

**PAPER CODE - 105101 || 105201**

<b>BSC</b>	<b>PHYSICS (SEMICONDUCTOR PHYSICS)</b>	<b>L:3</b>	<b>T:1</b>	<b>P:3</b>	<b>CREDIT:5.5</b>
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**SEMICONDUCTOR OPTOELECTRONICS****PREREQUISITE: SEMICONDUCTOR PHYSICS****MODULE 1: REVIEW OF SEMICONDUCTOR PHYSICS (10 LECTURES)**

E-K DIAGRAM, DENSITY OF STATES, OCCUPATION PROBABILITY, FERMI LEVEL AND QUASI-FERMI LEVEL (VARIATION BY CARRIER CONCENTRATION AND TEMPERATURE); P-N JUNCTION, METAL-SEMICONDUCTOR JUNCTION (OHMIC AND SCHOTTKY); CARRIER TRANSPORT, GENERATION, AND RECOMBINATION; SEMICONDUCTOR MATERIALS OF INTEREST FOR OPTOELECTRONIC DEVICES, BANDGAP MODIFICATION, HETEROSTRUCTURES; LIGHT- SEMICONDUCTOR INTERACTION: RATES OF OPTICAL TRANSITIONS, JOINT DENSITY OF STATES, CONDITION FOR OPTICAL AMPLIFICATION.

**MODULE 2: SEMICONDUCTOR LIGHT EMITTING DIODES (LEDs) (6 LECTURES)**

RATE EQUATIONS FOR CARRIER DENSITY, RADIATIVE AND NON-RADIATIVE RECOMBINATION MECHANISMS IN SEMICONDUCTORS, LED: DEVICE STRUCTURE, MATERIALS, CHARACTERISTICS, AND FIGURES OF MERIT.

**MODULE 3: SEMICONDUCTOR LASERS (8 LECTURES)**

REVIEW OF LASER PHYSICS; RATE EQUATIONS FOR CARRIER- AND PHOTON-DENSITY, AND THEIR STEADY STATE SOLUTIONS, LASER DYNAMICS, RELAXATION OSCILLATIONS, INPUT-OUTPUT CHARACTERISTICS OF LASERS. SEMICONDUCTOR LASER: STRUCTURE, MATERIALS, DEVICE CHARACTERISTICS, AND FIGURES OF MERIT; DFB, DBR, AND VERTICAL-CAVITY SURFACE-EMITTING LASERS (VECSEL), TUNABLE SEMICONDUCTOR LASERS.

**MODULE 4: PHOTODETECTORS (6 LECTURES)**

TYPES OF SEMICONDUCTOR PHOTODETECTORS -P-N JUNCTION, PIN, AND AVALANCHE AND THEIR STRUCTURE, MATERIALS, WORKING PRINCIPLE, AND CHARACTERISTICS, NOISE LIMITS ON PERFORMANCE; SOLAR CELLS.

**MODULE 5: LOW-DIMENSIONAL OPTOELECTRONIC DEVICES (6 LECTURES)**

QUANTUM-WELL, -WIRE, AND -DOT BASED LEDs, LASERS, AND PHOTODETECTORS.

**SUGGESTED TEXT/REFERENCE BOOKS**

📖 J. SINGH, *SEMICONDUCTOR OPTOELECTRONICS: PHYSICS AND TECHNOLOGY*, MCGRAW-HILL INC. (1995).

📖 B. E. A. SALEH AND M. C. TEICH, *FUNDAMENTALS OF PHOTONICS*, JOHN WILEY & SONS,

- 📖 S. M. SZE, *SEMICONDUCTOR DEVICES: PHYSICS AND TECHNOLOGY*, WILEY (2008).
- 📖 YARIV AND P. YEH, *PHOTONICS: OPTICAL ELECTRONICS IN MODERN COMMUNICATIONS*, OXFORD UNIVERSITY PRESS, NEW YORK (2007).
- 📖 P. BHATTACHARYA, *SEMICONDUCTOR OPTOELECTRONIC DEVICES*, PRENTICE HALL OF INDIA (1997).
- 📖 ONLINE COURSE: "SEMICONDUCTOR OPTOELECTRONICS" BY M R SHENOY ON NPTEL
- 📖 ONLINE COURSE: "OPTOELECTRONIC MATERIALS AND DEVICES" BY MONICA KATYAR AND DEEPAK GUPTA ON NPTEL

### **SEMICONDUCTOR PHYSICS**

**PREREQUISITE: "INTRODUCTION TO QUANTUM MECHANICS" DESIRABLE**

#### **MODULE 1: ELECTRONIC MATERIALS (8 LECTURES)**

FREE ELECTRON THEORY, DENSITY OF STATES AND ENERGY BAND DIAGRAMS, KRONIG-PENNY MODEL (TO INTRODUCE ORIGIN OF BAND GAP), ENERGY BANDS IN SOLIDS, E-K DIAGRAM, DIRECT AND INDIRECT BANDGAPS, TYPES OF ELECTRONIC MATERIALS: METALS, SEMICONDUCTORS, AND INSULATORS, DENSITY OF STATES, OCCUPATION PROBABILITY, FERMI LEVEL, EFFECTIVE MASS, PHONONS.

#### **MODULE 2: SEMICONDUCTORS (10 LECTURES)**

INTRINSIC AND EXTRINSIC SEMICONDUCTORS, DEPENDENCE OF FERMI LEVEL ON CARRIER-CONCENTRATION AND TEMPERATURE (EQUILIBRIUM CARRIER STATISTICS), CARRIER GENERATION AND RECOMBINATION, CARRIER TRANSPORT: DIFFUSION AND DRIFT, P-N JUNCTION, METAL-SEMICONDUCTOR JUNCTION (OHMIC AND SCHOTTKY), SEMICONDUCTOR MATERIALS OF INTEREST FOR OPTOELECTRONIC DEVICES.

#### **MODULE 3: LIGHT-SEMICONDUCTOR INTERACTION (6 LECTURES)**

OPTICAL TRANSITIONS IN BULK SEMICONDUCTORS: ABSORPTION, SPONTANEOUS EMISSION, AND STIMULATED EMISSION; JOINT DENSITY OF STATES, DENSITY OF STATES FOR PHOTONS, TRANSITION RATES (FERMI'S GOLDEN RULE), OPTICAL LOSS AND GAIN; PHOTOVOLTAIC EFFECT, EXCITON, DRUDE MODEL.

#### **MODULE 4: MEASUREMENTS (6 LECTURES)**

FOUR-POINT PROBE AND VAN DER PAUW MEASUREMENTS FOR CARRIER DENSITY, RESISTIVITY, AND HALL MOBILITY; HOT-POINT PROBE MEASUREMENT, CAPACITANCE-VOLTAGE MEASUREMENTS, PARAMETER EXTRACTION FROM DIODE I-V CHARACTERISTICS, DLTS, BAND GAP BY UV-VIS SPECTROSCOPY, ABSORPTION/TRANSMISSION.

#### **MODULE 5: ENGINEERED SEMICONDUCTOR MATERIALS (6 LECTURES)**

DENSITY OF STATES IN 2D, 1D AND 0D (QUALITATIVELY). PRACTICAL EXAMPLES OF LOW-DIMENSIONAL SYSTEMS SUCH AS QUANTUM WELLS, WIRES, AND DOTS: DESIGN, FABRICATION, AND CHARACTERIZATION TECHNIQUES. HETEROJUNCTIONS AND ASSOCIATED BAND-DIAGRAMS

**SUGGESTED TEXT/REFERENCE BOOKS**

- 📖 J. SINGH, *SEMICONDUCTOR OPTOELECTRONICS: PHYSICS AND TECHNOLOGY*, MCGRAW-HILL INC. (1995).
- 📖 B. E. A. SALEH AND M. C. TEICH, *FUNDAMENTALS OF PHOTONICS*, JOHN WILEY & SONS, INC., (2007).
- 📖 S. M. SZE, *SEMICONDUCTOR DEVICES: PHYSICS AND TECHNOLOGY*, WILEY (2008).
- 📖 YARIV AND P. YEH, *PHOTONICS: OPTICAL ELECTRONICS IN MODERN COMMUNICATIONS*, OXFORD UNIVERSITY PRESS, NEW YORK (2007).
- 📖 P. BHATTACHARYA, *SEMICONDUCTOR OPTOELECTRONIC DEVICES*, PRENTICE HALL OF INDIA (1997).
- 📖 ONLINE COURSE: "SEMICONDUCTOR OPTOELECTRONICS" BY M R SHENOY ON NPTEL
- 📖 NLINE COURSE: "OPTOELECTRONIC MATERIALS AND DEVICES" BY MONICA KATIYAR AND DEEPAK GUPTAON NPTEL

**LABORATORY –**

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**PAPER CODE - 105202**

<b>BSC</b>	<b>MATHEMATICS –II (PROBABILITY AND STATISTICS)</b>	<b>L:3</b>	<b>T:1</b>	<b>P:0</b>	<b>CREDIT:4</b>
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**CONTENTS****MODULE 1: BASIC PROBABILITY (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.

**MODULE 2: CONTINUOUS PROBABILITY DISTRIBUTIONS (4 LECTURES)**

CONTINUOUS RANDOM VARIABLES AND THEIR PROPERTIES, DISTRIBUTION FUNCTIONS AND DENSITIES, NORMAL, EXPONENTIAL AND GAMMA DENSITIES.

**MODULE 3: BIVARIATE DISTRIBUTIONS (4 LECTURES)**

BIVARIATE DISTRIBUTIONS AND THEIR PROPERTIES, DISTRIBUTION OF SUMS AND QUOTIENTS, CONDITIONAL DENSITIES, BAYES' RULE.

**MODULE 4: BASIC STATISTICS (8 LECTURES)**

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.

**MODULE 5: APPLIED STATISTICS (8 LECTURES)**

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, SINGLE MEAN, DIFFERENCE OF MEANS AND DIFFERENCE OF STANDARD DEVIATIONS.

**MODULE 6: SMALL SAMPLES (4 LECTURES)**

TEST FOR SINGLE MEAN, DIFFERENCE OF MEANS AND CORRELATION COEFFICIENTS, TEST FOR RATIO OF VARIANCES - CHI-SQUARE TEST FOR GOODNESS OF FIT AND INDEPENDENCE OF ATTRIBUTES.

**TEXT / REFERENCES:**

 E. KREYSZIG, "ADVANCED ENGINEERING MATHEMATICS", JOHN WILEY & SONS, 2006.

- 📖 P. G. HOEL, S. C. PORT AND C. J. STONE, "INTRODUCTION TO PROBABILITY THEORY", UNIVERSAL BOOK STALL, 2003.
- 📖 S. ROSS, "A FIRST COURSE IN PROBABILITY", PEARSON EDUCATION INDIA, 2002.
- 📖 W. FELLER, "AN INTRODUCTION TO PROBABILITY THEORY AND ITS APPLICATIONS", VOL. 1, WILEY, 1968.
- 📖 N.P. BALI AND M. GOYAL, "A TEXT BOOK OF ENGINEERING MATHEMATICS", LAXMI PUBLICATIONS, 2010.
- 📖 B.S. GREWAL, "HIGHER ENGINEERING MATHEMATICS", KHANNA PUBLISHERS, 2000.
- 📖 T. VEERARAJAN, "ENGINEERING MATHEMATICS", TATA MCGRAW-HILL, NEW DELHI, 2010
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**PAPER CODE – 100101 || 100201**

<b>ESC</b>	<b>BASIC ELECTRICAL ENGINEERING</b>	<b>L:3</b>	<b>T:1</b>	<b>P:2</b>	<b>CREDIT:5</b>
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**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

**[AKU-PATNA] [ooo – COMMON PAPERS (ALL BRANCH)]**

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 FITZGERALD, 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-

**[AKU-PATNA] [ooo – COMMON PAPERS (ALL BRANCH)]**

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

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<b>ESC</b>	<b>ENGINEERING GRAPHICS &amp; DESIGN</b>	<b>L:1</b>	<b>T:0</b>	<b>P:4</b>	<b>CREDIT:3</b>
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**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**

## [AKU-PATNA] [ooo – COMMON PAPERS (ALL BRANCH)]

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

**[AKU-PATNA] [ooo – COMMON PAPERS (ALL BRANCH)]**

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, SCITECH PUBLISHERS
- 📖 (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