

**SYLLABUS**  
**Of B.Sc Computer Science**  
**Batch 2013 onwards**



**Punjab Technical University**

**SCHEME AND SYLLABUS OF B.SC (COMPUTER SCIENCE) FOR THE BATCH 2013 ONWARDS**

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	External	Internal		
<b>Semester I</b>								
BCS-101	Algebra	3	1	0	60	40	100	4
BCS-102	Calculus	3	1	0	60	40	100	4
BCS-103	Classical Mechanics	3	1	0	60	40	100	4
BCS-104	Electrodynamics	3	1	0	60	40	100	4
BCS-105	Fundamentals of Information Technology	4	0	0	60	40	100	4
BCS-106	Problem Solving and Programming in C	4	0	0	60	40	100	4
BCS-107	Physics Lab (Based on BCS-103 & BCS-104)	0	0	4	60	40	100	2
BCS-108	Computer Lab (Based on BCS-105 & 106)	0	0	4	60	40	100	2
BCS-109	Communicative English-I	3	0	0	60	40	100	3
<b>Total</b>		<b>23</b>	<b>4</b>	<b>8</b>	<b>540</b>	<b>360</b>	<b>900</b>	<b>31</b>
<b>Semester II</b>								
BCS-201	Partial Differentiation & Differential Equations	3	1	0	60	40	100	4
BCS-202	Coordinate Geometry	3	1	0	60	40	100	4
BCS-203	Theory of Relativity & Electromagnetism	3	1	0	60	40	100	4
BCS-204	Theory of Waves & Oscillations	3	1	0	60	40	100	4
BCS-205	Object Oriented Programming in C++	4	0	0	60	40	100	4
BCS-206	Computer System Architecture	4	0	0	60	40	100	4
BCS-207	Physics Lab (Based on BCS-203 & BCS-204)	0	0	4	60	40	100	2
BCS-208	Computer Lab (Based on BCS-205 & BCS-206)	0	0	4	60	40	100	2
BCS-209	Communicative English-II	3	0	0	60	40	100	3
<b>Total</b>		<b>23</b>	<b>4</b>	<b>8</b>	<b>540</b>	<b>360</b>	<b>900</b>	<b>31</b>
<b>Semester III</b>								
BCS-301	Solid Geometry	3	1	0	60	40	100	4
BCS-302	Sequence Series and Calculus	3	1	0	60	40	100	4
BCS-303	Optics	3	1	0	60	40	100	4
BCS-304	Statistical Physics & Thermodynamics	3	1	0	60	40	100	4
BCS-305	Data Structures	4	0	0	60	40	100	4
BCS-306	Database Management Systems	4	0	0	60	40	100	4
BCS-307	Physics Lab (Based on BCS-303 & BCS-304)	0	0	4	60	40	100	2
BCS-308	Computer Lab (Based on BCS-305 & BCS-306)	0	0	4	60	40	100	2
HVPE-101	Human Values & Professional Ethics	3	0	0	60	40	100	3
<b>Total</b>		<b>23</b>	<b>4</b>	<b>8</b>	<b>540</b>	<b>360</b>	<b>900</b>	<b>31</b>

Semester IV								
BCS-401	Number Theory	3	1	0	60	40	100	4
BCS-402	Fundamentals of Statics	3	1	0	60	40	100	4
BCS-403	Atomic Molecular & Spectroscopy	3	1	0	60	40	100	4
BCS-404	Quantum Mechanics	3	1	0	60	40	100	4
BCS-405	Operating Systems	4	0	0	60	40	100	4
BCS-406	Data Communication & Computer Networks	4	0	0	60	40	100	4
BCS-407	Physics Lab (Based on BCS-403 & BCS-404)	0	0	4	60	40	100	2
BCS-408	Computer Lab (Based on BCS-405 & BCS-406)	0	0	4	60	40	100	2
EVSC-101	Environment Science	3	0	0	60	40	100	3
<b>Total</b>		<b>23</b>	<b>4</b>	<b>8</b>	<b>540</b>	<b>360</b>	<b>900</b>	<b>31</b>
Semester V								
BCS-501	Numerical Analysis	3	1	0	60	40	100	4
BCS-502	Fundamentals of Dynamics	3	1	0	60	40	100	4
BCS-503	Condensed Matter Physics	3	1	0	60	40	100	4
BCS-504	Electronics	3	1	0	60	40	100	4
BCS-505	Programming in Java	4	0	0	60	40	100	4
BCS-506	Software Engineering	4	0	0	60	40	100	4
BCS-507	Physics Lab (Based on BCS-503 & BCS-504)	0	0	4	60	40	100	2
BCS-508	Computer Lab (Based on BCS-505 & BCS-506)	0	0	4	60	40	100	2
<b>Total</b>		<b>20</b>	<b>4</b>	<b>8</b>	<b>480</b>	<b>320</b>	<b>800</b>	<b>28</b>
Semester VI								
BCS-601	Real Analysis	3	1	0	60	40	100	4
BCS-602	Linear Algebra	3	1	0	60	40	100	4
BCS-603	Nuclear Physics	3	1	0	60	40	100	4
BCS-604	Particle Physics	3	1	0	60	40	100	4
BCS-605	Multimedia	4	0	0	60	40	100	4
BCS-606	Computer Graphics	4	0	0	60	40	100	4
BCS-607	Physics Lab	0	0	4	60	40	100	2
BCS-608	Minor Project Work (Based on BCS-306 & BCS-505)	0	0	4	0	100	100	4
<b>Total</b>		<b>20</b>	<b>4</b>	<b>8</b>	<b>420</b>	<b>380</b>	<b>800</b>	<b>30</b>

# *First Semester*

## **BCS-101**

### **ALGEBRA**

#### SECTION A

Euclid's algorithm, synthetic division, roots and their multiplicity. Complex roots of real polynomials occur in conjugate pairs with same multiplicity. Relations between the roots and coefficients of general polynomial equation in one variable. Transformation of equations, symmetric functions of roots and sum of integral powers of roots. Solution of cubic equations by Cardon method, solution of biquadratic equations by Descarte's and Ferrari's Methods. Descarte's rule of signs, Newton's Method of divisors and Newton's Method of Approximation. Hermitian, Skew-hermitian, Orthogonal and Unitary Matrices.

Rank of a Matrix, Elementary Transmation and rank of Matrix, Rank of product of two Matrices. Computation of Inverse of a Matrix with Elementary Transmations.

#### SECTION B

Linear independence of row and column vectors. Row rank, Column rank of a matrix, Equivalence of column and row ranks, Nullity of matrix, Applications of matrices to a system of linear (both homogeneous and non-homogeneous) equations. Theorems on consistency of a system of linear equations. Eigen values, Eigen vectors, minimal and the characteristic equation of a matrix. Cayley Hamilton theorem and its use in finding inverse of a matrix.

#### **Suggested Readings**

- K.B. Dutta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi (2002).
- DR Sharma: Algebra and Trignometry, Sharma Publicatons.
- H.S. Hall and S.R. Knight: Higher Algebra, H.M. Publications, 1994.
- Chandrika Parsad : Text book on Algebra and Theory of Equations, Pothishala Pvt. Ltd.,Allahabad.
- S.L. Loney : Plane Trigonometry Part–II, Macmillan and Company, London.
- Shanti Narayan : Text Book of Matrix.

INTERNAL MARKS- 40

EXTERNAL MARKS- 60

## **BCS-102 CALCULUS**

### **SECTION-A**

Absolute Values and Inequations, **Bounds** : l.u.b., g.l.b. of sets of real numbers. Limit of a function, uniqueness of limit, Algebra of limits, limit from definition.

**Continuity** : Theorem on Composite Functions, Sign of Function in Neighbourhood of Points of Continuity, Bolzano Root Location Theorem, Intermediate Value Theorem (or Darboux Property), Cantor Theorem on Nested Intervals, Maximum and Minimum Values Theorem. Uniform continuity, differentiation of hyperbolic functions.

### **SECTION-B**

Successive differentiation. Leibnitz theorem. Taylor's and Maclaurin's theorem with various forms of remainders. Indeterminate forms. Tests for concavity and convexity, Points of inflexion, Multiple Points. Asymptotes (Cartesian, Parametric and Polar coordinate). Tracing of Curves (Cartesian, Parametric and polar coordinates)

### **Suggested Readings**

- N. Piskunov : Differential and Integral Calculus, Peace Publishers, Moscow.
- Gorakh Prasad : Differential Calculus, Pothishala Pvt. Ltd., Allahabad.
- Erwin Kreyszig : Advanced Engineering Mathematics, John Wiley and Sons, 1999.
- DR Sharma: Calculus, Sharma Publications

INTERNAL MARKS- 40

EXTERNAL MARKS- 60

## **BCS-103**

# **CLASSICAL MECHANICS**

### **SECTION-A**

Coordinate Systems:- Cartesian and spherical polar co-ordinate systems, area, volume, velocity and Acceleration in these systems. Solid angle, Relationship of conservation laws and symmetries of space and time.

Forces in Nature :- Brief introduction, centre of mass, equivalent one body problem, central forces, equation of motion under central force, equation of orbit and turning point s. Kepler Laws. Concept of Ether and Michel son-Morley experiment.

### **SECTION-B**

Frames of References :- Inertial frame of reference. Galilean transformation and Invariance. Non Internal frames, coriolis force and its application. Variation of acceleration due to gravity with latitude. Foucault pendulum.

Special Theory of Relativity :- Postulates of Special Theory of Relativity , Lorentz Transformations , observer and viewer in relativity. Relativity of simultaneity , Length , Time , Velocities. Doppler effect . Variation of mass with velocity , mass – energy relationship , relativistic momentum and energy , their transformation, concepts of Minkowski space, four vector formulation.

### **Suggested Readings**

- Mechanics by H.S. Hans & S.P. Puri, 3<sup>rd</sup> Ed, TMH
- Schaum's Theory and Problems of Theoretical Mechanics by Murray R. Spiegel
- Mechanics by LD Landau and EM Lifshitz, 3<sup>rd</sup> Ed, Butterworth-Heinemann

INTERNAL MARKS- 40

EXTERNAL MARKS- 60

## **BCS-104**

### **ELECTRODYNAMICS**

#### **SECTION-A**

Vector Calculus :- Basic ideas of Vector Calculus Gradient, Divergence, curl and their physical significance. Laplacian in rectangular, cylindrical spherical coordinates.

Electrostatic :- Coulomb's Law for point charges and continuous distribution of charges. Electric field due to dipole, line charge and sheet of charge. Electric flux, Gauss's Law and its applications. Gauss's divergence theorem and differential form of Gauss's Law. Green's theorem.

Electric Field :- Work and potential difference. Potential difference as line integral of field. Electric potential due to a point charge a group of point charges, dipole and quadruple moments, long uniformly charged wire, charged disc. Stoke's theorem and its applications in Electrostatic field,  $\text{curl } E=0$ . Electric fields as gradient of scalar potential. Calculation of E due to a point charge and dipole from potential. Potential due to arbitrary charge distribution and multipole moments.

#### **SECTION-B**

Special Techniques :- Poisson and Laplace's equation and their solutions in Cartesian and spherical coordinates. Concept of electrical image. Calculation of electric potential and field due to a point charge placed near an infinitely conducting sheet.

Electric Current :- Current and current density, equation of continuity. Microscopic form of Ohm's Law ( $J = \sigma E$ ) and conductivity, Failure of Ohm's Law. Invariance of charge.

Electric Fields in different frames of reference:- Field of a point charge moving with constant velocity. Interaction between moving charges and force between parallel currents. Behaviour of various substances in magnetic field. Definition of M and H and their relation of free and bound currents. Permeability and susceptibility and their interrelationship. Orbital motion of electrons and diamagnetism.

#### **Suggested Readings**

- Fundamentals of Electricity and Magnetism by Arthur F. Kipp.
- Electricity and Magnetism, Berkeley Physics Course, Vol. II by E.M. Purcell.
- Introduction to Classical Electrodynamics by David Griffith.
- EM Waves and Radiating System by Edward C. Jordan and K.G. Balmain.
- Fields and Waves Electromagnetic by David K. Cheng.



INTERNAL MARKS- 40

EXTERNAL MARKS- 60

## BCS-105

# FUNDAMENTALS OF INFORMATION TECHNOLOGY

### SECTION- A

**Computer Fundamentals:** Block structure of a computer, characteristics of computers, problem solving with computers, generations of computers, and classification of computers on the basis of capacity, purpose, and generation. **Number System:** Bit, byte, binary, decimal, hexadecimal, and octal systems, conversion from one system to the other, representation of characters, integers and fractions.

**Binary Arithmetic:** Addition, subtraction and multiplication. **Memory Types:** Magnetic core, RAM, ROM, Secondary, Cache, Bubble Memory. **Input and Output Units:** Keyboard, Mouse, Monitor (CRT and LCD): Light pen, joystick, Mouse, Touch screen; OCR, OMR, MICR. **Overview of storage devices:** Floppy disk, hard disk, compact disk, DVD, tape. **Printers:** Impact, non-impact, working mechanism of Drum printer, Dot Matrix printer, Inkjet printer and Laser printer. **Computer languages:** Machine language, assembly language, higher level language and 4GL. **Software:** System Software, application software and open source software, Introduction to Compiler, Interpreter and Assembler,

### SECTION - B

**Operating system:** Batch, multi-programming, time sharing, network operating system, on-line and real time operating system, Distributed operating system, multi-processor, Multi-tasking and multiprogramming. **Graphical OS:** Fundamentals of windows, types of windows, anatomy of windows, windows explorer, customizing windows, control panel, taskbar setting, Network settings, Introduction to UNIX/Linux.

#### **Personal Productivity Software:**

**Word processing:** Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors.

**Spreadsheet :** Workbook, worksheets, data types, operators, cell formats, freeze

panes, editing features, formatting features, creating formulas, using formulas, cell references, replication, sorting, filtering, functions, Charts & Graphs.

**Presentation Graphics Software:** Templates, views, formatting slides, slides with graphs, animation, using special features, presenting slide shows.

**Computer Network and Communication:** Network types, network topologies, network communication devices, physical communication media. **Internet and its**

**Applications:** E-mail, TELNET, FTP, World Wide Web, Internet chatting; Intranet, Extranet, Gopher, Mosaic, WAIS. **Security management tools:** PC tools, Norton Utilities, Virus, worms, threats, virus detection, prevention and cure utilities, firewalls, proxy.

### **Suggested Readings**

1. **“Fundamentals of Computers”**, PK Sinha, 6<sup>th</sup> Edition, BPB Publications, New Delhi
2. **“Fundamentals of Computers”**, V. Rajaraman, 4<sup>th</sup> Edition, Prentice Hall of India, New Delhi.
3. **“Information Technology”**, Satish Jain, 7<sup>th</sup> Edition, BPB.
4. **“Computers Today”**, D. H. Sanders, Fourth Edition, McGraw Hill.

INTERNAL MARKS- 40

EXTERNAL MARKS- 60

## **BCS-106**

# **PROBLEM SOLVING AND PROGRAMMING IN C**

### **SECTION –A**

**Algorithm and Programming Development:** Steps in development of a program, Flow charts, Algorithm Development, Program Debugging, Compilation and Execution.

**Fundamentals of C:** I/O statements, Assignment Statements, Constants, Variables, Operators and Expressions, Standards and Formatted statements, Keywords, Data Types and Identifiers. **Control Structures:** Introduction, Decision making with if –statement, if-else and Nested if, while and do-while, for loop. Jump statements: break, continue, goto, switch Statement **Functions:** Introduction to Functions, Function Declaration, Function Categories, Standard Functions, Parameters and Parameter Passing, Call– by value/reference, Recursion, Global and Local Variables, Storage classes.

### **SECTION-B**

**Arrays:** Introduction to Arrays, Array Declaration, Single and Multidimensional Array, Memory Representation, Matrices, Strings, String handling functions.

**Structure and Union:** Declaration of structure, Accessing structure members, Structure Initialization, Arrays of structure, nested structures, Unions **Pointers:** Introduction to Pointers, Address operator and pointers, Declaring and Initializing pointers, Assignment through pointers, Pointers and Arrays

**Files:** Introduction, Creating a data file, opening and closing a data file, processing a data file. **Preprocessor Directives:** Introduction and Use, Macros, Conditional Preprocessors, Header Files

## Suggested Readings

1. **Fundamentals of Computer Programming**, Anita Goel, Pearson, 2012
2. **Let us C**, Yashvant P Kanetkar, Twelfth Edition, BPB Publications, New Delhi.
3. **Programming in ANSI C**, E. Balagurusami, Fifth Edition, Tata McGraw Hill
4. **Programming in C**, Byron S. Gottfried, Third Edition, McGraw Hill.
5. **Application Programming in C**, 4<sup>th</sup> edition, RS Salaria, Khanna Publishers
6. **Programming in C**, Byron S. Gottfried, 3<sup>rd</sup> Edition, McGraw Hill.
7. **Programming in C**, Ashok Kamthane, Pearson, 2011
8. **C Programming Language**, Kerighan & Richie, 2<sup>nd</sup> ed., PHI

## **BCS-107**

### **PHYSICS LAB**

#### **Practicals Based on BCS-103 & BCS-104**

- Exercise on fitting of given data to straight line and calculation of probable error.
- To study the dependence of moment of inertia on distribution of mass (by noting time periods of oscillations using objects of various geometrical shapes but of same mass).
- To establish relationship between torque and angular acceleration using fly wheel.
- To find the moment of inertia of a flywheel.
- Study of bending of beams and determination of young's Modulus.
- Determination of Poissons or rubber plastic.
- To find young's modulus, modulus of rigidity & Poisson ratio by Searle's method.
- To study flow of water through capillary tubes of different length and area of cross section of  
(at least two each) and calculate coefficient of viscosity.
- To determine energy transfer, coefficient of restitution and verify laws of conservation of  
linear momentum and kinetic energy in elastic collisions using one dimensional collisions of hanging spheres.
- Melde's experiment
- Kundt's tube.
- Measure time period as a function of distance of centre of suspension (oscillation) from  
centre of mass, plot relevant graphs, determine radius of gyration and acceleration due to gravity.
- Find the value of g by Caterer's pendulum.
- To compare the M.I. of solid & hollow sphere of same mass using tensional pendulum
- Measure time period of oscillation of a Maxwell needle and determine modulus of rigidity of the material of a given wire.
- To measure obtain logarithmic decrement, coefficient of damping, relaxation time, and quality factor of a damped simple pendulum.

INTERNAL MARKS- 40  
EXTERNAL MARKS- 60

## **BCS-108**

### **COMPUTER LAB**

#### **Practicals Based on BCS-105 & BCS-106**

1. Practical Based on operating system (windows/unix)
2. Use of word processing software, spread sheet software and presentation software
3. Keywords and Identifiers: introduction, purpose
4. Variables and constants: data types, Initialization, declaration, scope, memory limits
5. Input-output statements: formatted and non-formatted statements
6. Operators: Arithmetic, logical, conditional, assignment, bitwise increment/decrement operators
7. Decision Making: switch, if-else, nested if, else-if ladder, break, continue, goto
8. Loops: while, do-while, for
9. Functions: definition, declaration, variable scope, parameterized functions,
10. return statement, call by value, call by reference, recursive functions
11. Pre-processor Directives: Pre-processor directives like INCLUDE, #ifdef, #define, etc
12. Header Files: STDIO.H, MATH.H, STRING.H, PROCESS.H etc
13. Arrays: Array declarations, Single and multi-dimensional, memory limits, strings
14. and string functions
15. Pointers: Pointer declarations, pointer to function, pointer to array/string,
16. Files: Creation and editing of various types of files, closing a file( using functions and without functions)

INTERNAL MARKS- 40

EXTERNAL MARKS- 60

## **BCS-109**

### **COMMUNICATIVE ENGLISH-I**

#### **SECTION-A**

English Language: Sentence, Parts of speech, Tenses, Active passive voice, Direct Indirect speech, Creative writing& vocabulary, Comprehension passage, Reading of biographies of at least 10 IT business personalities (can be a home assignment or classroom reading). Business communication-Types, Medias, Objectives, Modals, Process, Importance Understanding Barriers to communication & ways to handle and improve barriers.

#### **SECTION B**

Presentation skills-Its Purpose in business world, How to find material for presentation, How to sequence the speech with proper introduction and conclusion, How to Prepare PPT& Complete set of required body language while delivering presentation. Reading & writing skills- Importance of reading and writing, improving writing skills through understanding and practicing Notice, E-mail, Tenders, Advertisement, formal letter. Listening skills-Its importance as individual and as a leader or as a worker, Its types, barriers to listening & remedies to improve listening barriers. Non verbal Communication- understanding what is called non verbal communication, its importance as an individual, as a student, as a worker and as a leader, its types.

#### **Suggested Readings/ Books**

1. Vandana R Singh, The Written Word, Oxford University Press, New Delhi
2. KK Ramchandran, et al Business Communication, Macmillan, New Delhi
3. Swati Samantaray, Busines Commnication and Commnicative English, Sultan Chand, New Delhi.
4. S.P. Dhanavel, English and Communication Skills for Students of Science and Engineering (with audio CD)
5. Wren & Martin, High School Grammar, S. Chand & Co Ltd, New Delhi.

*Second Semester*



INTERNAL MARKS- 40

EXTERNAL MARKS- 60

## **BCS-201**

# **PARTIAL DIFFERENTIATION & DIFFERENTIAL EQUATIONS**

### **SECTION A**

Limit and Continuity of Functions of several variables. Differentiability of real-valued functions of two variables. Partial differentiation, Euler's theorem on homogenous functions.

### **SECTION B**

Exact differential equations, First order and higher degree equations solvable for  $x$ ,  $y$ ,  $p$ . Clairaut's form and singular solutions. Geometrical meaning of a differential equation. Orthogonal trajectories. Linear differential equations with constant and variable coefficients. Variation of Parameters method, Reduction method, series solutions of differential equations. Power series method, Bessel and Legendre equations. (only series solution).

### **Suggested Readings**

- D.A. Murray: Introductory Course in Differential Equations. Orient Longman (India)
- G.F. Simmons: Differential Equations, Tata McGraw Hill
- E.A. Coddington: An Introduction to Ordinary Differential Equations, Prentice Hall of India, 1961.
- Gorakh Prasad: Integral Calculus, Pothishala Pvt. Ltd., Allahabad.
- Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley and Sons
- Partial Differentiation & Differential Equations by DR Sharma, Sharma Publications.

INTERNAL MARKS- 40

EXTERNAL MARKS- 60

## **BCS-202**

### **COORDINATE GEOMETRY**

#### **SECTION-A**

**Transformation of Axes in Two Dimensions** : Shifting of origin, rotation of axes, invariants. **Pair of Straight Lines** : Joint equation of pair of straight lines and angle between them, Condition of parallelism and perpendicularity, Joint equation of the angle bisectors, Joint equation of lines joining origin to the intersection of a line and a curve.

**Circle** : General equation of circle, Circle through intersection of two lines, Tangents, normals, chord of contact, pole and polar, pair of tangents from a point, equation of chord in terms of mid-point, angle of intersection and orthogonality, power of a point with respect to circle, radical axis, co-axial family of circles, limiting points.

#### **SECTION-B**

**Parabola, Ellipse and Hyperbola** : Parabola, Ellipse and Hyperbola and their properties. Tangents, normals, chord of contact, pole and polar, pair of tangents from a point, equation of chord in terms of mid-point, diameter. Conjugate diameters of ellipse and hyperbola, special properties of parabola, ellipse and hyperbola, conjugate hyperbola, asymptotes of hyperbola, rectangular hyperbola. General Equation of Second Degree.

**Polar Co-ordinates** : Polar equation of a line, circle, conics, equations of chords, tangents and normals only.

#### **Suggested Readings**

- Jain, PK. & Ahmad, KA, Text Book of Analytical Geometry of Two Dimensions, New Age International Publishers, 2004.
- Allen, R.G.D., Mathematical Analysis for Economists, Macmillan India, Ltd. 2005.
- Grewal, B.S., Elementary Engineering Mathematics, Khanna Publishers, 2007.
- Coordinate Geometry by DR Sharma, Sharma Publications.

## **BCS-203**

# **THEORY OF RELATIVITY & ELECTROMAGNETISM**

### **SECTION-A**

Concepts of theory of relativity. Lorentz transformations, observer and viewer in relativity. Relativity of simultaneity, Length, Time, velocities. Relativistic Doppler effect.

Variation of mass with velocity, mass–energy equivalence, rest mass in an inelastic collision, relativistic momentum & energy, their transformation, concepts of Minkowski space, four vector formulation.

Physical interpretation of Maxwell's equations, E.M. waves and wave equation in a medium having finite permeability and permittivity but with conductivity  $\neq 0$ ). Poynting vector, Impedance of a dielectric to EM waves. EM waves in a conducting medium and Skin depth. EM wave velocity in a conductor and anomalous dispersion. Response of a conducting medium to EM waves. Reflection and transmission of EM waves at a boundary of two dielectric media for normal and oblique incidence.

### **SECTION-B**

Lorentz's force, Definition of B. Biot Savart's Law and its application to long straight wire, circular current loop and solenoid. Ampere's Circuital law and its application. Divergence and curl of B. Hall effect, expression and coefficient. Vector potential, Definition and derivation, current–density–definition, its use in calculation of charge in magnetic field at a current sheet. Transformation equation of E and B from one frame to another. Faraday's Law of EM induction, Displacement current, Maxwell's equations. Mutual inductance and reciprocity theorem. Self inductance, L for solenoid, Coupling of Electrical circuits. Analysis of LCR series and parallel resonant, circuits Q–factor, Power consumed, power factor.

#### **Suggested Readings:**

- Fundamentals of Vibrations and Waves by S.P. Puri.
- Physics of Vibrations and Waves by H.J. Pain.
- EM Waves and Radiating Systems by Edward C. Jordan and K.G. Balmain.
- Fields and Waves Electromagnetic by David K. Cheng.

INTERNAL MARKS- 40

EXTERNAL MARKS- 60

## **BCS-204**

# **THEORY OF WAVES & OSCILLATIONS**

### **SECTION-A**

Simply harmonic motion, energy of a SHO. Compound pendulum. Torsional pendulum  
Electrical Oscillations Transverse Vibrations of a mass on string, composition of two  
perpendicular SHM of same period and of period in ratio 1:2.

Decay of free Vibrations due to damping. Differential equation of motion, types of motion, types of  
damping. Determination of damping co-efficient– Logarithmic decrement, relaxation time  
and Q-Factor. Electromagnetic damping (Electrical oscillator).

### **SECTION-B**

Differential equation for forced mechanical and electrical oscillators. Transient and steady  
state behaviour. Displacement and velocity variation with driving force frequency, variation  
of phase with frequency, resonance. Power supplied to an oscillator and its variation with  
frequency. Q-value and band width. Q-value as an amplification factor. Stiffness coupled  
oscillators, Normal co-ordinates and normal modes of vibration. Inductance coupling of  
electrical Oscillators

Types of waves, wave equation (transverse) and its solution characteristic impedance of a  
string. Impedance matching. Reflection and Transmission of waves at boundary. Reflection  
and transmission of energy. Reflected and transmitted energy coefficients. Standing waves  
on a string of fixed length. Energy of vibration string. Wave and group velocity.

### **Suggested Readings**

- Fundamentals of Vibrations and Waves by S.P. Puri, 3<sup>rd</sup> ed.,TMH
- Physics of Vibrations and Waves by H.J. Pain, Wiley & Sons, 2005
- EM Waves and Radiating Systems by Edward C. Jordan and K.G. Balmain, 2<sup>ND</sup> Ed,PHI
- Fields and Waves Electromagnetic by David K. Cheng.
- Theory of Vibrations with Applications by William T. Thomson, Pearson, 2011

## **BCS-205**

### **OBJECT ORIENTED PROGRAMMING IN C++**

#### **SECTION-A**

**Introduction:** Object oriented programming approach, characteristics of object orientated languages, Bridging C & C++ (Overview of C Concepts). **Structures and Unions:** Declaration of structures, Accessing structure members, Structure Initialization, Arrays of structure, nested structures, structure with pointers, functions & structures, Unions, Structure/Union Versus Class in C++. **Class Declaration:** Data Members, Member Functions, Private and Public Members, Data Hiding and Encapsulation, Array within a class. **Class Function Definition:** Member Function definition inside the class and outside the class, Friend Function, Inline Function, Static Members & Functions, Scope Resolution Operator, Private and Public Member Functions, Nesting of Member Functions. Creating Objects, Accessing class data members, Accessing member functions, Arrays of Objects, Objects as function arguments: Pass by value, Pass by reference, Pointers to Objects. Constructors and Destructors: Declaration and Definition, Default Constructors, Parameterized Constructors, Constructor Overloading, Copy Constructors. Destructors: Definition and use.

#### **SECTION-B**

**Inheritance** - Extending Classes Concept of inheritance, Base class, Derived class, Defining derived classes, Visibility modes : Private, public, protected; Single inheritance: Privately derived, Publicly derived; Making a protected member inheritable, Access Control to private and protected members by member functions of a derived class, Multilevel inheritance, Nesting of classes.

**Function Overloading & Operator Overloading:** Binary & Unary. **Polymorphism:** Definition, early Binding, Polymorphism with pointers, Virtual Functions, late binding, pure virtual functions.

**Input/output files:** Streams, buffers & iostreams, header files, redirection, file input and output.

#### **Suggested Readings:**

1. Object Oriented Programming with C++, E. Balagurusami, Fourth Edition, Tata McGraw Hill
2. Object Oriented Programming in Turbo C++, Robert Lafore, Fourth Edition Galgotia Publications.
3. The C++ Programming Language, Bjarna Stroustrup, Third Edition, Addison-Wesley Publishing Company.
4. Object Oriented Programming Using C++, Salaria, R. S, Fourth Edition, Khanna Book Publishing

**BCS-206**  
**COMPUTER SYSTEM ARCHITECTURE**  
**SECTION-A**

**Introduction to Computer Organization:** Introduction to Computer and CPU (Computer Organization, Computer Design and Computer Architecture), Stored Program Concept- Von Neumann Architecture. Introduction to Flynn's Classification-SISD, SIMD, MIMD

**Register Transfer and Micro operations-** Introduction to Registers, Register Transfer Language, Data movement among Registers and Memory.

**Micro operations:** Introduction to micro operations, Types of micro operations--Logic Operations, Shift operations, Arithmetic and Shift operations.

**Common Bus System :** Introduction to Common Bus System, Types of Buses(Data Bus, Control Bus, Address Bus), 16 bit Common Bus System--Data Movement among registers using Bus.

**Basic Computer Instructions-** Introduction to Instruction, Types of Instructions (Memory Reference, I/O Reference and Register Reference), Instruction Cycle, Instruction Formats (Direct and Indirect Address Instructions, Zero Address, One Address, Two Address and Three Address Instructions)

**Interrupt:** Introduction to Interrupt and Interrupt Cycle.

**Design of Control Unit:** Introduction to Control Unit, Types of Control Unit (Hardwired & Micro programmed Control Unit). **Addressing Modes-**Introduction & different types of Addressing Modes.

**SECTION - B**

**I/O Organization:** I/O Interface Unit, types of ports (I/O port, Network Port, USB port, Serial and Parallel Port), Concept of I/O bus, Isolated I/O versus Memory Mapped I/O.

**I/O Data Transfer Techniques:** Programmed I/O, Interrupt Initiated I/O, DMA Controller and IOP. **Synchronous and Asynchronous Data Transfer:** Concept of strobe and handshaking, source and destination initiated data transfer. **Stack Organization:** Memory Stack and Register Stack

**Memory organization:** Memory Hierarchy, Main Memory (RAM and ROM chips, Logical and Physical Addresses, Memory Address Map, Memory Connection to CPU), AssociativeMemory **Cache Memory:** Cache Memory (Initialization of Cache Memory, Writing data into

Cache, Locality of Reference, Hit Ratio), Replacement Algorithms (LRU and FIFO). **Cache Memory Mapping Techniques:** Direct Mapping, Associative Mapping and Set-Associative Mapping. Harvard Architecture, Mobile Devices Architecture (Android, Symbian and Windows Lite), Layered Approach Architecture.

## **Suggested Readings**

1. **Computer System Architecture**, M.Morris Mano, Third Edition, Pearson, 2007
2. **Essentials of Computer Architecture**, Douglas E Comer, Pearson Education, 2008
3. **Computer Architecture and Organization**, Subrata Ghoshal, Pearson, 2011.
4. **Computer System Architecture**, Rop William, 2<sup>nd</sup> Edition, PHI
5. **Computer System Design and Architecture**, Vincent P Heuring, Pearson
6. **Computer Organization and Architecture**, J.P. Hayes, Third Edition, TMH
7. **Computer Organization and Architecture**, Stallings, Eighth Edition, PHI

## BCS-207

### PHYSICS LAB

#### Practicals Based on BCS-203 & BCS-204

- To determine low resistance with Carey Fosters Bridge.
- To determine the resistance and specific resistance of copper with the help of Kelvin's double bridge.
- To study the variation of resistance of a filament of a bulb with its temperature.
- To study the magnetic field produced by a current carrying solenoid using a search coil
- and calculate permeability of air.
- To study the induced e.m.f. as function of the velocity of the magnet.
- Study of phase relationships using impedance triangler for LCR circuit and calculate impedance.
- Resonance in a series and parallel LCR circuits for different R-value and calculate Q-value.
- Capacitance by flashing and quenching of a neon lamp.
- Measurement of Capacitance, determination of permittivity of a medium air and relative permittivity by de-Sauty's bridge.
- To determined I using Anderson Bridge.
- To find the coefficient of self inductance by Lay Leigh's Method.
- To measure the charge sensitivity of a moving coil Ballistic galvanometer using a known capacitor.
- To find the angle of dip in the lab using an earth inductor.
- To find the value of  $B_H$  the horizontal component of earth's magnetic field in the lab using a deflection & vibration magnetometer.
- To study the variation of magnetic field with distance along the axis of coil carrying current by plotting a graph.



INTERNAL MARKS- 40  
EXTERNAL MARKS- 60

## **BCS-208**

### **COMPUTER LAB**

#### **(Practicals Based on BCS-205 & BCS-206)**

1. **Structures:** Definition, declaration, scope, functions
2. **Union:** Definition, declaration, scope, functions
3. **Class:** Definition, declaration, members, scope of members,
4. **Class Function:** definition (Inside class, outside class), in-line functions, static function, friend functions, scope of functions(public, private), nesting of member functions
5. **Class Data members:** creating objects, accessing member functions, array of objects, objects as arguments( Pass by value, pass by reference)
6. **Constructor and destructor:** creating default constructor, parameterized constructor, copy constructor, destructor
7. **Inheritance:** base class, derived class, visibility mode (public, private, protected), single inheritance, multi-level inheritance, multiple inheritance, nesting of classes, access control to functions(with different scope),
8. Function overloading and overriding, operator overloading, Early binding, late binding, virtual functions, pure virtual functions
9. **Input/output files:** streams, buffers and io-streams, various input-output functions, processing files using class functions

## **BCS-209**

# **COMMUNICATIVE ENGLISH-II**

### **SECTION-A**

Introduction to Business Communication, Meaning and Definition; process and classification of communication; elements & characteristics of communication; barriers to effective communication in business organization; Formal and Informal communication; grapevine, importance of effective communication in business house; Principles of effective communication Writing Skills Inter-office memorandums; faxes; E-mails; Notices, Advertisement; writing effective sales letters - to agents; suppliers; customers; report writing; project writing;

### **SECTION-B**

Curriculum Vitae (CV) Drafting a CV; writing job application and other applications; do's and don'ts while appearing for an Interview; types of interview. Presentation Skills Introduction; need of good presentation skills in professional life; preparing a good presentations; group discussion; extempore speaking. Biographies of any five renowned personalities.

#### **Suggested Readings/ Books:**

- Effective Business Communication, M.V. RODRIGUEZ
- Business Communication, Meenakshi Raman, Parkash Singh, Paperback Edition, Oxford University Press.

*Third Semester*

## **BCS-301**

# **SOLID GEOMETRY**

### **SECTION-A**

Intersection of three planes, Condition for three planes to intersect in a point or along a line or to form a prism. Change of axes, Shift of origin, rotation of axes. Sphere, Section of a sphere by a plane, spheres of a given circle. Intersection of a line and a sphere. Tangent line, tangent plane, power of a point w.r.t. a sphere, radical planes.

### **SECTION-B**

Cylinder as surface generated by a line moving parallel to a fixed line and through fixed curve. Different kinds of cylinders such as right circular, elliptic, hyperbolic and parabolic in standard forms, Cone with a vertex at the origin as the graph of homogeneous equation of second degree in  $x, y, z$ . Cone as a surface generated by a line passing through a fixed curve and fixed point outside the plane of the curve, right circular and elliptic cones.

### **Suggested Readings**

1. Gorakh Prasad and H.C. Gupta, Text Book on Coordinate Geometry.
2. S.L. Loney, The Elements of Coordinate Geometry, Macmillan and Company, London.
3. Narayan, S.: Analytical Solid Geometry, Sultan Chand & Sons.
4. Kreyszig, E.: Advanced Engineering Mathematics.
5. Thomas, G.B. and Finney, R.L.: Calculus and Analytic Geometry.
6. Sharma, DR: Solid Geometry

## **BCS-302**

# **SEQUENCE SERIES AND CALCULUS**

### **SECTION-A**

Definition of a sequence. Theorems on limits of sequences. Bounded and monotonic sequences. Cauchy's convergence criterion. Series of non-negative terms. Comparison tests. Cauchy's integral tests. Ratio tests. Cauchy's root test. Raabe's test logarithmic test. De'morgan's and Bertrand's tests. Kummer's test, Cauchy Condensation test, Gauss test, alternative series. Leibnitz's test, absolute and conditional convergence.

### **SECTION-B**

Partitions, Upper and lower sums. Upper and lower integrals, Riemann integrability. Conditions of existence of Riemann integrability of continuous functions and of monotone functions. Algebra of integrable functions. Inequalities involving integrals. Improper integrals and statements of their conditions of existence. Test of the convergence of improper integrals, Beta and Gamma functions

### **Suggested Readings**

1. Malik, S.C.: Mathematical Analysis, Wiley Eastern Ltd.
2. Apostol, T.M.: Mathematical Analysis, Addison Wesley Series in Mathematics
3. Narayan, S.: Integral Calculus, Sultan Chand & Sons.
4. Sharma, DR: Sequence Series & Riemann Integration, Sharma Publications.

## BCS-303

### OPTICS

#### SECTION-A

**Interference of Light:** Superposition of light waves and interference, young's double slit experiment, Distribution of intensity in young's double slit experiment, Conditions for sustained interference pattern, Coherent sources of light, Interference pattern by division of wave front, Fresnel Biprism, Displacement of fringes.

**Interference by Division of Amplitude:** Change of phase on reflection, Interference in thin films due to reflected and transmitted light, Need for extended source for interference by division of amplitude, Fringes of equal inclination and equal. Thickness non reflecting films, Newton's Rings. Michelson Interferometer.

#### SECTION-B

**Diffraction:** Huygen's fresnel theory, half-period zones, Zone plate, Distinction between fresnel and fraunhofer diffraction. Fraunhofer diffraction at rectangular and circular apertures, Effect of diffraction in optical imaging, Resolving power of telescope in diffraction grating, its use as a spectroscopic element and its resolving power, Resolving power of microscope.

**Polarization:** Plane Polarized light, Elliptically polarized light, wire grid polarizer, Sheet polarizer, Mal's Law, Brewster Law, Polarization by reflection, Scattering, Double reflection.

#### Suggested Readings

1. Fundamentals of Optics, F.A. Jenkins and Harvey E White,(Mcgraw Hill) 4<sup>th</sup> edition
2. Optics, Ajoy Ghatak,(McMillan Indian) 2<sup>nd</sup> edition, 7<sup>th</sup> Ed
3. Introduction to Atomic Spectra, H.E. White (Mcgraw Hill, Book Co., Inc., New York)
4. Laser Fundamentals, W.T. Silfvast (Foundation Books), New Delhi
5. Laser and Non-Liner Optics, B.B. Laud (New Age Pub
6. Optics, Born and Wolf, (Pergamon Press) 7<sup>th</sup> edition
7. Laser, Svelto, (Plenum Pres) 3<sup>rd</sup> edition, New York

## BCS-304

# STATISTICAL PHYSICS AND THERMODYNAMICS

### SECTION-A

Basic ideas of statistical physics. Scope of statistical physics. Basic ideas about probability, distribution of four distinguishable particles in two compartment of equal size. Concept of macro states. microstates, thermodynamic probability, Effects of constraints on the system, Distribution of  $n$  particles in two compartments, Deviation from the state of maximum probability, equilibrium state of dynamic system.

Phase space and its division into elementary cells, Three kinds of statistics. The basic approach in the three statistics. Maxwell Boltzman (MB) statistics applied to an ideal gas in equilibrium. Experimental verification of Maxwell Boltzman law of distribution of molecular speeds, Need for quantum statistics-Bose-Einstein (B.E.) statistics, Derivation of Planck's law of radiation, Fermi-Dirac (F.D.) statistics.

### SECTION-B

Statistical definition of entropy, Change of entropy of a system, Additive nature of entropy, Law of increase of entropy, Reversible and irreversible process and their examples. Work done in a reversible process. Examples of increase of entropy in natural processes, Entropy and disorder, Brief review of terms and laws of thermodynamics, Carnot's cycle, Entropy changes in Carnot cycle.

Derivation of Maxwell's thermo dynamical relations, Cooling produced by adiabatic stretching, Adiabatic compression, Change of internal energy with volume, specific heat at constant pressure and constant volume, Expression for  $C_p - C_v$ , Change of state and Clayperon equation, Thermo dynamical treatment of Joule-Thomson effect, Use of Joule-Thomson effect, liquefaction of helium, Production of very low temperature by adiabatic demagnetization.

### Suggested Readings

- Statistical Mechanics : An Introductory Text, Bhattacharjee, J.K.(Allied Pub., Delhi)
- Statistical Physics, Bhattacharjee, J.K. (Allied Pub., Delhi)
- Statistical Mechanics, B.B. Laud (Macmillan India Ltd)
- Statistical Physics and Thermodynamics, V.S. Bhatia (Sohan Lal Nagin Chand, Jalandhar)
- Statistical Physics and Thermodynamics, A.K. Sikri (Pardeep Publication, Jalandhar)
- A Treatise on Heat, M.N. Saha & B.N. Srivastava, (The Indian Press pvt. Ltd., Allahabad)

## **BCS-305**

# **DATA STRUCTURES**

### **SECTION-A**

Introduction to Data Structures: Basic concept of data, Problem analysis, algorithm complexity, Big O notation and time space trade off, Types of data structures: arrays records, pointers, stack, queue, trees, linked list packet, blocks, tracks, sector(in storage devices). Searching and Sorting: Use of various data structures for searching and sorting, linear and binary search, bubble sort, insertion sort, selection sort. Stacks & Queues: Basics of stacks and queues, Recursion, Polish notation, circular Queues, priority Queues.

### **SECTION-B**

Linked Lists: Single linked list, Circular linked list, Doubly linked list and Dynamic storage management, generalized list, Garbage Collection. Trees: Definition & Concepts, Basic trees, Binary tree representations, Binary tree traversals and application of trees.

### **Suggested Readings**

- Data Structures, Lipschutz Seymour, Second Edition, TMH
- Algorithm + Data Structures = Programs, Niclaus Wirth, Prentice Hall
- Data Structures, Tanenbaum, Paperback Edition
- An Introduction to Data Structures Applications, Trembley & Soreson, 2<sup>nd</sup> Ed



## **BCS-306**

# **DATABASE MANAGEMENT SYSTEMS**

### **SECTION-A**

An overview of DBMS: Concept of File Processing Systems and database systems, Database Administrator and his responsibilities. Physical and Logical data independence. Three level Architecture of Database System: the external level, conceptual level and the internal level. Introduction to Data Models: Entity Relationship Model, Hierarchical, Network and Relational Model. Comparison of Network, Hierarchical and Relational Model.

### **SECTION-B**

Relational data Model: Relational database, relational algebra and calculus, SQL dependencies, functional dependency, multi-valued dependency and join, normalization. Database protection: Recovery, Concurrency Management, Database Security, Integrity and Control, Disaster Management Distributed databases: Structure of a distributed database, design of distributed databases.

### **Suggested Readings**

1. "An Introduction to Database System", Bipin C. Desai, Galgotia Publications.
2. "An Introduction to Data Base Systems", C.J. Date, Eighth Edition, Narosa Publications.
3. "Database System Concepts", Henry F. Korth, Fifth Edition, McGraw Hill.
4. "Introduction to Database Management", Naveen Prakash, TMH
5. "Principles of Database Systems", Ullman, Second Edition, Galgotia Publications.
6. "Database Systems: Design, Implementation, and Management", Rob Coronel, Ninth Ed

INTERNAL MARKS- 40  
EXTERNAL MARKS- 60

## **BCS-307**

### **PHYSICS LAB**

#### **(Practicals Based on BCS-303 & BCS-304)**

1. To determine refractive index of glass and liquid using spectrometer.
2. To determine the Cauchy's constants.
3. To study the refractive index of a doubly refracting prism.
4. To set up Newton's rings to determine wavelength of sodium light.
5. To determine the wavelength by using plane diffraction grating (Use Hg source)
6. To determine dispersive power of plane diffraction grating.
7. To determine resolving power of a telescope.
8. To determine resolving power of a grating.

## **BCS-308**

### **COMPUTER LAB**

#### **(Practicals Based on BCS-305 & BCS-306)**

1. Program using Recursion.
2. Traversing the elements of an Array
3. Inserting an element in an Array
4. Deleting an element from an Array
5. Merging of two Arrays
6. Linear Search
7. Binary Search
8. Insertion Sort
9. Bubble Sort
10. Selection Sort
11. Implementing PUSH & POP operations of a Stack
12. Array Implementation of a Queue and Circular Queue
13. Converting infix notation into post fix notation
14. Insertion in single and double Linked List
15. Deletion from single and double Linked List
16. Creation and maintenance of Database
17. Implementation and execution of SQL Queries

## HVPE-101

# HUMAN VALUES & PROFESSIONAL ETHICS

### SECTION-A

1. Course Introduction – Need, Basic Guidelines, Content and Process for Value Education
  - Understanding the need, basic guidelines, content and process for Value Education.
  - Self Exploration–what is it?- its content and process; „Natural Acceptance“ and Experiential Validation- as the mechanism for self exploration.
  - Continuous Happiness and Prosperity- A look at basic Human Aspirations
  - Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
  - Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
  - Method to fulfill the above human aspirations: understanding and living in harmony at various levels
2. Understanding Harmony in the Human Being – Harmony in Myself!
  - Understanding human being as a co-existence of the sentient „I“ and the material “Body”
  - Understanding the needs of Self („I“) and „Body“ – Sukh and Suvidha
  - Understanding the Body as an instrument of „I“ (I being the doer, seer and enjoyer)
  - Understanding the characteristics and activities of „I“ and harmony in „I“
  - Understanding the harmony of I with the Body: Sanyam and Swasthya;
  - correct appraisal of Physical needs, meaning of Prosperity in detail
  - Programs to ensure Sanyam and Swasthya
3. Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship
  - Understanding harmony in the Family- the basic unit of human interaction
  - Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship
  - Understanding the meaning of Vishwas; Difference between intention and competence
  - Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship
  - Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals
  - Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha )- from family to world family.

## SECTION-B

4. Understanding Harmony in the Nature and Existence – Whole existence as Co-existence
  - Understanding the harmony in the Nature
  - Interconnectedness and mutual fulfillment among the four orders of nature - recyclability and self-regulation in nature
  - Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space
  - Holistic perception of harmony at all levels of existence
  - Implications of the above Holistic Understanding of Harmony on Professional Ethics
  - Natural acceptance of human values
  - Definitiveness of Ethical Human Conduct
  - Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
  - Competence in professional ethics:
    - Ability to utilize the professional competence for augmenting universal human order
    - Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems
    - Ability to identify and develop appropriate technologies and management patterns for above production systems.
  - Case studies of typical holistic technologies, management models and production systems
  - Strategy for transition from the present state to Universal Human Order:
    - At the level of individual: as socially and ecologically responsible engineers, technologists and managers
    - At the level of society: as mutually enriching institutions and organizations

### Suggested Readings

- R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Value Education.
- Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
- A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
- Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
- PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
- A.N. Tripathy, 2003, Human Values, New Age International Publishers
- Subhas Palekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
- M Govindrajan, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd
- B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
- B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008

*Fourth Semester*

INTERNAL MARKS- 40  
EXTERNAL MARKS- 60

## **BCS-401**

# **NUMBER THEORY**

### **SECTION-A**

The division algorithm, The greatest common divisor, least common multiple, The Euclidean algorithm, The Diophantine equation  $ax + by = c$  Prime numbers and their distribution, The fundamental theorem of arithmetic, Basic properties of congruences, Linear congruences, Special divisibility tests.

### **SECTION-B**

Chinese remainder theorem, The Fermat's theorem, Wilson's theorem,  $\tau$  and functions, Mobius Inversion formula, Greatest integer function, Euler's Phi function, Euler's theorem, some properties of the Phi Function.

### **Suggested Readings**

Niven and Zuckerman: An Introduction To Number Theory.

## **BCS-402**

# **FUNDAMENTALS OF STATICS**

### **SECTION-A**

Basic concepts, composition and resolution of forces (parallelogram law, polygon law, Lami's Theorem,  $(\lambda-\mu)$  theorem. Resultant of a number of coplanar forces, parallel forces. Moments : Varignon's theorem of moments, Generalized theorem of moments, Couples Resultant of two Coplanar Couples, Equilibrium of two coplanar couples, Resultant of a force and a couple. Equilibrium of coplanar forces.

### **SECTION-B**

Friction, Laws of friction, Equilibrium of a particle on a rough plane. Centre of Gravity (C.G.); Basic concepts of C.G. of a rod, triangular lamina solid hemisphere, hollow hemisphere, solid cone and hollow cone. Forces in three dimensions, wrenches, null lines, and null planes.

### **Suggested Readings**

1. S.L. Loney, Statics, Macmillan and Company, London.
2. R.S. Verma, A Text Book on Statics, Optical Pvt. Ltd., Allahabad.
3. Narayan, S. : Analytical Solid Geometry, Sultan Chand & Sons
4. Kreyszig, E. : Advanced Engineering Mathematics.
5. Sharma, DR: Fundamentals of Statics, Sharma Publications



## **BCS-403**

# **ATOMIC MOLECULAR & SPECTROSCOPY**

### **SECTION-A**

Spectrum of Hydrogen atom, Line structure, Normal Zeeman effect, electron spin, Stern Gerlach experiment, spin orbit coupling, electron magnetic moment, total angular momentum, Hyperfine structure. Exchange symmetry of wave function, exclusion principle, shells, subshells in atoms, atomic spectra (Helium), LS coupling, selection rules.

### **SECTION-B**

Derivation of Einstein relations, Concept of stimulated emission and population inversion, Fauchber Ledenberg formula, Threshold and Schawlow Tonnes condition, three level and four level laser schemes, elementary theory of optical cavity, Longitudinal and transverse modes. Components of laser devices, condition for laser action, types of lasers, Ruby and Nd:YAG lasers, Mode of creating population inversion and output characteristics, application of lasers –a general outline, Basics of holography.

### **Suggested Readings**

1. Introduction to Atomic Spectra: H.E. White-Auckland McGraw Hill
2. Fundamentals of Molecular Spectroscopy: C.B. Banwell-Tata McGraw Hill
3. Spectroscopy Vol. I, II & III: Walker & Straughen
4. Introduction to Molecular Spectroscopy: G.M. Barrow-Tokyo McGraw Hill
5. Spectra of Diatomic Molecules: Herzberg-New York.
6. Molecular Spectroscopy: Jeanne L McHale.

## **BCS-404**

# **QUANTUM MECHANICS**

### **SECTION-A**

Brief introduction to need and development of quantum mechanics, Wave particle duality, De broglie hypothesis, Uncertainty principle, Guassian wave packet. Operator correspondence. Normalization and probability interpretation of wave function. Superposition principle. Expectation value, Probability current and conservation of probability. Admissibility conditions or wave function. Ehrenfest theorem, Eigen function and eigen value.

### **SECTION- B**

Fundamental postulates of wave mechanics, Schrodinger equation for a free particle and equation of a particle subject to forces. Schrodinger equation, Application to stationary states for one dimension, Potential Barrier, rectangular potential well, degeneracy, Orthogonality, Linear harmonic oscillator. Interaction energy ideas, X-ray spectra, Mosley law, Absorption spectra, Auger effect, Molecular bonding, Molecular spectra, symmetric structure, Rotational Vibrational, electronic level and spectra of molecules, Raman spectra.

### **Suggested Readings**

1. A Text book of Quantum Mechanics, P.M. Mathews and K. Venkatesan, (Tata McGraw Hill Pub., Co., Delhi)
2. Quantum Mechanics J.L. Powell and B. Craseman (Narosa Pub. House, New Delhi)
3. Concepts of Modern Physics, Arthur Beiser, McGraw Hill Pub. Co., New Delhi, 9<sup>th</sup> Ed.
4. Fundamentals of Molecular Spectroscopy, C.N. Banwell (Tata McGraw Hill Pub. Co., Delhi)
5. Atomic Spectra, H.G. Kuhn (Longmans), 2<sup>nd</sup> Ed.
6. Introduction to Quantum Mechanics, L. Pauling and E.B. Wilson (Tata McGraw Hill Pub. Co., Delhi)
7. Schiff, L. Quantum Mechanics.

## **BCS-405**

# **OPERATING SYSTEMS**

### **SECTION A**

Introduction: Application programs and system programs; functions of an operating system; classification of operating systems-Multi-user, multiprogramming, multiprocessing, time sharing, multi-threaded. Subsystems – Top Layer, Middle Layer, Bottom Layer, Bootstrap, Protection and security. Processes and Threads: Program vs. Process; Process context, address space, identification, transition, state & management. Thread management-benefits, synchronization issues; applications of threads. CPU Management: Objectives, Pre-emptive vs. Non-pre-emptive, context switching, scheduling schemes; multi-processor scheduling, thread scheduling. Inter-process Communications: Introduction, message passing model, shared memory model. Pipe, FIFO and Socket.

### **SECTION-B**

Memory Management: Introduction, address binding, relocation, loading, linking, memory sharing and protection; Paging and segmentation; Virtual memory: basic concepts of demand paging, performance, page replacement. Thrashing. I/O Device Management: I/O devices and controllers, device drivers; disk storage, scheduling and management. File Management: Basic concepts, file operations, access methods, directory structures and management, remote file systems; file protection. Protection & Security: Need, environments: software, hardware, unauthorized use, denial of services, access control and authentication. Application security, attacks, virus & anti-virus, firewall.

### **Suggested Readings**

1. Operating System Principles by Abraham Silberschatz and Peter Baer Galvin, Seventh Edition, Published by Wiley-India
2. Operating Systems by Sibsankar Haldar and Alex A. Aravind, Published by Pearson Education.
3. An Introduction to Operating Systems By Dietel H.M., Second Edition, Published by Addison Wesley.
4. Operating system by Milan Milenkovic, Second Edition
5. Operating system by Stalling, W., Sixth Edition, Published by Prentice Hall (India)

## **BCS-406**

# **DATA COMMUNICATION AND COMPUTER NETWORKS**

### **SECTION- A**

Data communications concepts: Digital and analog transmissions-Modem, parallel and serial, synchronous and asynchronous, Modes of communication: Simplex, half duplex, full duplex, Concept of multiplexing, De-multiplexing. Types of Networks: LAN, MAN, WAN Network Topologies: Bus, Star, Ring, Mesh, Tree, Hybrid Communication Channels: Wired transmissions: Telephone lines, leased lines, switch line, coaxial cables-base band, broadband, optical fiber transmission. Wireless Transmission: (Standards and Specification) Microwave transmission, Infrared transmission, Laser transmission, Radio transmission and Satellite transmission and Blue Tooth, Frequency Spectrum. Communication Switching Techniques: Circuit Switching, Message Switching, Packet Switching. Network Reference Models: OSI Reference Model, TCP/IP Reference Model, Comparison of OSI and TCP/IP Reference Models.

### **SECTION- B**

Data Link Layer Design Issues: Services provided to the Network Layer, Framing, Error Control (error detection and correction code), Flow Control, Data Link Layer in the Internet (SLIP, PPP). Types of Multiplexing: FDM, TDM, CDMA MAC sub layer: CSMA/CD/CA, IEEE standards (IEEE802.3 Ethernet, Gigabit Ethernet, IEEE 802.4 Token Bus, IEEE 802.5 Token Ring) The Network Layer: Design Issues, Routing Algorithms: Optimality Principle, Shortest Path Routing, Congestion Control Policies, Concept of Internet working.

### **Suggested Readings**

1. Computer Networks, Tanenbaum, Andrew, Fifth Edition, PHI
2. Data Communication and Networking, Behrouz A. Forouzan, Fourth Edition
3. Computer Today, S.K. Basandra, First Edition, Galgotia
4. Data Communication System, Black, Ulysse, Third Edition, PHI
5. Data and Computer Communications, Stalling, Ninth Edition, PHI

INTERNAL MARKS- 40  
EXTERNAL MARKS- 60

## **BCS-407**

### **PHYSICS LAB**

#### **(Practicals Based on BCS-403 & BCS-404)**

##### **List of Experiments**

- 1) Verify Laws of probability distribution by throwing of similar coins.
- 2) To study the photoelectric effect and determine the value of planck's constant
- 3) To study the variation of light intensity with distance using photovoltaic cell (inverse Square Law)
- 4) To study the absorption spectra of iodine vapours
- 5) To study the rotation of plane of polarization by using polarimeter.
- 6) Optical activity of sugar solution by polarimeter
- 7) Determine the ionization potential of mercury.
- 8) To determine the heating efficiency of electric kettle with varying voltage.

INTERNAL MARKS- 40  
EXTERNAL MARKS- 60

## **BCS-408**

### **COMPUTER LAB**

#### **Practicals to be Based on BCS-405 & BCS-406**

##### **List of Experiments**

- Introduction to Windows and Linux Operating Systems
- Implementation of CPU Scheduling algorithms
- Study of Network Components
- Network Troubleshooting in Windows and Linux

## EVSC-101

# ENVIRONMENT SCIENCE

### SECTION-A

Introduction: Definition and scope and importance of multidisciplinary nature of environment. Need for public awareness. Natural Resources: Natural Resources and associated problems, use and over exploitation, case studies of forest resources and water resources. Ecosystems: Concept of Ecosystem, Structure, interrelationship, producers, consumers and decomposers, ecological pyramids-biodiversity and importance. Hot spots of biodiversity. Environmental Pollution: Definition, Causes, effects and control measures of air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measure of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster Management : Floods, earthquake, cyclone and landslides.

### SECTION-B

Social Issues and the Environment From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation Public awareness Human Population and the Environment, Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health, Human Rights, Value Education, HIV/AIDS. Women and child Welfare. Role of Information Technology in Environment and human health. Case studies.

### Suggested Readings

- Agarwal, K. C., Environment Biology, Nidi Publ. Ltd. Bikaner.
- Jadhav, H & Bhosale, V.M, Environment Protection and Laws. Himalaya Pub.
- Rao M. N. & Datta A.K. Waste Water Treatment. Oxford & IBH.
- Principle of Environment Science by Cunningham, W.P.
- Essentials of Environment Science by Joseph.
- Environment Pollution Control Engineering by Rao, C.S.
- Perspectives in Environmental Studies by Kaushik, A.

*Fifth Semester*



## **BCS-501**

# **NUMERICAL ANALYSIS**

### **SECTION-A**

Error generation, propagation, error estimation and error bounds, Solution of non-linear equations, Bisection method, Iteration method Newton's method, Generalized Newton Method, Method of false position, Muller's method, rate of convergence of these methods. Solution of linear system of equation, direct method, Gauss elimination variant (Gauss Jordan and Crout reduction), Triangular Method, Iterative method, Jacobi's method, Gauss Seidel Method. Finite Differences ; Forward, Backward, Central, Divided differences, Shift operator, relationship between the operator, and detection of errors by use of difference operator.

### **SECTION-B**

Interpolation with divided difference, Newton's formula, Lagrangian Method., Finite difference interpolation, Gauss formula, Stirling formula, Bessel's Formula, Error Estimation Extrapolation. Method of least squares for curve fitting, Fitting of straight line, exponential and power curve, fitting of polynomial. Numerical differentiation, Method based on interpolation, Numerical Integration, Trapezoidal rule, Simpson's rule, Weddle rule, Romberg Integration, Gaussian integration method, Gaussian legendre integration. Double numerical integration. Numerical solution of ordinary differential equation, Equation of first and second order, System of simultaneous equation, Milne's Method, the Runge-Kutta method. Predictor-Corrector methods.

### **Suggested Books:**

- Numerical Analysis by DR Sharma, Sharma Publications
- Numerical Analysis by G Shanker Rao, Shanker G. Rao, New Age International
- Introductory Methods of Numerical Analysis by SS Sastry, PHI
- Numerical Analysis by N. Islam, Academic Publishers
- R.S. Salaria: Computer Oriented Numerical Methods, 2007, Khanna Book Co. Publishing Co. (P) Ltd.

## **BCS-502**

# **FUNDAMENTALS OF DYNAMICS**

### **SECTION-A**

Motion of a particle with constant acceleration, acceleration of falling bodies, motion under gravity, motion of a body projected vertically upwards : Motion of two particles connected by a string, motion along a smooth inclined plane, constrained motion along a smooth inclined plane. Variable acceleration : Simple harmonic motion, elastic string. Curvilinear motion of a particle in a plane : Definition of velocity and acceleration, projectiles, motion in a circle, motion under constraint, central forces motion.

### **SECTION-B**

Work, power, conservative fields and the potential energy, work done against gravity, potential energy of a gravitational field. Linear momentum, angular momentum, conservation of angular momentum, impulsive forces, principle of impulse and momentum, motion with respect to centre of mass of a system of particles, collisions of elastic bodies, loss of energy during impact. Central Orbits. Kepler's laws of motion

#### **Suggested Books:**

- Fundamentals of Dynamics by DR Sharma, Sharma Publications
- An Elementary Treatise on the Dynamics of a Practice and of Rigid Bodies by S.L. Loney, Cambridge University Press

## **BCS-503**

# **CONDENSED MATTER PHYSICS**

### **SECTION-A**

Crystal structure, Symmetry operations for a two dimensional crystal, Two dimensional Bravais lattices, Three dimensional Bravais lattices, Basic primitive cells, Crystal planes and Miller indices, Diamond and NaCl structure. Crystal Diffraction: Bragg's law, Experimental methods for crystal structure studies, Laue equations, Reciprocal lattices of SC, BCC and FCC, Bragg's law in reciprocal lattice, Brillouin zones and its derivation in two dimensions, Structure factor and atomic form factor.

### **SECTION-B**

Lattice vibrations, Concepts of phonons, Scattering of neutrons by phonons, Vibration and monoatomic, linear chains, Density of modes, Einstein and Debye models of specific heat, Free electron model of metals, Free electron, fermi gas and Fermi energy. Band Theory: Kronig-Penney model, Metals and insulators, Conductivity and its variation with temperature in semiconductors, Fermi levels in intrinsic and extrinsic semiconductors, Qualitative discussion of band gap in semiconductors, Superconductivity, Magnetic field effect in superconductors, BCS theory, Thermal properties of superconductors.

### **Suggested Books**

- Elements of Modern Physics by S.H. Patil (TMGH, 2012).
- Solid State Physics by Puri and Babbar.

INTERNAL MARKS- 40

EXTERNAL MARKS- 60

## **BCS-504**

# **ELECTRONICS**

### **SECTION-A**

Concepts of current and voltage sources, p-n junction, Biasing of diode, V-A characteristics, Zener diode, LCD to ICD rectification: half wave, full wave rectifiers and bridge rectifiers, Filter circuits (RC, LC p-filters), Efficiency, Ripple factor, Voltage regulation, Voltage multiplier circuits. Junction transistor : Structure and working relation between different currents in transistors, Sign conventions, Amplifying action, Different configurations of a transistor and their comparison, CB and CE characteristics, Structure of JEFT and MOSFET, Transistor biasing and stabilization of operating point, Fixed bias, Collector to base bias, Bias circuit with emitter resistor, Voltage divider biasing circuit.

### **SECTION-B**

Working of CE amplifier, Amplifier analysis using 'h'parameters, Equivalent circuits, Determination of current gain, Power gain, Input impedance, FET amplifier and its voltage gain, Operational amplifier, Characteristics and applications, Feed back in amplifiers, Different types, Voltage gain, Advantage of negative feed back, Emitter follower as negative feed back circuit. Barkausen criterion of sustained oscillations, L oscillator (tuned collector, tuned base Hartley), RC oscillators, phase shift and Wein bridge, Modulation and detection, AM and FM, Power in AM and generation of AM detector, Radio transmitter, Radio wave propagation, Ionosphere, Radio receiver, TV receiver.

#### **Suggested Books:**

- Basic Electronics by DC Tayal, Himalaya Publishing House
- Basic Electronics and Linear Circuits by N.N. Bhargave, D.C. Kulshreshtha and S.C. Gupta.
- Foundations of Electronics by D. Chatopadhyay, B. Saha and N.N. Purkit.

## **BCS-505**

# **PROGRAMMING IN JAVA**

### **SECTION-A**

**FUNDAMENTALS OF OBJECT-ORIENTED PROGRAMMING:** - Introduction; Object-Oriented Paradigm; Basic Concepts of Object-Oriented Programming Benefits of OOP; Applications of OOP. **JAVA EVOLUTION:** - Java History; Java Features; How Java Differs from C and C++; Java and Internet, Java and World Wide Web, Web Browsers; Hardware and Software Requirements; Java Support Systems, Java Environment

**OVERVIEW OF JAVA LANGUAGE:** - Introduction; Simple Java Program; Comments in java; An application with Two Classes; Java Program Structure; Java Tokens; Java Statements; Implementing a Java Program; Java Virtual Machine; Command Line Arguments; Programming Style.

**CONSTANTS, VARIABLES AND DATA TYPES:** - Introduction; Constants; Variables; Data Types; Variables, Constants, Standard Default Values.

**OPERATORS AND EXPRESSIONS:** - Introduction to Operators, Expressions; Operator Precedence; Mathematical Functions.

**DECISION MAKING, BRANCHING AND LOOPING:** - Decision making and Branching Statements, Looping Statements, Labeled loops, Jumping Statements

**CLASSES, OBJECTS AND METHODS:** - Introduction; Defining a Class; Adding Variables; Adding Variables; Adding Methods; Creating Objects; Accessing Class Members; Constructors; Methods Overloading; Static Members; Nesting of Methods; Inheritance: Extending a Class; Overriding Methods; Final Variables and Methods; Final Classes; Finalizer Methods; Abstract Methods and Classes; Visibility Control.

**ARRAYS, STRINGS AND VECTORS:** - Arrays; Jagged Arrays;; Strings; String functions: Vectors; Wrapper Classes.

**INTERFACES:** Introduction; Defining Interfaces; Extending Interfaces; Implementing Interfaces; Accessing Interface Variables, Implementing Multiple Inheritance using Interfaces.

## **SECTION-B**

**PACKAGES:** Introduction; System Packages; Using System Packages; Naming Conventions; Creating Packages; Accessing a Package; Using a Package; Adding a Class to a Package; Hiding Classes.

**MANAGING ERRORS AND EXCEPTIONS:** - Introduction; Types of Errors; Exceptions; Exception Handling using Try, Catch and Finally block; Throwing Our Own Exceptions; Using Exceptions for Debugging.

**APPLET PROGRAMMING:** - Introduction; How Applets Differ from Applications; Applet Life Cycle; Creating an Executable Applet; Passing Parameters to Applets; Aligning the Display; More about HTML Tags; Displaying Numerical Values; Getting Input from the User.

**GRAPHICS PROGRAMMING:** - Introduction; The Graphics Class; Lines and Rectangles; Circles and Ellipses; Drawing Arcs; Drawing Polygons; Line Graphs; Using Control Loops in Applets; Drawing Bar Charts. .

**EVENT HANDLING:** - Event delegation Approach; Action Listener; Adjustment Listener, Mouse Listener; Mouse Motion Listener; Window Listener; Key Listener; Item Listener

**JAVA I/O HANDLING :** I/O File Handling(Input Stream & Output Streams, File Input Stream & File Output Stream, Data I/P and O/P Streams, File Class, Reader and Writer Streams, Random Access File).

### **Suggested Books:**

- Programming In Java, E-Balaguruswamy, Fourth Edition, Tata McGraw Hill
- Mastering Java, Second Edition, BPB Publications
- 3.Advance Java, Ivan Bayross, BPB Publications

## **BCS-506**

# **SOFTWARE ENGINEERING**

### **SECTION-A**

Software: Characteristics, Components Applications, Software Process Models: Waterfall, Spiral, Prototyping, Fourth Generation Techniques, Concepts of Project Management, Role Of Metrics And Measurement.

S/W Project Planning: Objectives, Decomposition Techniques: S/W Sizing, Problem Based Estimation, Process Based Estimation, Cost Estimation Models: COCOMO Model, The S/W Equation, System Analysis: Principles Of Structured Analysis, Requirement Analysis, DFD, Entity Relationship Diagram, Data Dictionary. S/W Design: Objectives, Principles, Concepts, Design Methodologies: Data Design, Architecture Design, Procedural Design, Object – Oriented Concepts.

### **SECTION B**

Testing Fundamentals: Objectives, Principles, Testability, Test Case Design: White Box & Black Box testing, Testing Strategies: Verification & Validation, Unit Testing, Integration Testing, Validation Testing, System Testing.

Advanced topics in Software Engineering:

Reengineering: Reverse Engineering, Restructuring, Forward Engineering.

Computer Aided Software Engineering (CASE): Taxonomy of CASE tools.

#### **Suggested Books:**

- Roger S. Pressman, "Software Engineering – A Practitioner's Approach ", Sixth Edition, McGraw Hill
- R.E. Fairley, "Software Engineering Concepts", Paperback Edition, McGraw Hill.
- Jalote, "An Integrated Approach to Software Engineering", Third Edition, Narosa Publishing House

## BCS-507

### PHYSICS LAB (Based on BCS-503 & BCS-504)

#### List of Experiments

- Measurement of reverse saturation current in p-n-junction diode at various temperatures and to find the approximate value of energy gap.
- To draw forward and reverse bias characteristics of a p-n junction diode and draw a load line.
- Study of a diode as a clipping element.
- To measure the magnetic susceptibility of FeCl<sub>2</sub> solution by Quincke's Method.
- To trace the B-H curves for different materials using CRO and find the magnetic parameters from these.
  
- To study the response of RC circuit to various input voltage- square, sine and triangular.
- To measure the efficiency and ripple factors for (a) Halfwave (b) full wave and (c) bridge rectifier circuits.
- To study the reduction in the ripple in the rectified output with RC, LC filters.
- To draw the characteristics of a Zener diode.
- To study the stabilization of output voltage of a power supply with Zener diode.
- To measure the plot Common Emitter Characteristics of a transistor (pnp or npn).
- To plot Common Base Characteristics of and determine hparameters of a given transistor.
- To draw output and mutual characteristics of an FET (Experiments) and determine its parameters.
- To study the gain of an amplifier at different frequencies and to find Band width.
- To set up an oscillator and study its output on CRO for different C values.
- To trace the output wave form of full wave and half wave rectifiers.
- To trace the rectifier output with RC, LC and p-filters.
- To study the band width of a transistor amplifier.
- To find different frequencies using CRO.



## **BCS-508**

### **COMPUTER LAB (Based on BCS-505 & BCS-506)**

#### **List of Experiments**

- Operators and Mathematical Functions.
- Decision making, Branching and Looping Statements
- Classes, Objects and Methods.
- Arrays, Strings and Vectors.
- Interfaces.
- Packages.
- Exception handling.
- Applet Programming.
- Event Handling.
- I/O Handling.
- Test Cases

# *Sixth Semester*

INTERNAL MARKS- 40

EXTERNAL MARKS- 60

## **BCS-601**

# **REAL ANALYSIS**

### **SECTION-A**

Sequences and series of functions, Concept of Point-wise and Uniform convergence of sequence of functions and series of functions with special reference to power Series. Statement of Weierstrass M-Tests for Uniform convergence of sequence of functions and of series of functions. Simple applications. Determination of Radius of convergence of power series. Statement of properties of continuity of sum functions of power series, Term by term integration and Term by term differentiation of power Series. Abel's and Taylor's Theorems on power Series.

### **SECTION-B**

Fourier series. Fourier expansion of piecewise monotonic functions Euler's formula, even and odd functions, half range expansions.

Complex number as ordered pairs. Geometric representation of complex number. Limit, continuity, derivative of complex functions, analytic function, Cauchy-Riemann equation, conjugate functions, harmonic functions ; Conformal Mapping : Mapping of a complex function, conformal mapping and standard elementary transforms (Translational, magnification, rotational and inversion).

#### **Suggested Books:**

- Real Analysis by DR Sharma, Sharma Publications, Jalandhar
- Real Analysis, by A.R. Vasishtha,
- Real Analysis by V. Karunakaran, Pearson Education

## **BCS-602**

# **LINEAR ALGEBRA**

### **SECTION-A**

Definition of groups, rings and fields with illustrations. Definition of vector spaces, subspaces with examples, direct sum of subspaces, Linear span, Linear dependence, Linear independence of vectors, Linear combination of vectors, Basis of a vector space, Finitely generated vector spaces. Existence theorem for basis. Invariance of the number of elements of the basis set. Dimension of sum of two subspaces. Quotient space and its dimension.

### **SECTION-B**

Linear transformation, Algebra of linear transformation, Rank Nullity theorem, Isomorphism and Isomorphic spaces, Matrix of a linear transformation, change of basis, Linear operator.

#### **Suggested Books:**

- Linear Algebra by DR Sharma, Sharma Publications, Jalandhar
- K.Hoffman & R. Kunze, Linear Algebra, Prentice Hall
- V. Krishnamurthy, V. P. Mainra and J.L. Arora, An Introduction to Linear Algebra
- Shanti Narayan & P.K. Mittal, A Text Book of Matrices, 10th Edition, S. Chand & Co.

## **BCS-603**

# **NUCLEAR PHYSICS**

### **SECTION-A**

Constituents of nucleus and their intrinsic properties, Qualitative facts about size, mass, density, energy, charge, Binding energy, angular momentum, magnetic moment and electric quadrupole moments of the nucleus, Wave mechanical Properties of nucleus, Average binding energy and its variation with mass numbers, Properties of nuclear forces and saturation, Non-existence of electrons in the nucleus and neutron-proton model, Assumptions of liquid drop model, Semi-empirical mass formula, Conditions of nuclear stability, Nuclear shell model. Experimental evidence of magic numbers and its explanation.

### **SECTION-B**

Radioactivity, Modes of decay and successive radioactivity, Alpha emission, Electron emission, Positron emission, Electron capture, Gamma-ray emission, Internal conversion, Qualitative discussion of alpha, beta and gamma spectra, Geiger-Nuttall rule, Neutrino hypothesis of beta decay, Evidence of existence of neutrino, Qualitative discussion of alpha and beta decay theories, Nuclear reactions, reaction cross section, Conservation laws, Kinematics of nuclear reaction, Qvalue and its physical significance, Compound nucleus, Possible reaction with high energy particles.

#### **Suggested Books:**

- An Introduction to Nuclear Physics by M.R. Bhiday and V.A. Joshi
- Nuclear Physics by Burcham (Indian Ed.)
- Introduction to Nuclear & Particle V.K. Mittal, R.C. Verma & S.C. Gupta PHI (2009).

## **BCS-604**

# **PARTICLE PHYSICS**

### **SECTION-A**

Energy loss due to ionization (Bethe Bloch formula), Energy loss of electrons, Bremsstrahlung, Gamma-ray through matter. Pair production, Radiation loss by fast electrons, Radiation length; Electron-positron annihilation; Cyclotron; Betatron, Qualitative discussion of Synchrotron; Collider machines and linear accelerator.

### **SECTION-B**

Ionization chamber, Proportional counter, GM counter, Scintillation counter, Solid state detector's Elementary particles and their masses, Decay modes, Classification of these particles, types of interactions Conservation laws and quantum numbers, Concepts of isospin, Strangeness,

Parity, Charge conjugation. Antiparticles, Gell Man methods, Decay and strange particles. Particle symmetry, Introduction to quarks and qualitative discussion of quark model.

- Particle Physics, M.P. Khanna, Pearson Education
- Introduction to Nuclear & Particle V.K. Mittal, R.C. Verma & S.C. Gupta PHI.

## **BCS-605**

### **MULTIMEDIA**

#### **SECTION-A**

Introduction: Multimedia and its types, Introduction to Hypermedia, Hyper Text, Multimedia Systems and their Characteristics, Challenges, Desirable Features, Components and Applications, Trends in Multimedia. Multimedia Technology: Multimedia Systems Technology , Multimedia Hardware devices, Multimedia software development tools, Multimedia Authoring Tools, Multimedia Standards for Document Architecture, SGML, ODA, Multimedia Standards for Document interchange, MHEG, Multimedia Software for different media.

Storage Media: Magnetic and Optical Media, RAID and its levels, Compact Disc and its standards, DVD and its standards, Multimedia Servers. Audio: Basics of Digital Audio, Application of Digital Audio, Digitization of Sound, Sample Rates and Bit Size, Nyquist's Sampling Theorem Typical Audio Formats Delivering Audio over a Network, Introduction to MIDI (Musical Instrument Digital Interface), Components of a MIDI System Hardware Aspects of MIDI, MIDI Messages. Audio Compression, Simple Audio Compression Methods, Psychoacoustics, MPEG Audio Compression.

#### **SECTION-B**

Basics of Compression: Classifying Compression Algorithms, Lossless Compression Algorithms, Entropy Encoding, Run-length Encoding, Pattern Substitution, Basics of Information theory, Huffman Coding, Adaptive Huffman Coding, Arithmetic Coding, Lempel-Ziv-Welch (LZW) Algorithm, Source Coding Techniques: Transform Coding, Frequency Domain Methods, Differential Encoding. Image and Graphics Compression: Colour in Images, Types of Colour Models, Graphic/Image File Formats: TIFF, RIFF, BMP, PNG, PDF, Graphic/Image Data, and JPEG Compression, GIF Compression. Video Compression: Basics of Video , Video Signals, Analog Video, Digital Video, TV standards, H.261 Compression, Intra Frame Coding, Inter-frame (P-frame) Coding, MPEG Compression, MPEG Video, The MPEG Video Bitstream , Decoding MPEG Video in Software.

#### **Suggested Books:**

- Ralf Steinmetz and Klara Nahrstedt, "Multimedia Computing Communications and Applications" Pearson Education.
- Parag Havaldar, Gerard Medioni, "Multimedia Systems Design", PHI, Latest Edition

## **BCS-606**

# **COMPUTER GRAPHICS**

### **SECTION-A**

Introduction to Active and Passive Graphics, Applications of Computer Graphics, Input devices: light pens, Graphic tablets, Joysticks, Trackball, Data Glove, Digitizers, Image scanner, Graphs and Types of Graphs. Video Display Devices-- Refresh Cathode Ray Tube, Raster Scan displays, Random Scan displays, Architecture of Raster and Random Scan Monitors, Color CRT-monitors and Color generating techniques (Shadow Mask, Beam Penetration) , Direct View Storage Tube, Flat-Panel Displays; 3-D Viewing Devices, Raster Scan Systems, Random Scan Systems, Graphics monitors and workstations, Color Models (RGB and CMY), Lookup Table. Process and need of Scan Conversion, Scan conversion algorithms for Line, Circle and Ellipse, effect of scan conversion, Bresenham's algorithms for line and circle along with their derivations, Midpoint Circle Algorithm, Area filling techniques, flood fill techniques, character generation.

### **SECTION-B**

2-Dimensional Graphics: Cartesian and need of Homogeneous co-ordinate system, Geometric transformations (Translation, Scaling, Rotation, Reflection, Shearing), Two-dimensional viewing transformation and clipping (line, polygon and text), Cohen Sutherland, Sutherland Hodgeman and Liang Barsky algorithm for clipping. Introduction to 3-dimensional Graphics: Geometric Transformations (Translation, Scaling, Rotation, Reflection, Shearing), Mathematics of Projections (parallel & perspective). Introduction to 3-D viewing transformations and clipping.

#### **Suggested Books:**

- D. Hearn and M.P. Baker, "Computer Graphics", PHI New Delhi.
- J.D. Foley, A.V. Dam, "Introduction to Computer Graphics",
- S.K. Feiner, J.F. Hughes, Addison-Wesley Publishing Company, R.L. Phillips. N.Y.; Second Edition.
- R.A. Plastock and G. Kalley, "Computer Graphics", Second Edition, McGraw Hill



## **BCS-607**

### **PHYSICS LAB (Based ON BCS-603 & BCS-604)**

#### **List of Experiments**

- To draw and determine the plateau of a GM counter and find its dead time.
- To study the statistical fluctuations and end point energy of beta particles using GM counter.
- To study the absorption of beta particles in aluminium using GM counter and determine the absorption coefficient of beta particles from it.
- To study the characteristics of a thermistor and find its parameters.
- To study the absorption of beta particles in different materials like PB, Fe, Al, etc. using GM counter.
- To locate the peak position with gain of an amplifier of gamma ray spectrometer.