PAPER CODE - 101101

BSC	PHYSICS (MECHANICS & MECHANICS OF SOLIDS)	L:3	T:1	P:3	CREDIT:5.5

MECHANICS

PRE-REQUISITES: HIGH-SCHOOL EDUCATION

MODULE 1: VECTOR MECHANICS OF PARTICLES (20 LECTURES)

TRANSFORMATION OF SCALARS AND VECTORS UNDER ROTATION TRANSFORMATION; FORCES IN NATURE; NEWTON'S LAWS AND ITS COMPLETENESS IN DESCRIBING PARTICLE MOTION; FORM INVARIANCE OF NEWTON'S SECOND LAW; SOLVING NEWTON'S EQUATIONS OF MOTION IN POLAR COORDINATES; PROBLEMS INCLUDING CONSTRAINTS AND FRICTION; EXTENSION TO CYLINDRICAL AND SPHERICAL COORDINATES; POTENTIAL ENERGY FUNCTION; F = - GRAD V, EQUIPOTENTIAL SURFACES AND MEANING OF GRADIENT; CONSERVATIVE AND NON-CONSERVATIVE FORCES, CURL OF A FORCE FIELD; CENTRAL FORCES; CONSERVATION OF ANGULAR MOMENTUM; ENERGY EQUATION AND ENERGY DIAGRAMS; ELLIPTICAL, PARABOLIC AND HYPERBOLIC ORBITS; KEPLER PROBLEM; APPLICATION: SATELLITE MANOEUVRES; NON-INERTIAL FRAMES OF REFERENCE; ROTATING COORDINATE SYSTEM: FIVE-TERM ACCELERATION FORMULA. CENTRIPETAL AND CORIOLIS ACCELERATIONS; APPLICATIONS: WEATHER SYSTEMS, FOUCAULT PENDULUM; HARMONIC OSCILLATOR; DAMPED HARMONIC MOTION – OVER-DAMPED, CRITICALLY DAMPED AND LIGHTLY-DAMPED OSCILLATORS; FORCED OSCILLATIONS AND RESONANCE.

MODULE 2: PLANAR RIGID BODY MECHANICS (10 LECTURES

DEFINITION AND MOTION OF A RIGID BODY IN THE PLANE; ROTATION IN THE PLANE; KINEMATICS IN A COORDINATE SYSTEM ROTATING AND TRANSLATING IN THE PLANE; ANGULAR MOMENTUM ABOUT A POINT OF A RIGID BODY IN PLANAR MOTION; EULER'S LAWS OF MOTION, THEIR INDEPENDENCE FROM NEWTON'S LAWS, AND THEIR NECESSITY IN DESCRIBING RIGID BODY MOTION; EXAMPLES. INTRODUCTION TO THREE-DIMENSIONAL RIGID BODY MOTION — ONLY NEED TO HIGHLIGHT THE DISTINCTION FROM TWO-DIMENSIONAL MOTION IN TERMS OF (A) ANGULAR VELOCITY VECTOR, AND ITS RATE OF CHANGE AND (B) MOMENT OF INERTIA TENSOR; THREE-DIMENSIONAL MOTION OF A RIGID BODY WHEREIN ALL POINTS MOVE IN A COPLANAR MANNER: E.G. ROD EXECUTING CONICAL MOTION WITHCENTER OF MASS FIXED — ONLY NEED TO SHOW THAT THIS MOTION LOOKS TWO-DIMENSIONAL BUT IS THREE-DIMENSIONAL, AND TWO-DIMENSIONAL FORMULATION FAILS.

SUGGESTED REFERENCE BOOKS

- *ENGINEERING MECHANICS, 2ND ED. — MK HARBOLA*
- *INTRODUCTION TO MECHANICS — MK VERMA*
- *AN INTRODUCTION TO MECHANICS — D KLEPPNER& R KOLENKOW*
- *PRINCIPLES OF MECHANICS — JL SYNGE & BA GRIFFITHS*
- *MECHANICS — JP DEN HARTOG*
- *ENGINEERING MECHANICS - DYNAMICS, 7TH ED. - JL MERIAM*

- 🕮 *MECHANICAL VIBRATIONS — JP DEN HARTOG*
- 🕮 *THEORY OF VIBRATIONS WITH APPLICATIONS — WT THOMSON*

MECHANICS OF SOLIDS

PREREQUISITES: (I) PHYSICS (MECHANICS) ALL MODULES AND (II) MATHEMATICS COURSE WITH ORDINARY DIERENTIAL EQUATIONS

MODULE 3: STATICS (10 LECTURES)

FREE BODY DIAGRAMS WITH EXAMPLES ON MODELLING OF TYPICAL SUPPORTS AND JOINTS; CONDITION FOR EQUILIBRIUM IN THREE- AND TWO- DIMENSIONS; FRICTION: LIMITING AND NON-LIMITING CASES; FORCEDISPLACEMENT RELATIONSHIP; GEOMETRIC COMPATIBILITY FOR SMALL DEFORMATIONS; ILLUSTRATIONS THROUGH SIMPLE PROBLEMS ON AXIALLY LOADED MEMBERS LIKE TRUSSES.

MODULE 4: MECHANICS OF SOLIDS (30 LECTURES)

CONCEPT OF STRESS AT A POINT; PLANET STRESS: TRANSFORMATION OF STRESSES AT A POINT, PRINCIPAL STRESSES AND MOHR'S CIRCLE; DISPLACEMENT FIELD; CONCEPT OF STRAIN AT A POINT; PLANE STRAIN: TRANSFORMATION OF STRAIN AT A POINT, PRINCIPAL STRAINS AND MOHR'S CIRCLE; STRAIN ROSEOE; DISCUSSION OF EXPERIMENTAL RESULTS ON ONE- DIMENSIONAL MATERIAL BEHAVIOUR; CONCEPTS OF ELASTICITY, PLASTICITY, STRAIN HARDENING, FAILURE (FRACTURE / YIELDING); IDEALIZATION OF ONEDIMENSIONAL STRESS-STRAIN CURVE; GENERALIZED HOOKE'S LAW WITH AND WITHOUT THERMAL STRAINS FOR ISOTROPIC MATERIALS; COMPLETE EQUATIONS OF ELASTICITY; FORCE ANALYSIS — AXIAL FORCE, SHEAR FORCE, BENDING MOMENT AND TWISTING MOMENT DIAGRAMS OF SLENDER MEMBERS (WITHOUT USING SINGULARITY FUNCTIONS); TORSION OF CIRCULAR SHAFTS AND THIN-WALLED TUBES (PLASTIC ANALYSIS AND RECTANGULAR SHAFTS NOT TO BE DISCUSSED); MOMENT CURVATURE RELATIONSHIP FOR PURE BENDING OF BEAMS WITH SYMMETRIC CROSS-SECTION; BENDING STRESS; SHEAR STRESS; CASES OF COMBINED STRESSES; CONCEPT OF STRAIN ENERGY; YIELD CRITERIA; DEFLECTION DUE TO BENDING; INTEGRATION OF THE MOMENT-CURVATURE RELATIONSHIP FOR SIMPLE BOUNDARY CONDITIONS; METHOD OF SUPERPOSITION (WITHOUT USING SINGULARITY FUNCTIONS); STRAIN ENERGY AND COMPLEMENTARY STRAIN ENERGY FOR SIMPLE STRUCTURAL ELEMENTS (I.E. THOSE UNDER AXIAL LOAD, SHEAR FORCE, BENDING MOMENT AND TORSION); CASTIGLIANO'S THEOREMS FOR DEFLECTION ANALYSIS AND INDETERMINATE PROBLEMS.

REFERENCE BOOKS:

- 🕮 *AN INTRODUCTION TO THE MECHANICS OF SOLIDS, 2ND ED. WITH SI UNITS — SH CRANDALL, NC DAHL & TJ LARDNER*
- 🕮 *ENGINEERING MECHANICS: STATICS, 7TH ED. — JL MERIAM*
- 🕮 *ENGINEERING MECHANICS OF SOLIDS — EP POPOV*

LABORATORY

- ❖ COUPLED OSCILLATORS; EXPERIMENTS ON AN AIR-TRACK
- ❖ EXPERIMENT ON MOMENT OF INERTIA MEASUREMENT
- ❖ EXPERIMENTS WITH GYROSCOPE; RESONANCE PHENOMENA IN MECHANICAL OSCILLATORS.

PAPER CODE - 101102

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

CALCULUS (SINGLE VARIBALE)

MODULE 1A: CALCULUS: (12 LECTURES)

INTERVALS, CONVERGENCE OF SEQUENCES AND SERIES OF REAL NUMBERS, LIMIT AND CONTINUITY OF FUNCTIONS, DIFFERENTIABILITY OF FUNCTIONS, ROLLE'S THEOREM, MEAN VALUE THEOREMS, TAYLOR'S AND MACLAURIN THEOREMS WITH REMAINDERS; INDETERMINATE FORMS AND L'HOSPITAL'S RULE; MAXIMA AND MINIMA, RIEMANN INTEGRATION, FUNDAMENTAL THEOREM OF CALCULUS.

MODULE 1B: CALCULUS: (8 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 1C: SERIES: (PREREQUISITE 2B) (8 LECTURES)

POWER SERIES, TAYLOR'S SERIES. SERIES FOR EXPONENTIAL, TRIGONOMETRIC AND LOGARITHMIC FUNCTIONS; FOURIER SERIES: HALF RANGE SINE AND COSINE SERIES, PARSEVAL'S THEOREM

TEXTBOOKS/REFERENCES:

- *G.B. THOMAS AND R.L. FINNEY, CALCULUS AND ANALYTIC GEOMETRY, 9TH EDITION, PEARSON, REPRINT, 2002.*
- *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.*
- *N.P. BALI AND MANISH GOYAL, A TEXT BOOK OF ENGINEERING MATHEMATICS, LAXMI PUBLICATIONS,REPRINT, 2010.*
- *B.S. GREWAL, HIGHER ENGINEERING MATHEMATICS, KHANNA PUBLISHERS, 35TH EDITION, 2000.*

MATRICES AND LINEAR ALGEBRA

MODULE 2A: MATRICES (IN CASE VECTOR SPACES IS NOT TO BE TAUGHT) (14 LECTURES)

ALGEBRA OF MATRICES, 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, ORTHOGONAL TRANSFORMATION AND QUADRATIC TO CANONICAL FORMS.

MODULE 2B: MATRICES (IN CASE VECTOR SPACES IS TO BE TAUGHT) (8 LECTURES)

MATRICES, VECTORS: ADDITION AND SCALAR MULTIPLICATION, MATRIX MULTIPLICATION; LINEAR SYSTEMS OF EQUATIONS, LINEAR INDEPENDENCE, RANK OF A MATRIX, DETERMINANTS, CRAMER'S RULE, INVERSE OF A MATRIX, GAUSS ELIMINATION AND GAUSS-JORDAN ELIMINATION.

MODULE 2C: VECTOR SPACES (PREREQUISITE 4B) (10 LECTURES)

VECTOR SPACE, LINEAR DEPENDENCE OF VECTORS, BASIS, DIMENSION; LINEAR TRANSFORMATIONS (MAPS), RANGE AND KERNEL OF A LINEAR MAP, RANK AND NULLITY, INVERSE OF A LINEAR TRANSFORMATION, RANK- NULLITY THEOREM, COMPOSITION OF LINEAR MAPS, MATRIX ASSOCIATED WITH A LINEAR MAP.

MODULE 2D: VECTOR SPACES (PREREQUISITE 4B-C) (10 LECTURES)

EIGENVALUES, EIGENVECTORS, SYMMETRIC, SKEW-SYMMETRIC AND ORTHOGONAL MATRICES, EIGENBASES. DIAGONALIZATION; INNER PRODUCT SPACES, GRAM-SCHMIDT ORTHOGONALIZATION.

TEXTBOOKS/REFERENCES:

- *D. POOLE, LINEAR ALGEBRA: A MODERN INTRODUCTION, 2ND EDITION, BROOKS/COLE, 2005.*
- *V. KRISHNAMURTHY, V.P. MAINRA AND J.L. ARORA, AN INTRODUCTION TO LINEAR ALGEBRA, AFFILIATED EAST–WEST PRESS, REPRINT 2005.*
- *ERWIN KREYSZIG, ADVANCED ENGINEERING MATHEMATICS, 9TH EDITION, JOHN WILEY & SONS, 2006.*
- *VEERARAJAN T., ENGINEERING MATHEMATICS FOR FIRST YEAR, TATA MCGRAW-HILL, NEW DELHI, 2008.*
- *N.P. BALI AND MANISH GOYAL, A TEXT BOOK OF ENGINEERING MATHEMATICS, LAXMI PUBLICATIONS, REPRINT, 2010.*
- *B.S. GREWAL, HIGHER ENGINEERING MATHEMATICS, KHANNA PUBLISHERS, 35TH EDITION, 2000*

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