PANJAB UNIVERSITY, CHANDIGARH

SYLLABI OF FIRST YEAR COURSES IN
B.E. (Biotechnology Engineering)

Semester I

S.No	Subject	Code	L-T-P	Credits Theory	Credits Practical	University External Marks	University Internal Marks	Practical Marks Internal	Total Marks
1.	Calculus	MATHS101	4-1-0	4		50	50		100
2.	Basic Biology	BIO101	3-1-2	3	1	50	50	50	150
3.	Computer Programming	CS104	3-0-2	3	1	50	50	50	150
4.	Physics Course 1	-	4-0-3/4-0-2	3	1	50	50	50	150
5.	Ethics and Self Awareness	HSS101	2-0-0	2		50	50		100
6.	Introduction to Environment Science	GS101	3-0-0	3		50	50		100
	Total		28/27	18	3	300	300	150	750

Semester II

S.No	Subject	Code	L-T-P	Credits Theory	Credits Practical	University External Marks	University Internal Marks	Practical Marks Internal	Total Marks
1.	Differential Equations and Transforms	MATHS201	4-1-0	4		50	50		100
2.	Communication Skills	HSS202	2-0-0	2		50	50		100
3.	General Chemistry	CH202	4-0-3	3	1	50	50	50	150
4.	Workshop Practice	ME203	0-0-4		2			50	50
5.	Basic Biotechnology	BIO201	3-1-0	4		50	50		100
6.	Fundamentals of Biotechnology and Bioengineering	BIO202	3-1-2	3	1	50	50	50	150
	Total		28	16	4	250	250	150	650

Paper Title   : Calculus
Paper Code   : MATHS101

Pre Requisite : 10+2

Max (Univ. Exam) Marks : 50   **Time of examination: 3hrs.**

Internal Assessment : 50

Course Duration: 45 lectures of one hour each.

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

Objectives
- To understand the behaviour of infinite series and its use.
- To learn the concepts of functions of two and more than two variables and their applications.
- To learn the methods to evaluate multiple integrals and their applications to various problems.
- To understand the concepts of Vector calculus and their use in engineering problems.

S. No.	Topic	No. of Lectures
	PART A	
1.	**FUNCTIONS OF ONE VARIABLE** Sequences and Series: Sequences, Limits of sequences, Infinite series, series of positive terms, Integral test, Comparison test, Ratio test, Root test. Alternating series, Absolute and Conditional Convergence, Leibnitz test. Power series: radius of convergence of power series, Taylor's and Maclaurin's Series, Formulae for remainder term in Taylor and Maclaurin series, Error estimates. (Scope as in Chapter 8, Sections 8.1 – 8.10 of Reference 1). Integral Calculus: Areas of curves, Length of curves, Volume and surface areas of revolution (Scope as in Chapter 5, Sections 5.1, 5.3, 5.5, 5.6 of Reference 1).	9
2.	**DIFFERENTIAL CALCULUS OF FUNCTIONS OF TWO AND THREE VARIABLES** Concept of limit and continuity of a function of two and three variables, Partial derivatives, total derivative, Euler's theorem for homogeneous functions, composite function, differentiation of an implicit function, chain rule, change of variables, Jacobian, Taylor's theorem, Errors and increments, Maxima and minima of a function of two and three variables, Lagrange's method of multipliers (Scope as in Chapter 12, Sections 12.1 – 12.6, 12.8 – 12.9 of Reference 1).	9
3.	**SOLID GEOMETRY** Cylinder, Cone, Quadric surfaces, Surfaces of revolution. (Scope as in: 10.6, 10.7 of Reference 1).	3
	PART B	
4.	**INTEGRAL CALCULUS OF FUNCTIONS OF TWO AND THREE VARIABLES** Double and triple integrals, Change of order of integration, Change of Variables, Applications to area, volume and surface area.	9

	(Scope as in Chapter 13 of Reference 1).	
5.	**VECTOR DIFFERENTIAL CALCULUS** Vector-valued functions and space curves, arc lengths, unit tangent vector, Curvature and torsion of a curve, Gradient of a Scalar field, Directional Derivative (Scope as in Chapter 11, Sections 11.1, 11.3, 11.4, Chapter 12, Section 12.7 of Reference 1).	**8**
6.	**VECTOR INTEGRAL CALCULUS** Line integrals, Vector fields, Work, Circulation and Flux, Path Independence, Potential functions and Conservative fields, Green's theorem in the plane, Surface Areas and Surface Integrals, Stoke's Theorem, Gauss Divergence Theorem (Statements only) (Scope as in Chapter 14 of Reference 1).	**7**

Outcomes
- The students are able to test the behavior of infinite series.
- Ability to analyze functions of more than two variables and their applications.
- Ability to evaluate multiple integrals and apply them to practical problems.
- Ability to apply vector calculus to engineering problems

References:

1. G. B. Thomas, R. L. Finney. Calculus and Analytic Geometry, Ninth Edition, Pearson Education.
2. E. Kreyszig. Advanced Engineering Mathematics, Eighth Edition, John Wiley.
3. Michael D. Greenberg. Advanced Engineering Mathematics, Second Edition, Pearson Education.
4. Advanced Engineering Mathematics, Wylie and Barrett, McGraw Hill
5. B. V. Ramana. Higher Engineering Mathematics, Tata McGraw Hill.
6. R. K. Jain, S. R. K. Iyenger. Advanced Engineering Mathematics, Narosa Publications.

Paper Title : **Basic Biology (Theory)**
Paper Code : **BIO101**
Course Duration: 45 lectures of one hour each.

Max (Univ. Exam) Marks : 50   **Time of examination: 3hrs.**

Internal Assessment : 50

Note: The semester question paper of a subject will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each section.

Objective: To build on the foundation of biological aspects with emphasis on origin and propagation of various life forms and their constituent molecules.

Section A

Introduction to Biotechnology: definition, scope and future prospects   (2)
Origin of Life: theories of evolution, chemical evolution, organic evolution, Oparin-Haldane hypothesis, Miller's experiment   (4)

Cell structure and function: prokaryotic and eukaryotic cell (plant and animal cell), various cell organelles, their structure and functions   (9)

Cell Division: stages of mitosis and meiosis   (3)

Micro-organisms in Biotechnology: introduction to microorganisms, historical concept, beneficial and harmful micro-organisms and their applications   (5)

Section B

Introduction to Bio-molecules: role of water in biological systems, types of bonds and interactive forces in bio-molecules, carbohydrates, proteins, lipids, nucleic acids, porphyrins and vitamins
(13)

Introduction to enzymes: their classification and applications   (3)

Applications of biotechnology: In agriculture, medical, food industry and bioremediation
(6)

Books Recommended:

1. Campbell, NA, Reece, JB, Urry, LA, Cain, ML, Wasserman, SA, Minorsky, PV and Jackson, RB: Biology*,* Pearson/Benjamin Cummings, 8th edition, 2008

2. Pelczar MJ and Chan ECS (Jr): Microbiology, Tata McGraw Hill Pub. Co., 5th edition, 2003

3. Nelson DL and Cox MM: Lehninger Principles of Biochemistry*,* W.H. Freeman and Company, USA. 6th edition, 2013

4. Singh BD: Biotechnology: Expanding Horizons, Kalyani Publishers, 4th edition, 2012

Paper Title   : <u>Basic Biology (Practical)</u>

Internal Assessment : 50

1. To measure the pH of a solution
2. To prepare phosphate buffer solution
3. To test the presence of carbohydrates in a given sample by Molisch's test/Anthrone test
4. To test the presence of proteins in a given sample by Ninhydrin test/Biuret test
5. Estimation of DNA in a given sample by diphenylamine reaction
6. Estimation of RNA in a given sample by orcinol method
7. Preparation and study of wet mounts of different microorganisms

Paper Title   Computer Programming (Theory)
Paper Code   : CS104 / CS204
Course Duration: 45 lectures of one hour each.

Max (Univ. Exam) Marks : 50   **Time of examination: 3hrs.**

Internal Assessment : 50

 Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

Objective: To get basic knowledge of computers, its components and Operating systems and Linux. Shell Commands. To acquire programming skills in C and basic knowledge of Object Oriented Programming.

PART A

1.   **Introduction:** (8 hrs)

       Computer Basic, Block Diagram of Computer, Memory Hierarchy, Types of RAM, Secondary Memory Introduction to Operating Systems, Programming Languages, Program Structure, Linux Shell Commands, Bourne Shell, C Shell, Korn Shell

2.   **Basic Constructs of C:** (8 hrs)

       Keywords, Identifiers, Variables, Symbolic Constants, Data Types and their storage, Operands, Arithmetic Operators, Relational Operators, Logical Operators, Bitwise Operators, Increment & Decrement Operators, Expressions, Conditional Expressions, Assignment Operators and Expressions, Type Conversions, Precedence and Order of Evaluation, External Variables and Scope of Variables. Basic Input Output, Formatted I/O.

3.   **Program Control Flow:** (4 hrs)

       Statements and Blocks, Conditional Statements, IF, ELSE-IF, Switch Case statements, Control Loops, For, While and Do-While, Go to and Labels.

4.   **Arrays & Functions: (8 hrs)**

       Pointers and Addresses, Arrays, Multi dimensional arrays, strings, pointer arrays, Functions, Function Prototyping, Scope of functions, Arguments, Call by value and call by references, static variables, recursion.

       PART B

5.   **Structures:** (4 hrs)

Structures, Array of Structures, pointer to structures, Typedef, Unions, Bit fields, passing structures as an argument to functions , C-Preprocessor and Macros, Command line arguments.

6. **Input and Output** (7 hrs)

Standard and Formatted Input and Output, File Access & its types, Line Input and Output, Types of Files, Binary & ASCII Files, Error handling, stderr and exit functions

7   .I**ntroduction to Object Oriented Programming:** (6 hrs)

Classes and Objects, Structures vs Classes, Abstraction, Encapsulation, Polymorphism, Inheritance.

Recommended Books:

1. Brian Kernighan and Dennis M. Ritchie: The C Programming Language, Prentice Hall, 2nd Edition 2007
2. V.K. Jain : Fundamentals of Information Technology and Computer Programming, PHI. Latest Edition
3. K.N.King : C Programming : A Modern Approach, W.W. Norton Company 2nd edition (2008).
4. Herbert Schildt : C: The Complete Reference, Tata Mcgraw Hill Publications 4th edition.
5. Yashwant Kanetkar : Let us C++ , latest edition, BPB Publications
6. E. Balagurusamy : Programming in ANSI C++ , TMH publications, 4th edition, Reprint (2008).
7. Gottfired : Programming in ANSI C, Schaum Series, TMH publications, 2nd Edition (1996).

Paper Title   : Computer Programming Practical
Internal Assessment : 50

Instruction for Students: The candidate will be attending a laboratory session of 2 hours weekly and students have to perform the practical related to the following list.

1. Introduction to UNIX Shells, C Shell, Bourne Shell, Korn Shell
2. Writing and compiling C Program in Linux.
3. Introduction to basic structure of C program, utility of header and library files.
4. Implementation of program related to the basic constructs in C
5. Program using different data types in C
6. Programs using Loops and Conditional Statements in C
7. Programs using arrays single dimension and multi dimensions in C.
8. Implementation of Matrices and their basic functions such as addition, subtraction, multiplication, inverse.
9. Programs using functions by passing values using call by value and call by reference method
10. Programs related to structures and unions
11. Program to implement array using pointers

12. Programs related to string handling in C

13. Program to manage I/O files

14. Introduction to classes and program related to basic use of classes showing their advantages over structures.

15. Any other program related to theory program to enhance the understanding of students in the subject.

Physics Course 1

Any one of the following three papers to be chosen by institute

Paper Title : Oscillations And Optics (Theory)
Paper Code : APH 101 / APH 201
Course Duration: 45 lectures of one hour each.

Max (Univ. Exam) Marks : 50   **Time of examination: 3hrs.**

Internal Assessment : 50

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

PART A

Ultrasonics: Production and detection of ultrasonics (2)

SHM: Review of SHM, superposition of two SHM in one dimension, charge oscillations in LC circuits (3)

Damped Oscillations: Concept and cause of damping, differential equation of a damped oscillator and different kinds of damping, Methods of describing damping of an oscillator - logarithmic decrement, relaxation time, quality factor, band width. Series LCR circuit as a damped oscillator. (3)

Forced Oscillations: States of forced oscillations, differential equation of forced oscillator – its displacement, velocity and impedance, behaviour of displacement and velocity with driver's frequency, Power, bandwidth, Quality factor and amplification of forced oscillator, resonance in forced oscillators, forced oscillations in series LCR circuit (4)

Wave Motion: Wave equation and its solution, characteristic impedance of a string, reflection and transmission of waves on a string at a boundary, reflection and transmission of energy, the matching of impedances (3)

PART B

Interference: Division of wave front and amplitude; Fresnel's biprism, Newton's rings, Michelson interferometer and its applications for determination of λ and $d\lambda$. (4)

Diffraction: Fresnel and Fraunhofer diffraction, qualitative changes in diffraction pattern on moving from single slit to double slit, plane transmission grating, dispersive power & resolving power of a grating. (5)

Polarization: Methods of polarization, analysis of polarized light, quarter and half wave plates, double refraction. (4)

Lasers: Elementary idea of LASER production, spontaneous emission, stimulated emission, Einstein's coefficients, Helium-Neon, Ruby and semiconductor lasers, applications of lasers. (4)

Fibre Optics: Basics of optical fibre - its numerical aperture, coherent bundle, step index and graded index fibre, material dispersion, fibre Optics sensors, applications of optical fibre in communication systems. (3)

Holography: Basic principle, theory and requirements, applications (2)

References:

1. Physics for Engineers (Prentice Hall India) - N.K. Verma

2. Physics of Vibrations and Waves (5th Edition, John Wiley & Sons) – H.J.Pain

3. Optics – Ajoy Ghatak

Paper Title   : *Oscillations and Optics* **Practical**

Internal Assessment: 50

1. To study Lissajous figures obtained by superposition of oscillations with different frequencies and phases.
2. To find the wavelength of sodium light using Fresnel's biprism.
3. (i) To determine the wavelength of He-Ne laser using transmission grating.

    (ii) To determine the slit width using the diffraction pattern.

4. To determine the wave length of sodium light by Newton's rings method.
5. To determine the wave length of sodium light using a diffraction grating.
6. To find the specific rotation of sugar solution using a Bi-quartz Polarimeter.
7. To design a hollow prism and used it find the refractive index of a given liquid.
8. To determine the wavelength of laser using Michelson interferometer.

Paper Title : <u>Quantum And Statistical Physics</u> (Theory)
Paper Code : APH103 / APH203
Course Duration: 45 lectures of one hour each.

Max (Univ. Exam) Marks : 50   **Time of examination: 3hrs.**

Internal Assessment : 50

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

PART A

SPECIAL THEORY OF RELATIVITY

Inertial and non-inertial frames of reference, Galilean transformation, Michelson Morley Experiment, postulates of special theory of relativity, Lorentz transformation, Simultaneity, Length contraction, Time dilation, Doppler effect, Addition of velocities, variation of mass with velocity, mass-energy relation (7)

ORIGIN AND POSTULATES OF QUANTUM PHYSICS

Quantum theory of light, X-rays production, spectrum & diffraction (Bragg's law), photoelectric effect, Compton effect, pair production, photons & gravity, black holes, de-Broglie hypothesis, particle diffraction, uncertainty principle and applications (7)

Postulates of quantum mechanics, Schrodinger theory, time-dependent and time-independent Schrodinger equation, wave function, Born interpretation and normalization, expectation values (3)

PART B

APPLICATIONS OF QUANTUM PHYSICS

Particle in a box (infinite potential well), finite potential step and barrier problems, tunneling, linear harmonic oscillator (one-dimensional) (4)

Hydrogen atom (qualitative), radiative transitions and selection rules, Zeeman effect, Spin-orbit coupling, electron spin, Stern-Gerlach experiment, exclusion principle, symmetric and antisymmetric wavefunctions (5)

STATISTICAL PHYSICS

Maxwell-Boltzmann statistics, molecular energies in an ideal gas, Bose-Einstein and Fermi-Dirac statistics, black body radiation, Rayleigh-Jeans and Planck's radiation laws, free electrons in a metal, electron-energy distribution, Fermi energy, electronic specific heat, conduction in metals, thermionic emission. (10)

References:

1. Concepts of Modern Physics, by Arthur Beiser (McGraw-Hill)

2. Solid State Physics, by C. Kittel (Wiley Eastern)

3. Solid State Physics, by S.O. Pillai (New Age International)

4. Statistical Physics and Thermodynamics by V.S. Bhatia
Paper Title: <u>Quantum And Statistical Physics</u> (**Practical**)

Internal Assessment: 50

1) To study the quantized energy level of the first excited state in the Argon using the Frank-Hertz setup.
2) To find the value of Planck's constant and evaluate the work function of cathode material by used of photoelectric cell.
3) To study various characteristics of photo-voltaic cell: (a) Voltage-current characteristics, (b) loading characteristics, (c) power-resistance characteristics and (d) inverse square law behavior of the photo-current with distance of source of light from photo-voltaic cell
4) To study the response of a photo-resistor to varying intensity of light falling on it and deduce spectral sensitivity of its semiconductor material.
5) To study the Balmer Series of Mercury and Hydrogen spectrum using diffraction grating and calculate Rydberg constant

Paper Title : Physics of Materials
Paper Code : APH207 / APH107
Course Duration: 45 lectures of one hour each.

Max (Univ. Exam) Marks : 50   **Time of examination: 3hrs.**

Internal Assessment : 50

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

Part - A

Crystal structure: Bonding forces and energies, Primary and Secondary bonds, Space Lattices, Symmetries in a cubic lattice, Crystal Structures (cubic and hexagonal cells), Assignment of coordinates, directions and planes in crystals, Linear, Planar and Space densities in crystals, close packed morphology (Hexagonal and cubic close packing), single and polycrystalline structures, interstitial spaces (trigonal, tetrahedral and octahedral voids)

Structure of ceramics (NaCl, Zinc blende, silica and silicates, diamond crystal, Graphite, Fullerenes and carbon nanotubes)

Structure of polymers, crystallinity of long chain polymers

Crystal Structure analysis, X-ray diffraction and Bragg's law, Powder method for study of X-ray diffraction pattern

Crystal Defects (Point, line, surface and volume imperfections)   **(14hrs)**

Diffusion: Diffusion mechanisms, steady state diffusion, non-steady state diffusion, factors affecting diffusion, applications based on diffusion (corrosion resistance of Duralumin, carburization of steel, decarburization of steel, doping of semiconductors)   **(3hrs)**

Elastic, Anelastic and Viscoelastic Behaviour Elastic behaviour and its atomic model, rubber like elasticity, anelastic behaviour, relaxation processes, viscoelastic behaviour, spring-dashpot model
                                                                    (3hrs)

Part - B

Plastic Deformations and strengthening mechanisms : Tensile properties (Yield strength, Tensile Strength, Ductility, Resilience, Toughness), Dislocations and plastic deformation, characteristics of dislocations, slip systems, slip in single crystals, plastic deformation of polycrystalline materials, mechanisms of strengthening in metals (grain size reduction, solid-solution strengthening, strain hardening), recovery, recrystallization and grain growth **(5hrs)**

Fracture, Fatigue and Creep : Fracture (Ductile and brittle fractures), principles of fracture mechanics, fracture toughness, ductile to brittle transitions Cyclic stresses, S-N curve, crack initiation and propagation, factors that affect fatigue life, environmental effects, generalized creep behavior, stress and temperature effects.   **(5hrs)**

Phase Diagrams : One-Component (or Unary) Phase Diagrams, Binary Isomorphous Systems, Interpretation of Phase Diagrams, Development of Microstructure in   Isomorphous Alloys,

Mechanical Properties of Isomorphous Alloys ,Binary Eutectic Systems,   Development of Microstructure in Eutectic Alloy, Equilibrium Diagrams Having Intermediate Phases or Compounds, Eutectic and Peritectic Reactions, The Gibbs Phase -
Rule
(6hrs)

Phase Transformations : Kinetics of phase transformation, kinetics of solid state reactions, Isothermal transformation diagrams, continuous cooling transformation, temper embrittlement
(4hrs)

References:
1. Material science and Engineering – An Introduction by William D Callister, Jr, Sixth Edition, John Wiley and Sons.
2. Material science and Engineering – A First Course by V.Raghvan Fourth Edition, Eastern Economy Edition
3. Solid State Physics (New Age Publishers) – S.O. Pillai
4. Introduction to Solids (Tata McGraw Hill, Third Edition) - Leonid V Azaroff

Paper Title   : Physics of Materials (Practical)

Internal Assessment : 50

1. To find the energy band gap of the given semiconductor by four probe method.
2. To study the Hall Effect of a given semiconductor.
3. To determine the dielectric constant of the given materials.
4. To study the B-H curve of the ferromagnetic materials.
5. To determine the value of e/m for electron by long solenoid (helical) method.
6. To study the variation of magnetic field with distance along the axis of a circular coil carrying current by plotting a graph.
7. To find the Curie temperature of a Ferroelectric material by measuring Capacitance as a function of temperature.
8. To determine the thermal conductivity of an insulator material using guarded plate method (Lee's disc method).
9. To Study (a) Voltage-current characteristics (b) loading characteristics (c) Power-Resistance characteristics and (d) intensity response of photovoltaic cell.

Paper Title   : Ethics and Self Awareness
Paper Code   : HSS101   / HSS201
Max (Univ. Exam) Marks : 50   Time of examination: 3hrs.

Internal Assessment : 50

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

Lecture Wise Breakup   No. of Lectures

<div align="center">PART A</div>

1. Introduction to Ethics   (06)
    Concept of Ethics – Nature, Scope, Sources, Types, Functions and Factors
    influencing Ethics, Approaches to Ethics – Psychological, Philosophical
    and Social, Broader Ethical Issues in Society.
2.   Values, Norms, Standards and Morality   (04)
    Concept and Role, Relation with Ethics, Psycho-Social Theories of Moral
    Development – Kohlberg and Carol Gilligan
3.   Ethics and Business   (05)
    Concept of Business Ethics – Nature, Objectives and Factors influencing
    Business Ethics, 3 C's of Business Ethics, Ethics in Business
    Activities, Ethical Dilemmas in Business, Managing Ethics

<div align="center">PART B</div>

4. Self-Awareness   (04)
    Concept of Self Awareness – Need, Elements, Self Assessment – SWOT
    Analysis, Self Concepts – Self-Knowledge, Assertiveness and
    Self-Confidence, Self-Esteem
5.   Self-Development (11)
    Concept of Self-Development, Social Intelligence, Emotional Intelligence,
    Managing Time and Stress, Positive Human Qualities (Self-Efficacy,
    Empathy, Gratitude, Compassion, Forgiveness and Motivation),
    Personality Development Models – Johari Window, Transactional
    Analysis, Myers Briggs Type Indicator, Self-Awareness and
    Self-Development Exercises

BOOKS
1. Murthy, C.S.V., "Business Ethics – Text and Cases", Himalaya Publishing House
2. Hartman, Laura P. and Chatterjee, Abha, "Business Ethics", Tata McGraw Hill
3. Rao, A.B., "Business Ethics and Professional Values", Excel Books
4. Velasquez, Manuel G., "Business Ethics – Concepts and Cases", Prentice Hall
5. Corey, G., Schneider Corey, M., & Callanan, P., "Issues and Ethics in the Helping Professions", Brooks/Cole.

6. Hall, Calvin S., Lindzey, Dardner. & Cambell, John B., "Theories of Personality", Hamilton Printing Company.
7. Leary, M.R., "The Curse of Self: Self-awareness, Egotism and the Quality of Human Life", Oxford University Press.
8. Twain, Allan, "Self-Awareness"

Paper Title   : Introduction to Environment Science
Paper Code   : GS101 / GS 201

Max (Univ. Exam) Marks : 50   **Time of examination: 3hrs.**

Internal Assessment : 50

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

PART A

General (04)

Introduction, components of the environment, environmental degradation.

Ecology (04)

Elements of ecology: Ecological balance and consequences of change, principles of environmental impact assessment.

Air pollution and control (06)

Atmospheric composition, energy balance, climate, weather, dispersion, sources and effects of pollutants, primary and secondary pollutants, green house effect, depletion of ozone layer, standards and control measures.

PART B

Water pollution and control (06)

Hydrosphere, natural water, pollutants their origin and effects, river/lake/ground water pollution, standards and control.

Land Pollution (06)

Lithosphere, pollutants (municipal, industrial, commercial, agricultural, hazardous solid wastes): their origin and effects, collection and disposal of solid waste, recovery and conversion methods.

Noise Pollution (04)

Sources, effects, standards and control.

Books & References

- Masters, C.M., "Introduction to Environmental Engineering and Science", Prentice Hall of India Pvt. Ltd., 1991.
- Nebel, B.J.,"Environmental Science" Prentice –Hall Inc., 1987.

Paper Title   : Differential Equations and Transforms

Paper Code   : MATHS201

Pre Requisite   : Calculus (MATHS101)

Course Duration: 45 lectures of one hour each.

Max (Univ. Exam) Marks : 50   **Time of examination: 3hrs.**

Internal Assessment : 50

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

Objectives

- To learn the methods to formulate and solve linear differential equations and their applications to engineering problems
- To learn the concepts of Laplace transforms and to evaluate Laplace transforms and inverse Laplace transform
- To apply Laplace transforms to solve ordinary differential equations
- To learn the concept of Fourier series, integrals and transforms.
- To learn how to solve heat, wave and Laplace equations.

S. No.	Topic	No. of Lectures
	PART A	
1.	**ORDINARY DIFFERENTIAL EQUATIONS**	13
	Review of geometrical meaning of the differential equation $y' = f(x, y)$, directional fields, Exact differential equations (Scope as in Chapter 8, Section 8.7 of Reference 5), Integrating factors (Scope as in Chapter 8, Section 8.8 of Reference 5), Solution of differential equations with constant coefficients: method of differential operators. Non – homogeneous equations of second order with constant coefficients: Solution by method of variation of parameters (Scope as in Chapter 9, Section 9.7 of Reference 5). Power series method of solution (Scope as in Chapter 10, Section 10.2 of Reference 2)	
2.	**Laplace Transforms**	10
	Laplace transform, Inverse transforms, shifting, transform of derivatives and integrals. Unit step function, second shifting theorem, Dirac's Delta function.	

	Differentiation and integration of transforms. Convolution Theorem on Laplace Transforms. Application of Laplace transforms to solve ordinary differential equations with initial conditions (Scope as in Chapter 5, Sections 5.1 – 5.5 of Reference 1).		
	PART B		
3.	**Fourier Series and Transforms:** Periodic functions, Fourier series, Even and odd series, half range expansions, Complex Fourier Series, Approximation by trigonometric polynomials. Fourier integrals, Fourier Cosine and Sine transforms, Fourier Transforms (Scope as in Chapter 10, Sections 10.1 – 10.5, 10.7 – 10.10 of Reference 1).	**8**	
4.	**Partial Differential Equations:** Partial differential equations of first order, origin, solution of linear partial differential equations of first order, Integral surfaces passing through a given curve (Scope as in Chapter 2, Sections 1, 2, 4, 5 of Reference 4).	**6**	
5.	**Boundary Value Problems:** D'Alembert's solution of wave equation, separation of variables: one dimension and two dimension heat and wave equation, Laplace equation in Cartesian and Polar coordinates (Scope as in Chapter 11, Sections 11.1, 11.3 – 11.5, 11.8 – 11.9 of Reference 1).	**8**	

Outcomes

1. The student will learn to solve Ordinary Differential equations.
2. The students will be able to apply the tools of Laplace Transforms to model engineering problems and solve the resulting differential equations.
3. Students will understand the nature and behavior of trigonometric (Fourier) series and apply it to solve boundary value problems.

References:

1. E. Kreyszig. Advanced Engineering Mathematics, Eighth Edition, John Wiley.
2. B. V. Ramana. Higher Engineering Mathematics, Tata McGraw Hill.
3. R. K. Jain, S. R. K. Iyenger. Advanced Engineering Mathematics, Narosa Publications.
4. Ian N. Sneedon. Elements of Partial Differential Equations, McGraw-Hill, Singapore, 1957.
5. Michael D. Greenberg. Advanced Engineering Mathematics, Second Edition, Pearson Education.
6. Advanced Engineering Mathematics, Wylie and Barrett, McGraw Hill
7. Frank Ayers. Theory and Problems of Differential Equations, Shaum Outline Series, McGraw-Hill, Singapore, 1972.

Paper Title : Communication Skills
Paper Code : HSS202 / HSS102

Max (Univ. Exam) Marks : 50   **Time of examination: 3hrs.**

Internal Assessment : 50

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

Part –A

Lecture Wise Breakup   **No. of Lectures**

1. **Fundamentals of Communication Skills**   **(02)**
   Scope and Significance of Communication Skills, Listening, Speaking, Reading
   and Writing
2. **Writing Skills**   **(04)**
   Basics of Grammar – Word Order, Sentence Construction, Placing of Subject
   and Verbs, Parts of Speech, Use of Tenses, Articles, Prepositions, Phrasal Verbs,
   Active-Passive, Narration
3. **Vocabulary Building and Writing**   **(03)**
   Word Formations, Synonyms, Antonyms, Homonyms, One-Word Substitutes,
   Idioms and Phrases, Abbreviations of Scientific and Technical Words
4. **Speaking Skills**   **(03)**
   Introduction to Phonetic Sounds, English Phonemes, Stress, Rhythm
   and Intonation, Countering Stage Fright and Barriers of Communication
5. **Reading and Comprehension**   **(02)**

Part –B

Lecture Wise Breakup   **No. of Lectures**
1. **Advanced Communication Skills**   **(02)**
   Scope, Significance, Process of Communication in an organization, Types
   and Levels, Communication Networks, Technical Communication, Tools
   of Effective Communication
2. **Speaking Skills and Personality Development**   **(05)**
   Interpersonal Communication, Presentation Skills, Body Language and Voice
   Modulation, Persuasion, Negotiation and Linguistic Programming, Public
   Speaking, Group Discussions, Interviews and Case Studies, Power Point
   Presentations , Relevant to the context and locale, Technical Presentations,
   Conducting , Meeting and Conferences
3. **Communication and Media**   **(01)**
   Social and Political Context of Communication, Recent Developments in Media
4. **Advanced Techniques in Speaking Skills**   **(02)**
   Importance of Listening/Responding to native and global accents, Telephonic
   Interviews and Video Conferencing

5. **Advanced Techniques in Technical Writing** (04)
   Job Application, CV Writing, Business Letters, Memos, Minutes, Reports and
   Report Writing Strategies, E-mail Etiquette, Blog Writing, Instruction Manuals
   and Technical Proposals

Practical Sessions

1. Individual presentations with stress on delivery and content

2. Overcoming Stage Fright - Debates, extempore

3. How to discuss in a group - Group Discussion

4. Discussion on recent developments and current debates in the media

5. How to prepare for an Interview and face it with confidence

6. Conducting meeting and conferences

7. Exercises on Composition & Comprehension, Reading Improvement

TEXT BOOKS
1. Ludlow, R. and Panton, F., "The Essence of Effective Communication", Prentice Hall
2. Quirk, Randolph. and Sidney, Greenbaum., "A University Grammar of English", Pearson Education
3. Ashraf, M. Rizvi, "Effective Technical Communication", McGraw Hill
4. Bovee, Courtland L. and John, V. Thill., "Business Communication Today", Pearson Education

REFERNCE BOOKS
1. Guffrey, Mary E., "Essentials of Business Communication", South-Western College Publishing
2. Raman, Minakshi. And Sharma, S., "Technical Communication: Principles and Practice", Oxford University Press
3. Rodrigues, M.V., "Effective Communication", Himalaya Publishing House
4. McCarthy, Michael. and Felicity O' Dell., "English Vocabulary in Use", Cambridge University Press
5. Jones, Daniel., "The Pronunciation of English", Universal Book Stall
6. Sharma, R.C. and Mohan, K., "Business Correspondence and Report Writing", Tata McGraw Hill
7. Raman, Minakshi. And Sharma, S., "Technical Communication: Principles and Practice", Oxford University Press
8. Scott, Bill., "Communication for Professional Engineers", Thomas Teleford Ltd.
9. McMurrey, David A. and Joanne, Buckley., "Handbook for Technical Writing", Cengage Learning
10. Harve, L., Locke, W. and Morey, A., "Enhancing Employability and Recognizing Diversity", Universities UK and CSU
11. Lock, R., "Student Activities for taking charge of your Career Direction and Job Search", Cole Publishing
12. Pease, A., "Body Language", Sheldon Press

Paper Title : General Chemistry
Paper Code : CH202 / CH102
Course Duration: 45 lectures of one hour each.

Max (Univ. Exam) Marks : 50   **Time of examination: 3hrs.**

Internal Assessment : 50

Note for the examiner: The semester question paper will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt two questions from each section.

Objective: To impart the knowledge on basic concepts of general chemistry.
Details of the Course:

S. No.	Contents	Contact hrs
	PART A	
1.	***Quantum theory and atomic structure***: Introduction to wave mechanics, the Schrodinger equation, the Schrodinger equation as applied to hydrogen atom, the origin of quantum numbers and shapes of orbitals.	5
2.	***Chemical Bonding***: Valence bond theory, bond angles and shapes of molecules and ions (containing bond pairs and lone pairs), molecular orbital theory and application of molecular orbital theory to the formation of homonuclear (H_2, N_2) and heteronuclear diatomic molecules (NO, CO, CN). Comparison of VB and MO theories.	6
3.	***Stereochemistry of Organic Compounds***: Concept of isomerism. Types of isomerism. Optical isomerism–enantiomers, optical activity, properties of enantiomers, diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization, R & S systems of nomenclature. Geometric isomerism– determination of configuration of geometric isomers, E & Z system of nomenclature Conformational isomerism – conformational analysis of ethane and n-butane; conformations of cyclohexane, Newman projection,	8
	PART B	
4.	***Chemistry of Hydrocarbons***: House synthesis, halogenation of alkanes, free radical mechanism. Alkenes-catalytic hydrogenation, dehydration of alcohols, dehydrohalogenation, Saytzeff rule, electrophillic addition reactions, Markownikiff's rule, peroxide effect, mechanism of allylic substitution. Acidity of 1-alkynes, conjugated dienes, 1,2-and 1,4-additions. Ring-opening reactions of cyclopropane and cyclobutane, Chemistry of benzene, aromatic electrophillic substitution reactions, Friedel-Crafts reactions.	8
5.	***Chemistry of functional groups:*** Alkyl and aryl halides-nucleophilic substitution, synthetic utility of Grignard reagents, Alcohol-methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters, phenols- acidity of phenol. Aldehydes and ketones- Synthesis of aldehydes from acid chlorides, synthesis of ketones from nitriles and carboxylic acids, Mechanism of nucleophilic additions to carbonyl group with particular emphasis on	10

	benzoin and aldol condensations	
	Carboxylic acid- acidity of carboxylic acids, preparation of carboxylic acids, Hell-Volhard-Zelinsky reaction.	
	Amines- alkyl and aryl amines, basicity of amines.	
	Preparation of diazonium salts by reaction of amines with nitrous acid, synthetic utility of diazonium salts.	
6.	***Heterocyclic Compounds***: Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine. Comparison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed five and six-membered heterocycles. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fischer indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis.	8

Books Recommended

1. Inorganic Chemistry by A. G. Sharpe, 3rd Edition, Longman Publishers ELBS, 1992.
2. Concise: Inorganic Chemistry, J. D. Lee, 5th Edition, Chapman and Hall Publishers, 1996.
3. Advanced Inorganic Chemistry, F. A. Cotton & G. Wilkinson, 3rd Edition, Wiley Eastern Ltd., 1982.
4. Basic Inorganic Chemistry by F. A. Cotton & G. Wilkinson, Wiley EasternLtd., 1987. 12
5. Organic Chemistry by I. L. Finar, Vol. 1, 5th Ed., Pearson Education Asia.
6. Organic Chemistry by I. L. Finar, Vol.2, 5th Ed., Pearson Education Asia.
7. Organic Chemistry by F. A. Carey, 5th Ed., Tata McGraw Hill.
8. Fundamentals of Organic Chemistry by T. W. G. Solomons, John Wiley and Sons, Inc., New York, 1994.
9. Text-book of Organic Chemistry by B. S. Bahl & A. Bahl 16th Edition, S. Chand and Company Ltd., New Delhi.

Practicals:

Instruction for Students: The candidate will be attending a laboratory session of two hours weekly and has to perform any eight experiments.
1. Verify Lambert Beer's law using spectrophotometer and $CoCl_2$ or $K_2Cr_2O_7$ solution.
2. To determine the strength of an acid solution by using conductivity meter.
3. Determination of saponification number of an oil.
4. Preparation of a phenol formaldehyde resin.
5. Experiments on TLC (determination of Rf values and identification of various compounds).
6. To determine the heat of a neutralization reaction.
7. To determine the heat of solution of given compound.
8. Determination of total hardness of a water sample.
9. Determination of copper.
10. Determination of chloride ion and dissolved O2 in water.
11. Preparation of an inorganic complex/organic compound

Books Recommended:

1. A. I. Vogel : A textbook of Quantitative Inorganic Analysis, 2000, Published by Longman Gp. Ltd, 4th edition.

2. Shashi Chawla: Essentials of Experimental Engineering Chemistry. Published by Dhanpat Rai & Co. Delhi (2001).
3. Vogel's text book of quantitative chemical analysis, 6th Ed by J. Mendham, R. C. Denny, J. D. Barnes and M. J. K. Thomas, Pearson Education.

Paper Title: Workshop Practice **Paper Code:** ME 203 / ME103 **Time of examination:** 3hrs. **Internal Assessment : 50** **Course Prerequisites:** Basic Workshop Practices	
Course Objectives(CO) :	**Student will be able to:** 1. **Know different machines, tools and equipment, Identify different Engineering materials, metals and non-metals.** 2. **Understand different Mechanisms, Use of Machines, Tools and Equipment.** 3. **Knowledge of basic Manufacturing Processes in Electronics, Electrical, Machine, Welding, Fitting, Sheet Metal.Smithy, Foundry and Carpentry Workshops.**
Course Outcome :	**This course is designed to help students achieve the following outcomes.** 1) **Familiarity with common machines, Tools and Equipment in basic Workshop Practices.** 2) **On hand basic workshop practices in Electronics, Electrical, Machine, Welding, Fitting, Sheet Metal. Smithy, Foundry and Carpentry Workshops in Engineering professions.** 3) **Applications of Basic Workshop Practices..**

SYLLABUS	**8u98**
Instruction for Students: The candidate will be attending a laboratory session of three hours weekly. Practice of basic exercises related with different shops. On hand basic workshop practices in Electronics, Electrical, Machine, Welding, Fitting, Sheet Metal. Smithy, Foundry and Carpentry Workshops in Engineering professions. **Welding Workshop :** (Theory)Joining Processes, Welding and its Classification, Welding Processes, Fusion Welding, Pressure Welding, Electric Arc Welding, Gas Welding, Resistance Welding, Metal Inert gas Welding, Welding Joints, Welding Positions, Welding defects, Welding Applications, Basic welding design and Procedures, identification of materials, **Jobs: Butt Joint in Flat Position using SMAW.** **Lap Joint using Spot Welding** **Edge Joint in Horizontal Position using SMAW** **Tee Joint in Flat position using SMAW** **Corner Joint in vertical position using SMAW.** **Defect Identification and marking.** **Edge preparation and Fillet making, Tacking, Distortion identification** **Electronics Workshop :** To know about Soldering mechanism and techniques **Familiarity with Electronic Components / symbols** **Testing of electronic components** **Application of Soldering : Circuit Assembly** **List of Jobs :**	

Practice of Soldering and de-soldering
Identification and testing of a) passive electronic components b) Active electronic components
Assembly of Regulated Power supply circuit

Electrical Workshop:
Introduction of Various Electric wirings, Wiring Systems, Electrical wiring material and fitting, different type of cables, Conduit pipe and its fitting, inspection points, switches of all types, Distribution boards, M.C.B's etc.
Electric Shock and its management.
Electric Tools: Conversance with various tools and to carry out the following:
   a) Measurement of wire sizes using SWG and micrometer
   b) Identification of Phase and neutral in single phase supply

Jobs:
To control a lamp with a single way switch
To control a lamp from two different places
To assemble a fluorescent lamp with its accessories
To control a lamp, fan and a three pin socket in parallel connection with single way switches

Fitting Shop:
Introduction of Fitting, different type of operations, Tools, materials, precision instruments like Vernier caliper and Micrometer etc,
Safety precautions and Practical demonstration of tools and equipments

Jobs: To make a square from MS Flat, Punching, Cutting, Filling techniques and practice, Tapping, Counter Drilling

Smithy Workshop:
Introduction of Smithy and Forging process, Tools and Equipment's, Operations, Heat Treatment processes, Advantages, Dis-advantages, Defects and Safety precautions.
Jobs: Drawing and Upsetting Practice using Open Hearth Furnace.
Cold working process practice
Heat Treatment \: Annealing and hardening process

Machine Shop : Application, Function and different parts, Operations of Lathe, Type of Cutting Tools and their materials, Drill machine Types, applications and Functions. Hacksaw machines and functions, Work Holding devices and tools, chucks, Vices, machine Vices, V Block, Measuring Instruments uses, Shaper and Milling machine Applications.
Jobs: To perform Marking, Facing, Turning,taper Turing, Grooving, Knurling, parting, Drilling, Reaming operations on lathe machine,
Hacksawing practice on Power hacksaw,
Shaping operation practice on Shaper

Carpentry Shop:Classification of Tree, Timber. Advantages and uses of Timber, Seasoning of Wood, Tools Used, Defects and Prevention of Wood,

Jobs:
Tee Joint
Cross Joint
Tenon Joint,
L Shape Joint
Practice of Wood Working Lathe
Practice on multi-purpose Planer

Foundry Shop : Introduction to Foundry, Advantages and Disadvantages of castings process, Introduction to pattern and various hand tools, Ingredients of Green sands, Various Hand Molding processes, Introduction to Casting Defects,

Jobs: Identification and uses of hand tools, Preparation of Green sand in Muller, Preparation of Sand Mould of Single piece solid pattern, Split pattern, Preparation of Green sand Core, casting of a Mould and study its defects.

RECOMMENDED BOOKS

	NAME	AUTHOR(S)	PUBLISHER
1.	Introduction to Basic Manufacturing Processes and Workshop Technology	Rajender Singh	New Age International Publication
2	Manufacturing Processes	Chapman	Viva Books Private Limited

Paper Title : <u>**Basic Biotechnology (Theory)**</u>
Paper Code : <u>**BIO 201**</u>
Max (Univ. Exam) Marks : 50   **Time of examination: 3hrs.**

Internal Assessment : 50
Course Duration: 45 lectures of one hour each with four lectures per week.

Note: The semester question paper of a subject will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each section.

Objective: To make students understand the basic morphological and physiological aspects of biological systems. To introduce the students with the biotechnological aspects for product development for societal benefit.

<u>**Section A**</u>

Types of Animal Tissues: basic structure and function of epithelial tissue, connective tissue, muscular tissue and nervous tissue   (6)

Biological Systems: outlines of the major biological systems – digestive, circulatory, nervous, endocrine, and reproductive system   (12)

Basic Genetics: concept of gene and allele, Mendelian and non Mendelian inheritance   (5)

<u>**Section B**</u>

Introduction to biopolymers and synthetic polymers and their applications: Types of biopolymers and synthetic polymers, their application as implant material and in tissue engineering.

                                                                                                                          (7)

Introduction to Genetic Engineering: basic concepts, tools and applications   (7)

Introduction to biosafety, bioethics and IPR in biotechnology: concept of biosafety, need and application of biosafety in laboratories and industries, international and national norms regarding biosafety, GLP, GMP, bio-medical wastes, transportation of biological materials (8)

Books Recommended:
1. Campbell, NA, Reece, JB, Urry, LA, Cain, ML, Wasserman, SA, Minorsky, PV and Jackson, RB: Biology, Pearson/Benjamin Cummings, 8th edition, 2008

2. Singh BD: Biotechnology: Expanding Horizons, Kalyani Publishers, 4th edition, 2012

3. Tortora GJ and Derrickson BH: Principles of Anatomy and Physiology, John Wiley & Sons, 13th edition, 2011

4. Ratner, BD (Ed.), Hoffman, AS (Ed.), Schoen, FJ (Ed.) and Lemons, JE (Ed.). Biomaterials Science: An Introduction to Materials in Medicine, Academic Press, 3rd edition, 2013

Paper Title : Fundamentals of Biotechnology and Bioengineering (Theory)
Paper Code : BIO 202
Max (Univ. Exam) Marks : 50   **Time of examination: 3hrs.**

Internal Assessment : 50
Course Duration: 45 lectures of one hour each with four lectures per week.

Note: The semester question paper of a subject will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each section.

Objective: To introduce students to the engineering aspect applicable to biological systems for their efficient utilization for product development and make them aware of tools available to achieve the same.

Section A

Introduction to Engineering Calculations: System of units, conversion of units, dimensional consistency, scientific notations, mole concept, mixtures and solutions   (4)

Basic Tools in Biotechnology: types and principles of spectrophotometer, pH meter, autoclave, incubator, lyophilizer, microscope   (10)

Introduction to separation techniques in biotechnology: centrifugation, electrophoresis, chromatography   (7)

Introduction to radioactivity: types of radionuclides and their applications   (2)

Section B

Concepts in Bioengineering and Bioinstrumentation: biosensors-concept and construction, bioreactors-design and operation, biomedical instruments-construction and applications of ECG, EEG, MRI, ultrasound   (12)

Application of Computers to Biology: concepts of bioinformatics, types of databases, biochips   (6)

Introduction of nano-bioengineering: Introduction of nano-biotechnology and biological systems at nanoscale, applications of nano-biotechnology in medicine and healthcare
                                                         (4)

Books Recommended:
1. Himmelblau, DM and Riggs, JB: Basic Principles and Calculations in Chemical Engineering, PHI Learning Private Limited, 8th edition, 2013

2. Wilson K and Walker J: Principles and Techniques of Practical Biochemistry, Cambridge University Press, 5th edition, 2000

3. Khandpur RS: Handbook of Biomedical Instrumentation, Tata McGraw Hill, 2nd edition, 2003

4. Attwood, TK, Parry-Smith, DJ and Phukan, S: Introduction to Bioinformatics, Pearson Education Ltd, 1st edition, 2007

5. Vo-Dinh, T (Ed.): Nanotechnology in Biology and Medicine: Methods, Devices, and Applications, CRC Press, Taylor & Francis Group, 2007

Paper Title   : Fundamentals of Biotechnology and Bioengineering (Practical)

Internal Assessment : 50

1. To verify the validity of Beer Lambert law using a spectrophotometer
2. To prepare the standard curve of Bovine Serum Albumin (BSA)
3. To observe epithelial tissue under a microscope
4. To study the working and components of a CO_2 incubator
5. To study the working and components of an autoclave
6. Acquaintance to NCBI database
7. To learn the preparation of glycerol stocks
8. Case study of *Bt* cotton