CURRICULUM

FOR

UNDERGRADUATE DEGREE COURSES

IN

ENGINEERING & TECHNOLOGY

(Based on AICTE Model Curriculum 2018)

EFFECTIVE FROM ACADEMIC YEAR 2018-2019

ARYABHATTA KNOWLEDGE UNIVERSITY, PATNA

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ARYABHATTA KNOWLEDGE UNIVERSITY PATNA

CURRICULUM

UNDERGRADUATE DEGREE COURSES IN ENGINEERING & TECHNOLOGY

EFFECTIVE FROM ACADEMIC YEAR 2018-2019

BASED ON AICTE MODEL CURRICULUM 2018

Chanakya National Law University Campus,
Near Mithapur Bus Stand,
Mithapur,
Patna-800 001.

CURRICULUM CONTENTS

MESSAGES

PREFACE

ACKNOWLEDGEMENT

ARYABHATTA KNOWLEDGE UNIVERSITY PATNA

CURRICULUM
FOR
FIRST YEAR
UNDERGRADUATE DEGREE
COURSES IN
ENGINEERING & TECHNOLOGY

GROUP A

- 101 - CIVIL ENGINEERING
- 102 - MECHANICAL ENGINEERING
- 106 - INFORMATION TECHNOLOGY & ENGINEERING
- 107 - LEATHER TECHNOLOGY & ENGINEERING

GROUP B

- 103 - ELECTRICAL ENGINEERING
- 104 - ELECTRONICS AND COMMUNICATION ENGINEERING
- 105 - COMPUTER SCIENCE & ENGINEERING
- 110 - ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM FOR CIVIL ENGINEERING

SEMESTER – I

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	101101	Physics (Mechanics & Mechanics of Solids)	3	1	3	5.5
2	101102	Mathematics –I (Calculus, Multivariable Calculus and Linear Algebra)	3	1	0	4
3	200101	Basic Electrical Engineering	3	1	2	5
4	200102	Engineering Graphics & Design	1	0	4	3

SEMESTER – II

Sl. No.	Course Code	Course Title	L	T	P	Credits
5	100203	Chemistry	3	1	3	5.5
6	101204	Mathematics –II (Differential Equations)	3	1	0	4
7	200203	Programming for Problem Solving	3	0	4	5
8	200204	Workshop Manufacturing Practices	1	0	4	3
9	300201	English	2	0	2	3

DEFINITION OF CREDIT

Hour	Component	Credit
1	Lecture (L) per week	**1**
1	Tutorial (T) per week	**1**
1	Practical (P) per week	**0.5**

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.

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*

BSC	Mathematics –II (Differential Equations)	L:3	T:1	P:0	Credit:4

ORDINARY DIFFERENTIAL EQUATIONS

MODULE 3A: 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 3B: 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.

TEXTBOOKS/REFERENCES:

- *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.*
- *G.F. SIMMONS AND S.G. KRANTZ, DIFFERENTIAL EQUATIONS, TATA MCGRAW HILL, 2007.*

PARTIAL DIFFERENTIAL EQUATIONS

MODULE 3C: PARTIAL DIFFERENTIAL EQUATIONS – FIRST ORDER (6 LECTURES)

FIRST ORDER PARTIAL DIFFERENTIAL EQUATIONS, SOLUTIONS OF FIRST ORDER LINEAR AND NON-LINEAR PDES.

MODULE 3D: PARTIAL DIFFERENTIAL EQUATIONS – HIGHER ORDER (10 LECTURES)

SOLUTION TO HOMOGENOUS AND NON-HOMOGENOUS LINEAR PARTIAL DIFFERENTIAL EQUATIONS SECOND AND HIGHER ORDER BY COMPLIMENTARY FUNCTION AND PARTICULAR INTEGRAL METHOD. FLOWS, VIBRATIONS AND DIFFUSIONS, SECOND-ORDER LINEAR EQUATIONS AND THEIR CLASSIFICATION, INITIAL AND BOUNDARY CONDITIONS (WITH AN INFORMAL DESCRIPTION OF WELL-POSED PROBLEMS), D'ALEMBERT'S SOLUTION OF THE WAVE EQUATION; DUHAMEL'S PRINCIPLE FOR ONE DIMENSIONAL WAVE EQUATION. 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. BOUNDARY-VALUE PROBLEMS: SOLUTION OF BOUNDARY-VALUE PROBLEMS FOR VARIOUS LINEAR PDES IN VARIOUS GEOMETRIES.

TEXTBOOKS/REFERENCES:

- *S. J. FARLOW, PARTIAL DIFFERENTIAL EQUATIONS FOR SCIENTISTS AND ENGINEERS, DOVER PUBLICATIONS, 1993.*
- *R. HABERMAN, ELEMENTARY APPLIED PARTIAL DIFFERENTIAL EQUATIONS WITH FOURIER SERIES*
- *AND BOUNDARY VALUE PROBLEM, 4TH ED., PRENTICE HALL, 1998.*
- *IAN SNEDDON, ELEMENTS OF PARTIAL DIFFERENTIAL EQUATIONS, MCGRAW HILL, 1964.*
- *MANISH GOYAL AND N.P. BALI, TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS, UNIVERSITY SCIENCE PRESS, SECOND EDITION, 2010.*

COMPLEX VARIABLES

MODULE 4A: 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 4B: 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.

MODULE 4C: APPLICATIONS OF COMPLEX INTEGRATION BY RESIDUES: (4 LECTURES)

EVALUATION OF DEFINITE INTEGRAL INVOLVING SINE AND COSINE. EVALUATION OF CERTAIN IMPROPER INTEGRALS USING THE BROMWICH CONTOUR.

TEXTBOOKS/REFERENCES:

- *ERWIN KREYSZIG, ADVANCED ENGINEERING MATHEMATICS, 9TH EDITION, JOHN WILEY & SONS, 2006.*
- *J. W. BROWN AND R. V. CHURCHILL, COMPLEX VARIABLES AND APPLICATIONS, 7TH ED., MC- GRAW HILL, 2004.*
- *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.*

NUMERICAL METHODS

MODULE 5A: NUMERICAL METHODS – 1 (12 LECTURES)

SOLUTION OF POLYNOMIAL AND TRANSCENDENTAL EQUATIONS – BISECTION METHOD, NEWTON-RAPHSON METHOD AND REGULA-FALSI METHOD. FINITE DIFFERENCES, RELATION BETWEEN OPERATORS, INTERPOLATION USING NEWTON'S FORWARD AND BACKWARD DIFFERENCE FORMULAE. INTERPOLATION WITH UNEQUAL INTERVALS: NEWTON'S DIVIDED DIFFERENCE AND LAGRANGE'S FORMULAE. NUMERICAL DIFFERENTIATION, NUMERICAL INTEGRATION: TRAPEZOIDAL RULE AND SIMPSON'S 1/3RD AND 3/8 RULES.

MODULE 5B: NUMERICAL METHODS – 2 (10 LECTURES)

ORDINARY DIFFERENTIAL EQUATIONS: TAYLOR'S SERIES, EULER AND MODIFIED EULER'S METHODS. RUNGE- KUTTA METHOD OF FOURTH ORDER FOR SOLVING FIRST AND SECOND ORDER EQUATIONS. MILNE'S AND ADAM'S PREDICATOR-CORRECTOR METHODS. PARTIAL DIFFERENTIAL EQUATIONS: FINITE DIFFERENCE SOLUTION TWO DIMENSIONAL LAPLACE EQUATION AND POISSION EQUATION, IMPLICIT AND EXPLICIT METHODS FOR ONE DIMENSIONAL HEAT EQUATION (BENDER-SCHMIDT AND CRANK-NICHOLSON METHODS), FINITE DIFFERENCE EXPLICIT METHOD FOR WAVE EQUATION.

TEXTBOOKS/REFERENCES:

- *P. KANDASAMY, K. THILAGAVATHY, K. GUNAVATHI, NUMERICAL METHODS, S. CHAND & COMPANY, 2ND EDITION, REPRINT 2012.*
- *S.S. SASTRY, INTRODUCTORY METHODS OF NUMERICAL ANALYSIS, PHI, 4TH EDITION, 2005.*
- *ERWIN KREYSZIG, ADVANCED ENGINEERING MATHEMATICS, 9TH EDITION, JOHN WILEY & SONS, 2006.*
- *B.S. GREWAL, HIGHER ENGINEERING MATHEMATICS, KHANNA PUBLISHERS, 35TH EDITION, 2010.*

CURRICULUM FOR MECHANICAL ENGINEERING AND LEATHER TECHNOLOGY & ENGINEERING

SEMESTER – I

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Physics (Electromagnetism)	3	1	3	5.5
2	BSC	Mathematics –I (Calculus & Linear Algebra)	3	1	0	4
3	ESC	Basic Electrical Engineering	3	1	2	5
4	ESC	Engineering Graphics & Design	1	0	4	3

SEMESTER – II

Sl. No.	Course Code	Course Title	L	T	P	Credits
5	BSC	Chemistry	3	1	3	5.5
6	BSC	Mathematics –II (ODE & Complex Variables)	3	1	0	4
7	ESC	Programming for Problem Solving	3	0	4	5
8	ESC	Workshop Manufacturing Practices	1	0	4	3
9	HSMC	English	2	0	2	3

DEFINITION OF CREDIT

Hour	Component	Credit
1	Lecture (L) per week	**1**
1	Tutorial (T) per week	**1**
1	Practical (P) per week	**0.5**

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

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

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 EDN., 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

CURRICULUM
FOR
COMPUTER SCIENCE & ENGINEERING
AND
INFORMATION TECHNOLOGY & ENGINEERING

SEMESTER – I (COMPUTER SCIENCE & ENGINEERING)

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Chemistry	3	1	3	5.5
2	BSC	Mathematics –I (Calculus & Linear Algebra)	3	1	0	4
3	ESC	Programming for Problem Solving	3	0	4	5
4	ESC	Workshop Manufacturing Practices	1	0	4	3
5	HSMC	English	2	0	2	3

SEMESTER – II (COMPUTER SCIENCE & ENGINEERING)

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Physics (Semiconductor Physics)	3	1	3	5.5
2	BSC	Mathematics –II (Probability and Statistics)	3	1	0	4
3	ESC	Basic Electrical Engineering	3	1	2	5
4	ESC	Engineering Graphics & Design	1	0	4	3

SEMESTER – I (INFORMATION TECHNOLOGY & ENGINEERING)

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Physics (Semiconductor Physics)	3	1	3	5.5
2	BSC	Mathematics –I (Calculus & Linear Algebra)	3	1	0	4
3	ESC	Basic Electrical Engineering	3	1	2	5
4	ESC	Engineering Graphics & Design	1	0	4	3

SEMESTER – II (INFORMATION TECHNOLOGY & ENGINEERING)

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Chemistry	3	1	3	5.5
2	BSC	Mathematics –II (Probability and Statistics)	3	1	0	4
3	ESC	Programming for Problem Solving	3	0	4	5
4	ESC	Workshop Manufacturing Practices	1	0	4	3
5	HSMC	English	2	0	2	3

BSC	Physics (Semiconductor Physics)	L:3	T:1	P:3	Credit:5.5

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 KATIYAR 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 –

BSC	Mathematics –I (Calculus & Linear Algebra)	L:3	T:1	P:0	Credit:4

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.

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- 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.

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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

BSC	Mathematics –II (Probability and Statistics)	L:3	T:1	P:0	Credit:4

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

CURRICULUM
FOR
ELECTRICAL ENGINEERING,
ELECTRICAL AND ELECTRONICS ENGINEERING
AND
ELECTRICAL AND COMMUNICATION ENGINEERING

SEMESTER – I

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Chemistry	3	1	3	5.5
2	BSC	Mathematics –I (Calculus and Differential Equations)	3	1	0	4
3	ESC	Programming for Problem Solving	3	0	4	5
4	ESC	Workshop Manufacturing Practices	1	0	4	3
5	HSMC	English	2	0	2	3

SEMESTER – II

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Physics (Waves and Optics, and Introduction to Quantum Mechanics)	3	1	3	5.5
2	BSC	Mathematics –II (Linear Algebra, Transform Calculus and Numerical Methods)	3	1	0	4
3	ESC	Basic Electrical Engineering	3	1	2	5
4	ESC	Engineering Graphics & Design	1	0	4	3

DEFINITION OF CREDIT

Hour	Component	Credit
1	Lecture (L) per week	**1**
1	Tutorial (T) per week	**1**
1	Practical (P) per week	**0.5**

BSC	Physics (Waves and Optics, and Introduction to Quantum Mechanics)	L:3	T:1	P:3	Credit:5.5

CONTENTS

MODULE 1: WAVES (3 LECTURES)

MECHANICAL AND ELECTRICAL SIMPLE HARMONIC OSCILLATORS, DAMPED HARMONIC OSCILLATOR, FORCED MECHANICAL AND ELECTRICAL OSCILLATORS, IMPEDANCE, STEADY STATE MOTION OF FORCED DAMPED HARMONIC OSCILLATOR

MODULE 2: NON-DISPERSIVE TRANSVERSE AND LONGITUDINAL WAVES (4 LECTURES)

TRANSVERSE WAVE ON A STRING, THE WAVE EQUATION ON A STRING, HARMONIC WAVES, REFLECTION AND TRANSMISSION OF WAVES AT A BOUNDARY, IMPEDANCE MATCHING, STANDING WAVES AND THEIR EIGEN FREQUENCIES, LONGITUDINAL WAVES AND THE WAVE EQUATION FOR THEM, ACOUSTICS WAVES

MODULE 3: LIGHT AND OPTICS (3 LECTURES)

LIGHT AS AN ELECTROMAGNETIC WAVE AND FRESNEL EQUATIONS, REFLECTANCE AND TRANSMITTANCE, BREWSTER'S ANGLE, TOTAL INTERNAL REFLECTION, AND EVANESCENT WAVE. MIRRORS AND LENSES AND OPTICAL INSTRUMENTS BASED ON THEM

MODULE 4: WAVE OPTICS (5 LECTURES)

HUYGENS' PRINCIPLE, SUPERPOSITION OF WAVES AND INTERFERENCE OF LIGHT BY WAVEFRONT SPLITTING AND AMPLITUDE SPLITTING; YOUNG'S DOUBLE SLIT EXPERIMENT, NEWTON'S RINGS, MICHELSON INTERFEROMETER, MACH ZEHNDER INTERFEROMETER. FARUNHOFER DIFFRACTION FROM A SINGLE SLIT AND A CIRCULAR APERTURE, THE RAYLEIGH CRITERION FOR LIMIT OF RESOLUTION AND ITS APPLICATION TO VISION; DIFFRACTION GRATINGS AND THEIR RESOLVING POWER

MODULE 5: LASERS (5 LECTURES)

EINSTEIN'S THEORY OF MATTER RADIATION INTERACTION AND A AND B COEFFICIENTS; AMPLIFICATION OF LIGHT BY POPULATION INVERSION, DIFFERENT TYPES OF LASERS: GAS LASERS (HE-NE, CO2), SOLID-STATE LASERS (RUBY, NEODYMIUM), DYE LASERS; PROPERTIES OF LASER BEAMS: MONO-CHROMATICITY

MODULE 6: INTRODUCTION TO QUANTUM MECHANICS (5 LECTURES)

WAVE NATURE OF PARTICLES, TIME-DEPENDENT AND TIME-INDEPENDENT SCHRODINGER EQUATION FOR WAVE FUNCTION, BORN INTERPRETATION, PROBABILITY CURRENT, EXPECTATION VALUES, FREE-PARTICLE WAVE FUNCTION AND WAVE-PACKETS, UNCERTAINTY PRINCIPLE.

MODULE 7: SOLUTION OF WAVE EQUATION (6 LECTURES)

SOLUTION OF STATIONARY-STATE SCHRODINGER EQUATION FOR ONE DIMENSIONAL PROBLEMS–PARTICLE IN A BOX, PARTICLE IN ATTRACTIVE DELTA-FUNCTION POTENTIAL, SQUARE-WELL POTENTIAL, LINEAR HARMONIC OSCILLATOR. SCATTERING FROM A POTENTIAL BARRIER AND TUNNELING; RELATED EXAMPLES LIKE ALPHA- DECAY, FIELD-IONIZATION AND SCANNING TUNNELING MICROSCOPE, TUNNELING IN SEMICONDUCTOR STRUCTURES. THREE-DIMENSIONAL PROBLEMS: PARTICLE IN THREE DIMENSIONAL BOX AND RELATED EXAMPLES.

MODULE 8: INTRODUCTION TO SOLIDS AND SEMICONDUCTORS (9 LECTURES)

FREE ELECTRON THEORY OF METALS, FERMI LEVEL, DENSITY OF STATES IN 1, 2 AND 3 DIMENSIONS, BLOCH'S THEOREM FOR PARTICLES IN A PERIODIC POTENTIAL, KRONIG-PENNEY MODEL AND ORIGIN OF ENERGY BANDS.

TYPES OF ELECTRONIC MATERIALS: METALS, SEMICONDUCTORS, AND INSULATORS. 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.

TEXT / REFERENCES:

- *G. MAIN, "VIBRATIONS AND WAVES IN PHYSICS", CAMBRIDGE UNIVERSITY PRESS, 1993.*
- *H. J. PAIN, "THE PHYSICS OF VIBRATIONS AND WAVES", WILEY, 2006.*
- *E. HECHT, "OPTICS", PEARSON EDUCATION, 2008.*
- *A. GHATAK, "OPTICS", MCGRAW HILL EDUCATION, 2012.*
- *O. SVELTO, "PRINCIPLES OF LASERS", SPRINGER SCIENCE & BUSINESS MEDIA, 2010.*
- *D. J. GRIFFITHS, "QUANTUM MECHANICS", PEARSON EDUCATION, 2014.*
- *R. ROBINETT, "QUANTUM MECHANICS", OUP OXFORD, 2006.*
- *D. MCQUARRIE, "UANTUM CHEMISTRY", UNIVERSITY SCIENCE BOOKS, 2007.*
- *D. A. NEAMEN, "SEMICONDUCTOR PHYSICS AND DEVICES", TIMES MIRROR HIGH EDUCATION GROUP, CHICAGO, 1997.*
- *E.S. YANG, "MICROELECTRONIC DEVICES", MCGRAW HILL, SINGAPORE, 1988.*
- *B.G. STREETMAN, " SOLID STATE ELECTRONIC DEVICES", PRENTICE HALL OF INDIA, 1995*

LABORATORY –

BSC	Mathematics –I (Calculus and Differential Equations)	L:3	T:1	P:0	Credit:4

CONTENTS

MODULE 1: 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. ROLLE'S THEOREM, MEAN VALUE THEOREMS, TAYLOR'S AND MACLAURIN THEOREMS WITH REMAINDERS; INDETERMINATE FORMS AND L'HOSPITAL'S RULE; MAXIMA AND MINIMA.

MODULE 2: SEQUENCES AND SERIES (7 LECTURES)

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

MODULE 3: MULTIVARIABLE CALCULUS: DIFFERENTIATION (6 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 4: MULTIVARIABLE CALCULUS: INTEGRATION (7 LECTURES)

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

MODULE 5: FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS (3 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 6: ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER (6 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 7: PARTIAL DIFFERENTIAL EQUATIONS: FIRST ORDER (3 LECTURES)

FIRST ORDER PARTIAL DIFFERENTIAL EQUATIONS, SOLUTIONS OF FIRST ORDER LINEAR AND NON-LINEAR PDES.

TEXT / REFERENCES:

- *G.B. THOMAS AND R.L. FINNEY, "CALCULUS AND ANALYTIC GEOMETRY", PEARSON, 2002.*
- *T. VEERARAJAN, "ENGINEERING MATHEMATICS", MCGRAW-HILL, NEW DELHI, 2008.*
- *B. V. RAMANA, "HIGHER ENGINEERING MATHEMATICS", MCGRAW HILL, NEW DELHI, 2010.*
- *N.P. BALI AND M. GOYAL, "A TEXT BOOK OF ENGINEERING MATHEMATICS", LAXMI PUBLICATIONS, 2010.*
- *B.S. GREWAL, "HIGHER ENGINEERING MATHEMATICS", KHANNA PUBLISHERS, 2000.*
- *E. KREYSZIG, "ADVANCED ENGINEERING MATHEMATICS", JOHN WILEY & SONS, 2006.*
- *W. E. BOYCE AND R. C. DIPRIMA, "ELEMENTARY DIFFERENTIAL EQUATIONS AND BOUNDARY VALUE PROBLEMS", WILEY INDIA, 2009.*
- *S. L. ROSS, "DIFFERENTIAL EQUATIONS", 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.*
- *G.F. SIMMONS AND S.G. KRANTZ, "DIFFERENTIAL EQUATIONS", MCGRAW HILL, 2007.*

BSC	Mathematics –II (Linear Algebra, Transform Calculus and Numerical Methods)	L:3	T:1	P:0	Credit:4

MODULE 1: MATRICES (10 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 2: NUMERICAL METHODS-I (10 LECTURES)

SOLUTION OF POLYNOMIAL AND TRANSCENDENTAL EQUATIONS – BISECTION METHOD, NEWTON-RAPHSON METHOD AND REGULA-FALSI METHOD. FINITE DIFFERENCES, INTERPOLATION USING NEWTON'S FORWARD AND BACKWARD DIFFERENCE FORMULAE. CENTRAL DIFFERENCE INTERPOLATION: GAUSS'S FORWARD AND BACKWARD FORMULAE. NUMERICAL INTEGRATION: TRAPEZOIDAL RULE AND SIMPSON'S 1/3RD AND 3/8 RULES.

MODULE 3: NUMERICAL METHODS-II (10 LECTURES)

ORDINARY DIFFERENTIAL EQUATIONS: TAYLOR'S SERIES, EULER AND MODIFIED EULER'S METHODS. RUNGE- KUTTA METHOD OF FOURTH ORDER FOR SOLVING FIRST AND SECOND ORDER EQUATIONS. MILNE'S AND ADAM'S PREDICATOR-CORRECTOR METHODS. PARTIAL DIFFERENTIAL EQUATIONS: FINITE DIFFERENCE SOLUTION TWO DIMENSIONAL LAPLACE EQUATION AND POISSON EQUATION, IMPLICIT AND EXPLICIT METHODS FOR ONE DIMENSIONAL HEAT EQUATION (BENDER-SCHMIDT AND CRANK-NICHOLSON METHODS), FINITE DIFFERENCE EXPLICIT METHOD FOR WAVE EQUATION.

MODULE 4: TRANSFORM CALCULUS (10 LECTURES)

LAPLACE TRANSFORM, PROPERTIES OF LAPLACE TRANSFORM, LAPLACE TRANSFORM OF PERIODIC FUNCTIONS. FINDING INVERSE LAPLACE TRANSFORM BY DIFFERENT METHODS, CONVOLUTION THEOREM. EVALUATION OF INTEGRALS BY LAPLACE TRANSFORM, SOLVING ODES AND PDES BY LAPLACE TRANSFORM METHOD. FOURIER TRANSFORMS.

TEXT / REFERENCES:

- D. POOLE, "LINEAR ALGEBRA: A MODERN INTRODUCTION", BROOKS/COLE, 2005.
- N.P. BALI AND M. GOYAL, "A TEXT BOOK OF ENGINEERING MATHEMATICS", LAXMI PUBLICATIONS, 2008.
- B.S. GREWAL, "HIGHER ENGINEERING MATHEMATICS", KHANNA PUBLISHERS, 2010.
- V. KRISHNAMURTHY, V. P. MAINRA AND J. L. ARORA, "AN INTRODUCTION TO LINEAR ALGEBRA", AFFILIATED EAST-WEST PRESS, 2005.

CURRICULUM
FOR
COMMON PAPERS (ALL BRANCH)

SEMESTER – I & II

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	ESC	Basic Electrical Engineering	3	1	2	5
2	ESC	Engineering Graphics & Design	1	0	4	3
3	BSC	Chemistry	3	1	3	5.5
4	ESC	Programming for Problem Solving	3	0	4	5
5	ESC	Workshop Manufacturing Practices	1	0	4	3
6	HSMC	English	2	0	2	3

DEFINITION OF CREDIT

Hour	Component	Credit
1	Lecture (L) per week	**1**
1	Tutorial (T) per week	**1**
1	Practical (P) per week	**0.5**

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

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

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

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.

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.

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.

ARYABHATTA KNOWLEDGE UNIVERSITY PATNA

CREDIT TABLE
FOR
FIRST YEAR
UNDERGRADUATE DEGREE
COURSES IN
ENGINEERING & TECHNOLOGY

GROUP A

- 101 - CIVIL ENGINEERING
- 102 - MECHANICAL ENGINEERING
- 106 - INFORMATION TECHNOLOGY & ENGINEERING
- 107 - LEATHER TECHNOLOGY & ENGINEERING

GROUP B

- 103 - ELECTRICAL ENGINEERING
- 104 - ELECTRONICS AND COMMUNICATION ENGINEERING
- 105 - COMPUTER SCIENCE & ENGINEERING
- 110 - ELECTRICAL AND ELECTRONICS ENGINEERING

CREDIT TABLE
FOR
101 - CIVIL ENGINEERING

SEMESTER – I

Sl. No.	Course Code	Course Title	IA	ESE	TOTAL	L	T	P	Credit	Hours
Theory										
1	BSC	Physics (Mechanics & Mechanics of Solids)	30	70	100	3	1	0	4	4
2	BSC	Mathematics –I (Calculus, Multivariable Calculus and Linear Algebra)	30	70	100	3	1	0	4	4
3	ESC	Basic Electrical Engineering	30	70	100	3	1	0	4	4
4	ESC	Engineering Graphics & Design	30	70	100	1	0	0	1	1
Practical										
1	BSC	Physics (Mechanics & Mechanics of Solids)	20	30	50	0	0	3	1.5	3
2	ESC	Basic Electrical Engineering	20	30	50	0	0	2	1	2
3	ESC	Engineering Graphics & Design	20	30	50	0	0	4	2	4
	Total				550				17.5	22

TOTAL MARKS: 550 **TOTAL CREDITS: 17.5** **TOTAL HOURS: 22**

SEMESTER – II

Sl. No.	Course Code	Course Title	IA	ESE	TOTAL	L	T	P	Credit	Hours
Theory										
1	BSC	Chemistry	30	70	100	3	1	0	4	4
2	BSC	Mathematics –II (Differential Equations)	30	70	100	3	1	0	4	4
3	ESC	Programming for Problem Solving	30	70	100	3	0	0	3	3
4	ESC	Workshop Manufacturing Practices	30	70	100	1	0	0	1	1
5	HSMC	English	30	70	100	2	0	0	2	2
Practical										
1	BSC	Chemistry	20	30	50	0	0	3	1.5	3
2	ESC	Programming for Problem Solving	20	30	50	0	0	4	2	4
3	ESC	Workshop Manufacturing Practices	20	30	50	0	0	4	2	4
4	HSMC	English	20	30	50	0	0	2	1	2
	Total				700				20.5	27

TOTAL MARKS: 700 **TOTAL CREDITS: 20.5** **TOTAL HOURS: 27**

IA (INTERNAL ASSESMENT), ESE (END SEMESTER EXAMINATION)

CREDIT TABLE
FOR
102 - MECHANICAL ENGINEERING

SEMESTER – I

Sl. No.	Course Code	Course Title	IA	ESE	TOTAL	L	T	P	Credit	Hours
Theory										
1	BSC	Physics (Electromagnetism)	30	70	100	3	1	0	4	4
2	BSC	Mathematics –I (Calculus and Linear Algebra)	30	70	100	3	1	0	4	4
3	ESC	Basic Electrical Engineering	30	70	100	3	1	0	4	4
4	ESC	Engineering Graphics & Design	30	70	100	1	0	0	1	1
Practical										
1	BSC	Physics (Electromagnetism)	20	30	50	0	0	3	1.5	3
2	ESC	Basic Electrical Engineering	20	30	50	0	0	2	1	2
3	ESC	Engineering Graphics & Design	20	30	50	0	0	4	2	4
	Total				550				17.5	22

TOTAL MARKS: 550 **TOTAL CREDITS: 17.5** **TOTAL HOURS: 22**

SEMESTER – II

Sl. No.	Course Code	Course Title	IA	ESE	TOTAL	L	T	P	Credit	Hours
Theory										
1	BSC	Chemistry	30	70	100	3	1	0	4	4
2	BSC	Mathematics –II (ODE & Complex Variables)	30	70	100	3	1	0	4	4
3	ESC	Programming for Problem Solving	30	70	100	3	0	0	3	3
4	ESC	Workshop Manufacturing Practices	30	70	100	1	0	0	1	1
5	HSMC	English	30	70	100	2	0	0	2	2
Practical										
1	BSC	Chemistry	20	30	50	0	0	3	1.5	3
2	ESC	Programming for Problem Solving	20	30	50	0	0	4	2	4
3	ESC	Workshop Manufacturing Practices	20	30	50	0	0	4	2	4
4	HSMC	English	20	30	50	0	0	2	1	2
	Total				700				20.5	27

TOTAL MARKS: 700 **TOTAL CREDITS: 20.5** **TOTAL HOURS: 27**

IA (INTERNAL ASSESMENT), ESE (END SEMESTER EXAMINATION)

CREDIT TABLE
FOR
103 - ELECTRICAL ENGINEERING

SEMESTER – I

Sl. No.	Course Code	Course Title	IA	ESE	TOTAL	L	T	P	Credit	Hours
Theory										
1	BSC	Chemistry	30	70	100	3	1	0	4	4
2	BSC	Mathematics –I (Calculus and Differential Equations)	30	70	100	3	1	0	4	4
3	ESC	Programming for Problem Solving	30	70	100	3	0	0	3	3
4	ESC	Workshop Manufacturing Practices	30	70	100	1	0	0	1	1
5	HSMC	English	30	70	100	2	0	0	2	2
Practical										
1	BSC	Chemistry	20	30	50	0	0	3	1.5	3
2	ESC	Programming for Problem Solving	20	30	50	0	0	4	2	4
3	ESC	Workshop Manufacturing Practices	20	30	50	0	0	4	2	4
4	HSMC	English	20	30	50	0	0	2	1	2
	Total				700				20.5	27

TOTAL MARKS: 700 **TOTAL CREDITS: 20.5** **TOTAL HOURS: 27**

SEMESTER – II

Sl. No.	Course Code	Course Title	IA	ESE	TOTAL	L	T	P	Credit	Hours
Theory										
1	BSC	Physics (Wave and Optics and Introduction to Quantum Mechanics)	30	70	100	3	1	0	4	4
2	BSC	Mathematics –II (Linear Algebra, Transform Calculus and Numerical Methods)	30	70	100	3	1	0	4	4
3	ESC	Basic Electrical Engineering	30	70	100	3	1	0	4	4
4	ESC	Engineering Graphics & Design	30	70	100	1	0	0	1	1
Practical										
1	BSC	Physics (Wave and Optics and Introduction to Quantum Mechanics)	20	30	50	0	0	3	1.5	3
2	ESC	Basic Electrical Engineering	20	30	50	0	0	2	1	2
3	ESC	Engineering Graphics & Design	20	30	50	0	0	4	2	4
	Total				550				17.5	22

TOTAL MARKS: 550 **TOTAL CREDITS: 17.5** **TOTAL HOURS: 22**

IA (INTERNAL ASSESMENT), ESE (END SEMESTER EXAMINATION)

CREDIT TABLE

FOR

104 – ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER – I

Sl. No.	Course Code	Course Title	IA	ESE	TOTAL	L	T	P	Credit	Hours
Theory										
1	BSC	Chemistry	30	70	100	3	1	0	4	4
2	BSC	Mathematics –I (Calculus and Differential Equations)	30	70	100	3	1	0	4	4
3	ESC	Programming for Problem Solving	30	70	100	3	0	0	3	3
4	ESC	Workshop Manufacturing Practices	30	70	100	1	0	0	1	1
5	HSMC	English	30	70	100	2	0	0	2	2
Practical										
1	BSC	Chemistry	20	30	50	0	0	3	1.5	3
2	ESC	Programming for Problem Solving	20	30	50	0	0	4	2	4
3	ESC	Workshop Manufacturing Practices	20	30	50	0	0	4	2	4
4	HSMC	English	20	30	50	0	0	2	1	2
	Total				700				20.5	27

TOTAL MARKS: 700 **TOTAL CREDITS: 20.5** **TOTAL HOURS: 27**

SEMESTER – II

Sl. No.	Course Code	Course Title	IA	ESE	TOTAL	L	T	P	Credit	Hours
Theory										
1	BSC	Physics (Wave and Optics and Introduction to Quantum Mechanics)	30	70	100	3	1	0	4	4
2	BSC	Mathematics –II (Linear Algebra, Transform Calculus and Numerical Methods)	30	70	100	3	1	0	4	4
3	ESC	Basic Electrical Engineering	30	70	100	3	1	0	4	4
4	ESC	Engineering Graphics & Design	30	70	100	1	0	0	1	1
Practical										
1	BSC	Physics (Wave and Optics and Introduction to Quantum Mechanics)	20	30	50	0	0	3	1.5	3
2	ESC	Basic Electrical Engineering	20	30	50	0	0	2	1	2
3	ESC	Engineering Graphics & Design	20	30	50	0	0	4	2	4
	Total				550				17.5	22

TOTAL MARKS: 550 **TOTAL CREDITS: 17.5** **TOTAL HOURS: 22**

IA (INTERNAL ASSESMENT), ESE (END SEMESTER EXAMINATION)

CREDIT TABLE

FOR

105 – COMPUTER SCIENCE & ENGINEERING

SEMESTER – I

Sl. No.	Course Code	Course Title	IA	ESE	TOTAL	L	T	P	Credit	Hours
Theory										
1	BSC	Chemistry	30	70	100	3	1	0	4	4
2	BSC	Mathematics –I (Calculus and Linear Algebra)	30	70	100	3	1	0	4	4
3	ESC	Programming for Problem Solving	30	70	100	3	0	0	3	3
4	ESC	Workshop Manufacturing Practices	30	70	100	1	0	0	1	1
5	HSMC	English	30	70	100	2	0	0	2	2
Practical										
1	BSC	Chemistry	20	30	50	0	0	3	1.5	3
2	ESC	Programming for Problem Solving	20	30	50	0	0	4	2	4
3	ESC	Workshop Manufacturing Practices	20	30	50	0	0	4	2	4
4	HSMC	English	20	30	50	0	0	2	1	2
	Total				700				20.5	27

TOTAL MARKS: 700 **TOTAL CREDITS: 20.5** **TOTAL HOURS: 27**

SEMESTER – II

Sl. No.	Course Code	Course Title	IA	ESE	TOTAL	L	T	P	Credit	Hours
Theory										
1	BSC	Physics (Semiconductor Physics)	30	70	100	3	1	0	4	4
2	BSC	Mathematics –II (Probability and Statistics)	30	70	100	3	1	0	4	4
3	ESC	Basic Electrical Engineering	30	70	100	3	1	0	4	4
4	ESC	Engineering Graphics & Design	30	70	100	1	0	0	1	1
Practical										
1	BSC	Physics (Semiconductor Physics)	20	30	50	0	0	3	1.5	3
2	ESC	Basic Electrical Engineering	20	30	50	0	0	2	1	2
3	ESC	Engineering Graphics & Design	20	30	50	0	0	4	2	4
	Total				550				17.5	22

TOTAL MARKS: 550 **TOTAL CREDITS: 17.5** **TOTAL HOURS: 22**

IA (INTERNAL ASSESMENT), ESE (END SEMESTER EXAMINATION)

CREDIT TABLE
FOR
106 – INFORMATION TECHNOLOGY & ENGINEERING

SEMESTER – I

Sl. No.	Course Code	Course Title	IA	ESE	TOTAL	L	T	P	Credit	Hours
Theory										
1	BSC	Physics (Semiconductor Physics)	30	70	100	3	1	0	4	4
2	BSC	Mathematics –I (Calculus and Linear Algebra)	30	70	100	3	1	0	4	4
3	ESC	Basic Electrical Engineering	30	70	100	3	1	0	4	4
4	ESC	Engineering Graphics & Design	30	70	100	1	0	0	1	1
Practical										
1	BSC	Physics (Semiconductor Physics)	20	30	50	0	0	3	1.5	3
2	ESC	Basic Electrical Engineering	20	30	50	0	0	2	1	2
3	ESC	Engineering Graphics & Design	20	30	50	0	0	4	2	4
	Total				550				17.5	22

TOTAL MARKS: 550 **TOTAL CREDITS: 17.5** **TOTAL HOURS: 22**

SEMESTER – II

Sl. No.	Course Code	Course Title	IA	ESE	TOTAL	L	T	P	Credit	Hours
Theory										
1	BSC	Chemistry	30	70	100	3	1	0	4	4
2	BSC	Mathematics –II (Probability and Statistics)	30	70	100	3	1	0	4	4
3	ESC	Programming for Problem Solving	30	70	100	3	0	0	3	3
4	ESC	Workshop Manufacturing Practices	30	70	100	1	0	0	1	1
5	HSMC	English	30	70	100	2	0	0	2	2
Practical										
1	BSC	Chemistry	20	30	50	0	0	3	1.5	3
2	ESC	Programming for Problem Solving	20	30	50	0	0	4	2	4
3	ESC	Workshop Manufacturing Practices	20	30	50	0	0	4	2	4
4	HSMC	English	20	30	50	0	0	2	1	2
	Total				700				20.5	27

TOTAL MARKS: 700 **TOTAL CREDITS: 20.5** **TOTAL HOURS: 27**

IA (INTERNAL ASSESMENT), ESE (END SEMESTER EXAMINATION)

CREDIT TABLE
FOR
107 – LEATHER TECHNOLOGY & ENGINEERING

SEMESTER – I

Sl. No.	Course Code	Course Title	IA	ESE	TOTAL	L	T	P	Credit	Hours
Theory										
1	BSC	Physics (Electromagnetism)	30	70	100	3	1	0	4	4
2	BSC	Mathematics –I (Calculus and Linear Algebra)	30	70	100	3	1	0	4	4
3	ESC	Basic Electrical Engineering	30	70	100	3	1	0	4	4
4	ESC	Engineering Graphics & Design	30	70	100	1	0	0	1	1
Practical										
1	BSC	Physics (Electromagnetism)	20	30	50	0	0	3	1.5	3
2	ESC	Basic Electrical Engineering	20	30	50	0	0	2	1	2
3	ESC	Engineering Graphics & Design	20	30	50	0	0	4	2	4
	Total				550				17.5	22

TOTAL MARKS: 550 **TOTAL CREDITS: 17.5** **TOTAL HOURS: 22**

SEMESTER – II

Sl. No.	Course Code	Course Title	IA	ESE	TOTAL	L	T	P	Credit	Hours
Theory										
1	BSC	Chemistry	30	70	100	3	1	0	4	4
2	BSC	Mathematics –II (ODE & Complex Variables)	30	70	100	3	1	0	4	4
3	ESC	Programming for Problem Solving	30	70	100	3	0	0	3	3
4	ESC	Workshop Manufacturing Practices	30	70	100	1	0	0	1	1
5	HSMC	English	30	70	100	2	0	0	2	2
Practical										
1	BSC	Chemistry	20	30	50	0	0	3	1.5	3
2	ESC	Programming for Problem Solving	20	30	50	0	0	4	2	4
3	ESC	Workshop Manufacturing Practices	20	30	50	0	0	4	2	4
4	HSMC	English	20	30	50	0	0	2	1	2
	Total				700				20.5	27

TOTAL MARKS: 700 **TOTAL CREDITS: 20.5** **TOTAL HOURS: 27**

IA (INTERNAL ASSESMENT), ESE (END SEMESTER EXAMINATION)

CREDIT TABLE

FOR

110 – ELECTRICAL AND ELECTRONICS ENGINEERING

SEMESTER – I

Sl. No.	Course Code	Course Title	IA	ESE	TOTAL	L	T	P	Credit	Hours
Theory										
1	BSC	Chemistry	30	70	100	3	1	0	4	4
2	BSC	Mathematics –I (Calculus and Differential Equations)	30	70	100	3	1	0	4	4
3	ESC	Programming for Problem Solving	30	70	100	3	0	0	3	3
4	ESC	Workshop Manufacturing Practices	30	70	100	1	0	0	1	1
5	HSMC	English	30	70	100	2	0	0	2	2
Practical										
1	BSC	Chemistry	20	30	50	0	0	3	1.5	3
2	ESC	Programming for Problem Solving	20	30	50	0	0	4	2	4
3	ESC	Workshop Manufacturing Practices	20	30	50	0	0	4	2	4
4	HSMC	English	20	30	50	0	0	2	1	2
	Total				700				20.5	27

TOTAL MARKS: 700 **TOTAL CREDITS: 20.5** **TOTAL HOURS: 27**

SEMESTER – II

Sl. No.	Course Code	Course Title	IA	ESE	TOTAL	L	T	P	Credit	Hours
Theory										
1	BSC	Physics (Wave and Optics, Introduction to Quantum Mechanics)	30	70	100	3	1	0	4	4
2	BSC	Mathematics –II (Linear Algebra, Transform Calculus and Numerical Methods)	30	70	100	3	1	0	4	4
3	ESC	Basic Electrical Engineering	30	70	100	3	1	0	4	4
4	ESC	Engineering Graphics & Design	30	70	100	1	0	0	1	1
Practical										
1	BSC	Physics (Wave and Optics, Introduction to Quantum Mechanics)	20	30	50	0	0	3	1.5	3
2	ESC	Basic Electrical Engineering	20	30	50	0	0	2	1	2
3	ESC	Engineering Graphics & Design	20	30	50	0	0	4	2	4
	Total				550				17.5	22

TOTAL MARKS: 550 **TOTAL CREDITS: 17.5** **TOTAL HOURS: 22**

IA (INTERNAL ASSESMENT), ESE (END SEMESTER EXAMINATION)

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