AKU B.E./B.Tech MECH Sem 1 syllabus

Physics (Electromagnetism)

PAPER CODE - 102101
BSC PHYSICS (ELECTROMAGNETISM)

CREDIT:5.5

INTRODUCTION TO ELECTROMAGNETIC THEORY

MODULE 1: ELECTROSTATICS IN VACUUM
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
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
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

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

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

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

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

Engineering Graphics & Design

PAPER CODE – 100102 || 100202
ESC ENGINEERING GRAPHICS & DESIGN

CREDIT:3

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

Basic Electrical Engineering

PAPER CODE – 100101 || 100201
ESC BASIC ELECTRICAL ENGINEERING

CREDIT:5

MODULE 1: DC CIRCUITS

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

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:

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

MODULE 4: TRANSFORMERS

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

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
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

Mathematics –I (Calculus & Linear Algebra)

PAPER CODE – 102102
BSC MATHEMATICS –I (CALCULUS & LINEAR ALGEBRA)

CREDIT:4

MODULE 1: CALCULUS:
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:
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:
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):
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
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.