws for fluid flows
2. To understand the importance of dimensional analysis
3. To obtain the velocity and pressure variations in various types of simple flows
4. To analyze the flow in water pumps and turbines.

Contents:

Module: 1 **(8 lectures)**

Definition of fluid, Units and dimensions, Newton's law of viscosity, Properties of fluids, mass, density, specific volume, specific gravity, viscosity, surface tension and capillarity, vapor pressure, compressibility and bulk modulus.**Hydrostatics**; fluid force on plane and curved surfaces, manometers, buoyancy, uniformly accelerated motion.

Module: 2 **(4 lectures)**

Kinematics of fluid flow: Generalized continuity equation, Irrotational motion and solution to Laplace equation. Concept of stream lines, Equipotential Lines, Flow Nets.

Module: 3 **(6 lectures)**

Dynamics of fluid flow: Control volume and control surface, application of continuity equation and momentum equation, Bernoulli's equation and its applications.

Module: 4 **(4 lectures)**

Concept of boundary layer, boundary layer thickness, Displacement thickness, momentum thickness, energy thickness.

Module: 5 **(8 lectures)**

Laminar viscous flow through circular conduits, Couette and Poisuielle flow, Turbulent flow through pipes, Darcy Weisbach equation, friction factor for smooth and rough pipes, Moody's diagram**.**

Module: 6 **(6 lectures)**

Need for dimensional analysis, methods of dimension analysis, Similitude and types of similitude, Dimensionless parameters, application of dimensionless parameters Model analysis.

Module: 7 **(6 lectures)**

Forces on immersed bodies, concepts of separation, drag force, circulation and lift force.

Text Books:

1. Frank M. White, Fluid Mechanics (Sixth Edition), Tata McGraw-Hill, New Delhi (2008).
2. J. O. Wilkes, Fluid Mechanics for Chemical Engineers, Prentice Hall (1999).
3. Som and Biswas; Fluid Mechanics and machinery; TMH

4. Cengal; Fluid Mechanics; TMH
5. Modi & Seth; Fluid Mechanics; Standard Book House, Delhi

Practical:

1. Determination of density & viscosity of oil.
2. To determine the meta-centric height of a floating body.
3. Measurement of Coefficient of Discharge of given Orifice and Venturimeter
4. To determine the coefficient of discharge of Notch (Vand Rectangular types)
5. To determine the friction factor for the pipes.
6. To verify the Bernoulli's Theorem.
7. To find critical Reynolds number for a pipe flow.
8. To determine the minor losses due to sudden enlargement, sudden contraction and bends.
9. To show the velocity and pressure variation with radius in a free and forced vortex

Atleast 8 experiments should be performed from above list

Course Outcomes:

1. State the Newton's law of viscosity and explain the mechanics of fluids at rest and in motion by observing the fluid phenomena.
2. Compute force of buoyancy on a partially or fully submerged body and analyze the stability of a floating body.
3. Derive Euler's Equation of motion and deduce Bernoulli's equation.
4. Examine energy losses in pipe transitions and sketch energy gradient lines.
5. Evaluate pressure drop in pipe flow using Hagen-Poiseuille's equation.
6. Distinguish the types of flows.

PCC-ME 204	Applied Thermodynamics	3L:1T:0P	4 credits

Objectives:

1. To learn about of I law for reacting systems and heating value of fuels
2. To learn about gas and vapor cycles and their first law and second law efficiencies
3. To understand about the properties of dry and wet air and the principles of psychometric
4. To learn about gas dynamics of air flow and steam through nozzles
5. To learn the about reciprocating compressors with and without intercooling
6. To analyze the performance of steam turbines

Contents:

Module 1: **(8 lectures)**

Introduction to solid, liquid and gaseous fuels–Stoichiometry, exhaust gas analysis- First law analysisof combustion reactions. Heat calculations using enthalpy tables. Adiabatic flame temperature. Chemical equilibrium and equilibrium composition calculations using free energy.

Module 2: **(10 lectures)**

Thermodynamic cycles, Gas power cycles: Air standard Otto, Diesel and Dual Cycles. Air standard Brayton cycle, effect of reheat, regeneration and intercooling. Combined gas and vapor power cycles. Vapor compression refrigeration cycles cycle and comparison with Carnot cycle, refrigerants and their properties.

Module 3: **(6 lectures)**

Vapor power cycles: Basic Rankine cycle, Rankine cycle with superheat, reheat and regeneration, exergy analysis. Super- critical and ultra-super-critical Rankine cycle.

Module 4: **(8 lectures)**

Basics of compressible flow. Stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows- normal shocks- use of ideal gas tables for isentropic flow and normal shock flow- Flow of steam and refrigerant through nozzle, super saturation-compressible flow in diffusers, efficiency of nozzle and diffuser.

Module 5: **(5 lectures)**

Analysis of steam turbines, velocity and pressure compounding of steam turbines.

Module 6: **(5 lectures)**

Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors.

Text Books:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley andSons.
2. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India
3. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley andSons.
4. Nag, P. K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd

Outcomes:

1. After completing this course, the students will get a good understanding of various practical power cycles and heat pump cycles.
2. They will be able to analyze energy conversion in various thermal devices such as combustors, air coolers, nozzles, diffusers, steam turbines and reciprocating compressors.

3. They will be able to understand phenomena occurring in high speed compressible flows.

PCC-ME 205	Strength of Materials	3L:0T:3P	4.5 credits

Objectives:

1. To understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres for various types of simple loads.
2. To calculate the elastic deformation occurring in various simple geometries for different types of loading.

Contents:

Module :1 **(8 lectures)**

Deformation in solids- Hooke's law, stress and strain- tension, compression and shear stresses- elastic constants and their relations- volumetric, linear and shear strains- principal stresses and principal planes- Mohr's circle, theories of failure,

Module :2 **(8 lectures)**

Beams and types transverse loading on beams- shear force and bend moment diagrams- Types of beam supports, simply supported and over-hanging beams, cantilevers. Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, point and distributed loads.

Module :3 **(8 lectures)**

Moment of inertia about an axis and polar moment of inertia, deflection of a beam using double integration method, computation of slopes and deflection in beams, Maxwell's reciprocal theorems.

Module :4 **(8 lectures)**

Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection of helical springs.

Module :5 **(8 lectures)**

Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shells subjected to internal pressure.

Text Books:

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi,2001.
2. R. Subramanian, Strength of Materials, Oxford University Press,2007.
3. Ferdinand P. Been, Russel Johnson Jr. and John J. Dewole, Mechanics of Materials, Tata GrawHill Publishing Co. Ltd., New Delhi2005.

Practical:

1. Hooke's Law
2. Hardness Test: Rockwell, Brinell, Vicker
3. Izod & Charpy Impact Test
4. Bending Test
5. Torsion Test
6. Shear test
7. Compressive strength test
8. Fatigue Test

9. Verification of Maxwell's reciprocal theorem
10. Continuous beam deflection test
11. Strain Measurement

Atleast 8 experiments should be performed from above list

Course Outcomes:

1. After completing this course, the students should be able to recognize various types loads applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components
2. The students will be able to evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading

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PCC-ME 206	Engineering Materials	3L:1T:0P	4 Credits

Objectives:

1. Understanding of the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria.
2. To provide a detailed interpretation of equilibrium phase diagrams and Learning about different phases and heat treatment methods to tailor the properties of Fe-C alloys.

Contents

Module:1 (6 lectures)

Crystal Structure: Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

Module:2 (8 lectures)

Alloys, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstrctural aspects of ledeburite, austenite, ferrite and cementite, cast iron.

Module: 3 (10 lectures)

Mechanical Property measurement: Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; Hardness: Rockwell, Brinell and Vickers and their relation to strength, Introduction to non-destructive testing (NDT).

Module: 4 (10 lectures)

Heat treatment of Steel: Annealing, tempering, normalising and spheroidising, isothermal transformation diagrams for Fe-C alloys and microstructure development. Continuous cooling curves, T-T-T diagram and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening.

Module: 5 (8 lectures)

Alloying of steel, properties of stainless steel and tool steels, maraging steels- cast irons; grey, white, malleable and spheroidal cast irons- copper and copper alloys; brass, bronze and cupro-nickel; Aluminium and Al-Cu – Mg alloys- Nickel based superalloys and Titanium alloys.

Text Books:

1. W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India.
2. Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.
3. V. Raghavan, "Material Science and Engineering', Prentice Hall of India Private Limited, 1999.
4. U. C. Jindal, "Engineering Materials and Metallurgy", Pearson, 2011.

Course Outcomes:

1. Student will be able to identify crystal structures for various materials and understand the defects in such structures
2. Understand how to tailor material properties of ferrous and non-ferrous alloys
3. How to quantify mechanical integrity and failure in materials

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PCC-ME 207	**Instrumentation and Control**	**3L:1T:0P**	**4 credits**

Objectives:

1. To provide a basic knowledge about measurement systems and their components
2. To learn about various sensors used for measurement of mechanical quantities
3. To learn about system stability and control
4. To integrate the measurement systems with the process for process monitoring and control

Module: 1 **(10 lectures)**

Measurement systems and performance -configuration of a measuring system, Methods for correction for interfering and modifying inputs– accuracy, range, resolution, error sources, precision, error sensitivity etc.Classification of errors and statistical analysis of experimental data.

Module: 2 **(8 lectures)**

Instrumentation system elements -sensors for common engineering measurements. Transducers based on variable resistance, variable induction, variable capacitance and piezo-electric effects, Displacement transducer.

Module: 3 **(6 lectures)**

Signal processing and conditioning; correction elements- actuators: pneumatic, hydraulic, electric.

Module :4 **(10 lectures)**

Control systems – basic elements, open/closed loop, design of block diagram; control method – P, PI, PID, when to choose what, tuning of controllers.

Module :5 **(6 lectures)**

System models, transfer function and system response, frequency response; Nyquist diagrams and their use.

Practical group based project utilizing above concepts.

Text Books:

1. Instrumentation and control systems by W. Bolton, 2nd edition, Newnes, 2000
2. Thomas G. Beckwith, Roy D. Marangoni, John H. Lienhard V, Mechanical Measurements (6^{th} Edition) 6th Edition, Pearson Education India, 2007
3. Gregory K. McMillan, Process/Industrial Instruments and Controls Handbook, Fifth Edition, McGraw-Hill: New York, 1999.

Course Outcomes:

Upon completion of this course, the students will be able to understand the measurement of various quantities using instruments, their accuracy & range, and the techniques for controlling devices automatically.

Electrical Engineering
IV Semester
Branch code - 103

PCC-EE08	**Digital Electronics**	**3L:0T:0P**	**3 credits**

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand working of logic families and logic gates.
- Design and implement Combinational and Sequential logic circuits.
- Understand the process of Analog to Digital conversion and Digital to Analog conversion.
- Be able to use PLDs to implement the given logical problem.

Module 1:Fundamentals of Digital Systems and logic families (7Hours)

Digitalsignals,digitalcircuits,AND,OR,NOT,NAND,NORandExclusive-ORoperations,Boolean algebra,examplesofICgates,numbersystems-binary,signedbinary,octalhexadecimalnumber,binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

Module 2: Combinational Digital Circuits (7Hours)

Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Sub tractors, BCD arithmetic, carry look ahead adder, serialadder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method off unction realization.

Module 3: Sequential circuits and systems (7Hours)

A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T andD-typesflipflops,applicationsofflipflops,shiftregisters,applicationsofshiftregisters,serialtoparallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

Semester V (Third year]
Branch/Course Civil Engineering

V SEMESTER						
Branch/Course Civil Engineering - 101						
sr. no.	CODE	Course Title	L	T	P	Credit
1		Mechanics of Materials	3	0	0	3
2		Hydraulic Engineering	2	0	2	3
3		Analysis and Design of Concrete Structure	2	1	0	3
4		Geotechnical Engineering -I	3	0	2	4
5		Hydrology & Water Resources Engineering	2	0	2	3
6		Environmental Engineering -I	3	0	2	4
7		Transportation Engineering	3	0	2	4
8		Constitution of India/ Essence of Indian Traditional Knowledge	2	-	-	0
9		Innovation/IPR/Entrepreneurship/Internship at end of 2nd semester for 6 week				6
			TOTAL CREDIT			30

Semester V (Third year]
Branch/Course Mechanical Engineering

Semester V						
Branch/Course: Mechanical Engineering (102)						
sr. no.	CODE	Course Title	L	T	P	Credit
1		Heat Transfer	3	0	3	4.5
2		Fluid Machinery	3	0	3	4.5
3		Manufacturing Processes	3	0	3	4.5
4		Kinematics of Machine	3	1	0	4
5		Essence of Indian Knowledge Tradition	2	0	0	0
6		Open Elective- I	12 WEEK			3
7		Innovation/Entrepreneurship (Summer Vacation after 4th sem.)	6 WEEK			6
8		Competitive Courses (GATE, IES, etc.)	8			0
			TOTAL			26.5

v) To live some big environmentalist for a week or so to understand his work
vi) To work in kitchen garden for mess
vii) To know about the different varieties of plants
viii) Shutting down the fans and ACs of the campus for an hour or so

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Mechanical Engineering
V Semester

PCC-ME 301	Heat Transfer	3L:0T:3P	4.5 Credits

Objectives:

1. The aim of the course is to build a solid foundation in heat transfer exposing students to the three basic modes namely conduction, convection and radiation.
2. Rigorous treatment of governing equations and solution procedures for the three modes will be provided, along with solution of practical problems using empirical correlations.
3. The course will also briefly cover boiling and condensation heat transfer, and the analysis and design of heat exchangers.

Contents:

Module: 1 **(12 lectures)**

Introduction to three modes of heat transfer, Derivation of heat balance equation- Steady one dimensional solution for conduction heat transfer in Cartesian, cylindrical and spherical geometry, concept of conduction and film resistances, critical insulation thickness, lumped system approximation and Biot number, heat transfer through pin fins- Two dimensional conduction solutions for both steady and unsteady heat transfer-approximate solution to unsteady conduction heat transfer by the use of Heissler charts.

Module:2 **(8 lectures)**

Heat convection, basic equations, boundary layers- Forced convection, external and internal flows- Natural convective heat transfer- Dimensionless parameters for forced and free convection heat transfer-Correlations for forced and free convection- Approximate solutions to laminar boundary layer equations (momentum and energy) for both internal and external flow-Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection.

Module: 3 **(8 lectures)**

Interaction of radiation with materials, definitions of radiative properties, Stefan Boltzmann's law, black and gray body radiation, Calculation of radiation heat transfer between surfaces using radiative properties, view factors and the radiosity method.

Module: 4 **(6 lectures)**

Types of heat exchangers, Analysis and design of heat exchangers using bothLMTD and ε-NTU methods.

Module: 5 **(3 lectures)**

Boiling and Condensation heat transfer, Pool boiling curve.

Module: 6 **(3 lectures)**

Introduction mass transfer, Similarity between heat and mass transfer

Text Books:

1. Bejan, Heat Transfer John Wiley, 1993
2. J.P.Holman, Heat Transfer, Eighth Edition, McGraw Hill, 1997.
3. F.P.Incropera, and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley, Sixth Edition, 2007.
4. MassoudKaviany, Principles of Heat Transfer, John Wiley, 2002
5. Yunus A Cengel, Heat Transfer: A Practical Approach, McGraw Hill, 2002

Practical:

1. Determination of Thermal Conductivity of a Metal Rod.
2. Determination of Overall Heat Transfer Coefficient of a Composite wall.
3. To find the effectiveness of a pin fin in a rectangular duct natural convective condition and plot temperature distribution along its length.
4. To find the effectiveness of a pin fin in a rectangular duct under forced convective and plot temperature distribution along its length
5. Determination of Heat Transfer Coefficient in a free Convection on a vertical tube.
6. Determination of Heat Transfer Coefficient in a Forced Convention Flow through a Pipe.
7. Determination of Emissivity of a Surface.
8. Determination of Stefan Boltzmann's Constant.
9. Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers.

Course Outcomes:

1. After completing the course, the students will be able to formulate and analyze a heat

transfer problem involving any of the three modes of heat transfer

2. The students will be able to obtain exact solutions for the temperature variation using analytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer
3. The students will be able to design devices such as heat exchangers and also estimate the insulation needed to reduce heat losses where necessary.

PCC-ME 302	Fluid Machinery	3L:0T:3P	4.5 Credits

Objectives:

The objective is to present the mathematical and physical principles in understanding the linear continuum behavior of solids.

Contents:

Module: 1

Introduction – Classification of fluid machinery. **(Lectures: 2)**

Module: 2

Dynamic action of fluid jet – Impact of fluid jet on fixed and moving flat places, impact of jet on fixed and moving curved vanes, flow over radial vanes, jet propulsions. **(Lectures: 4)**

Module: 3

Euler's fundamental equation, degree of reaction. **(Lectures:2)**

Module: 4

Hydraulic turbines, introduction, classification, impulse turbine, construction details, velocity triangles, power and efficiency calculations, reaction turbines; constructional details, working principle, velocity triangles, power and efficiency calculations, draft tube, cavitation, governing.

(Lectures: 10)

Module: 5

Principle of similarity in fluid machinery; unit and specific quantities, testing models and selection of hydraulic turbines. **(Lectures: 3)**

Module: 6

Positive displacement pumps: Reciprocating pump; working principle, classification, slip, indicator diagram, effect of friction and acceleration, theory of air vessel, performance

characteristics gas gear oil pump and screw pump.

(Lectures: 4)

Module: 7

Rotodynamic pumps: Introduction, classification, centrifugal pump; main components, working principle velocity triangle, effect of shape of blade specific speed, heats, power and efficiency, calculations minimum steering speed, multi stage pumps, performance characteristic, comparison with reciprocating pump.

(Lectures: 7)

Course Outcomes:

Upon completion of this course, students will be able understand the deformation behavior of solids under different types of loading and obtain mathematical solutions for simple geometries.

Text Books:

1. G. T. Mase, R. E. Smelser and G. E. Mase, Continuum Mechanics for Engineers, Third Edition, CRC Press,2004.
2. Y. C. Fung, Foundations of Solid Mechanics, Prentice Hall International, 1965.
3. Lawrence. E. Malvern, Introduction to Mechanics of a Continuous Medium, Prentice Hall international, 1969.
4. Hydrantic Machine by Jagdish Lal
5. Hydraulics & Hydraulic Machines by Vasandari
6. Hydrantic Machine by RD Purohit

Practical:

1. Performance on hydraulic turbines:
    a. Pelton wheel
    b. Francis turbine
    c. Kaplan turbine.
2. Performance on hydraulic pumps:
    a. Single stage and multi stage centrifugal pumps
    b. Reciprocating pump.
3. Performance test of a two stage reciprocating air compressor
4. Performance test on an air blower

OPTIONAL

1. Visit to hydraulic power station/Municipal water pump house and case studies.
2. Demonstration of cut section models of hydraulic turbines and pumps.

PCC-ME 303	Manufacturing Processes	3L:0T:3P	4.5 Credits

Objectives:

To motivate and challenge students to understand and develop an appreciation of the processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional or unconventional manufacturing methods

Contents:

Module: 1

Conventional Manufacturing processes: Casting and Moulding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses. **(Lectures6)**

Module: 2

Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming(forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy. **(Lectures6)**

Module: 3

Metal cutting: Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, Cutting tool materials, Cutting fluids, Coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining.

(Lectures8)

Module: 4

Joining/fastening processes: Physics of welding, brazing and soldering; design considerations in welding, Solid and liquid state joining processes; Adhesive bonding.

Additive manufacturing: Rapid prototyping and rapid tooling **(Lectures5)**

Module:5

Machine Tools:

(a) Lathe: Principle, types, operations, turret/capstan, semi/automatic, Tool layout.

(b) Shaper, slotted, planer, operation, drive.

(c) Milling, Milling cutter, up & down milling, dividing head indexing, Max chip thickness, power required.

(d) Drilling and boring, reaming tools, Geometry of twist drill, Grinding, Grinding wheel, Abrasive, cutting action, grinding wheel specification, Grinding wheel wear, alterations, wear, fracture wear, dressing and trimming. Max chip thickness and guest criteria, Flat and cylindrical grinding, Centerless grinding, Super finishing, Honing lapping, Polishing

(Lectures15)

Course Outcomes:

Upon completion of this course, students will be able to understand the different conventional and unconventional manufacturing methods employed for making different products

Text Books:

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)- Pearson India, 2014
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems
3. Degarmo, Black &Kohser, Materials and Processes in Manufacturing

Practical:

Minimum of 10 Experiment need to be performed

I. Metal Casting Lab:

1. Pattern Design and making – for one casting drawing.
2. Sand properties testing (strengths and permeability)
3. Moulding, Melting and Casting

II. Welding Lab:

1. ARC Welding Lap & Butt Joint
2. Spot Welding
3. Gas Welding

III. Mechanical Press Working:

1. Blanking & Piercing operation and study of simple, compound and progressivepress tool.
2. Bending and other operations

IV. Machining Lab:

1. Cutting operation (Orthogonal & Oblique) on lathe machine
2. Bolt making on lathe machine
3. Facing, plain turning and step turning knurling
4. Boring and internal thread cutting.
5. Finishing of a surface on surface –grinding machine
6. Gear cutting on milling machine (Spur Gear).
7. Machining a block on shaper machine.
8. Drilling holes on drilling machine

PCC-ME 304	Kinematics of Machine	3L:1T:0P	4 credits

Objectives:

1. To understand the kinematics and rigid- body dynamics of kinematically driven machine components
2. To understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link
3. To be able to design some linkage mechanisms and cam systems to generate specified output motion
4. To understand the kinematics of gear trains

Contents:

Module 1

Introduction: Classification of mechanisms: -Basic kinematic concepts and Definitions-Degree of freedom, mobility-Grashof's law, Kinematic inversions of four bar chain and slider crank chains. **(Lectures 5)**

Module 2

Kinematic analysis of plane mechanism: Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, kinematic analysis of simple mechanisms- slider crank mechanism dynamics- Coriolis component of acceleration.

(Lectures 6)

Module 3

Friction devices: Belt drive, Clutch, Shoe brakes, Band and block brakes. **(Lectures 6)**

Module 4

Gear: gear terminology, Involute and Cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting.

Gear Train: Analysis of simple, compound, reverted and epicyclic gear train with problems.

(Lectures 10)

Module 5

Balancing of rotating masses: Balancing of rotating masses in the same plane by a single revolving mass. Balancing of several rotating masses in the same plane. Balancing of several rotating masses in different planes by two revolving masses in suitable planes.

(**Lectures8**)

Module 6

Governors: Watt, Porter, Proel & Hartnell Governors, Effect of friction, controlling force, governor effort and power, sensitivity and isochronisms.

(Lectures 6)

Course Outcomes:

- After completing this course, the students can design various types of linkage mechanisms for obtaining specific motion and analyse them for optimal functioning

Text Books:

[1.] Thomas Bevan, Theory of Machines, 3rd edition, CBS Publishers & Distributors, 2005.
[2.] CleghornW.L. , Mechanisms of Machines, Oxford University Press, 2005.
[3.] Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGrawHill, 2009.
[4.] Ghosh A. and Mallick A.K., Theory of Mechanisms and Machines, Affiliated East-West Pvt. Ltd, New Delhi, 1988.
