

**RAMA UNIVERSITY UTTAR PRADESH,
KANPUR**

Faculty of Engineering & Technology



SYLLABUS & EVALUATION SCHEME

[Effective from the Session 2014-15]

B. Tech. Biotechnology

1st, 2nd, 3rd & 4th Year

Course Detail and Evaluation Scheme

B. Tech. Biotechnology First Year

(Effective from the Session 2014-15)

SEMESTER-I

S. N.	Subject Code	Name of the Subject	Periods			Evaluation Scheme			Total Marks	Credit
			L	T	P	CE	MTE	ETE		
Theory Subject										
1	BBT-101	Elementary Mathematics-I	3	1	0	20	20	60	100	4
2	BBT-102	Elementary Biology-I	3	1	0	20	20	60	100	4
3	BAS-102/ BAS-104	Engineering Chemistry/ Professional Communication	3	1	0	20	20	60	100	4
4	BBT-104/ BCS-101	Introduction to Biotechnology / Computer Concepts & Programming in C	3	1	0	20	20	60	100	4
5	BAS-101	Engineering Physics-I	3	0	0	20	20	60	100	3
6	BME-101/ BAS-105	Basic Manufacturing Processes/ Environment & Ecology	2	0	0	20	20	60	100	2
Practical/Drawing/Design										
7	BAS-152/ BAS-154	Engineering Chemistry Lab/ Professional Communication Lab	0	0	2	30	20	60	100	1
8	BBT-152	Biology Lab-I	0	0	2	30	20	60	100	1
9	BWS-151/ BCE-151	Workshop Practice/ Basic Engineering Drawing	0	0	3	30	20	60	100	1
10	BAS-151/ BCS-151	Engineering Physics Lab/ Computer Programming Lab	0	0	2	30	20	60	100	1
Total			16	4	9	240	200	560	1000	25

L-Lecture, T-Tutorial, P- Practical, CE- Continuous Evaluation, MTE-Mid Term Examination, ETE-End Term Examination

Evaluation Scheme:

- **Course without practical components**

For Continuous Evaluation (CE) is such as: 20 Marks

- a. Attendance: 5 Marks
- b. Assignments/ Quiz / Seminar/Term paper /Project :15Marks

MTE - Mid Term Examination: 20 Marks

- a. First Mid Term Examination: 10 marks
- b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 60 Marks

- **Course with practical components only**

For Continuous Evaluation (CE) is such as: 30 Marks

Conduct / Perform/Execution /Practical File/ Viva-Voice

MTE - Mid Term Examination: 20 Marks

- a. First Mid Term Examination: 10 marks
- b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 50 Marks

Convener

Signature:

Name : Mr.

Date :

Internal Members

Signature: 1..... 2.....

Name: Mr. Mr.

Date:

External Members

Signature: 1..... 2.....

Name: Prof. (Dr.) Dr.

Date:

Course Detail and Evaluation Scheme

B. Tech. Biotechnology First Year

(Effective from the Session 2014-15)

SEMESTER-II

S. N.	Subject Code	Name of the Subject	Periods			Evaluation Scheme			Total Marks	Credit
			L	T	P	CE	MTE	ETE		
Theory Subject										
1	BBT-201	Elementary Mathematics-II	3	1	0	20	20	60	100	4
2	BBT-202	Elementary Biology-II	3	1	0	20	20	60	100	4
3	BAS-202/ BAS-204	Engineering Chemistry/ Professional Communication	3	1	0	20	20	60	100	4
4	BBT-204/ BCS-201	Introduction to Biotechnology / Computer Concepts & Programming in C	3	1	0	20	20	60	100	4
5	BAS-201	Engineering Physics-II	2	0	0	20	20	60	100	2
6	BME-201/ BAS-205	Basic Manufacturing Processes/ Environment & Ecology	2	0	0	20	20	60	100	2
Practical/Drawing/Design										
7	BAS-252/ BAS-254	Engineering Chemistry Lab/ Professional Communication Lab	0	0	2	30	20	50	100	1
8	BBT-252	Biology Lab-II	0	0	2	30	20	50	100	1
9	BWS-251/ BCE-251	Workshop Practice/ Basic Engineering Drawing	0	0	3	30	20	50	100	1
10	BAS-251/ BCS-251	Engineering Physics Lab/ Computer Programming Lab	0	0	2	30	20	50	100	1
Total			16	4	9	240	200	560	1000	24

L-Lecture, T-Tutorial, P- Practical, CE- Continuous Evaluation, MTE-Mid Term Examination, ETE-End Term Examination

Evaluation Scheme:

- **Course without practical components**

For Continuous Evaluation (CE) is such as: 20 Marks

1. Attendance: 5 Marks

2. Assignments/ Quiz / Seminar/Term paper /Project :15Marks

MTE - Mid Term Examination: 20 Marks

a. First Mid Term Examination: 10 marks

b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 60 Marks

- **Course with practical components only**

For Continuous Evaluation (CE) is such as: 30 Marks

Conduct / Perform/Execution /Practical File/ Viva-Voice

MTE - Mid Term Examination: 20 Marks

a. First Mid Term Examination: 10 marks

b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 50 Marks

Convener

Signature:

Name : Mr.

Date :

Internal Members

Signature: 1.....

Name: Mr.

Date:

2.....

Mr.

External Members

Signature: 1.....

Name: Prof. (Dr.).

Date:

2.....

Dr.

BAS 105/ BAS 205: Environment and Ecology

LTP

200

Credit: 2

UNIT-I: Nature and Scope of Environment

Introduction to Environmental Science - Definition and scope and need for public awareness Ecosystems Concept, structure and functions, restoration of damaged ecosystems Biodiversity – Definition, description at national and global level, threats and conservation Natural Resources -Renewable and non-renewable and their equitable use for sustainability, Material cycles – carbon, nitrogen and sulphur cycle. Conventional and Non-conventional Energy Sources –fossil fuel-based, hydroelectric, wind, -nuclear and solar energy, biomass, biodiesel, hydrogen as an alternative fuel.

UNIT-II: Environmental Changes and Human Health

Social Issues Related to Environment– Sustainable development, urban problems (related to water and energy conservation and waste management), resettlement and rehabilitation Environmental ethics. Environmental Pollution–Definition, causes and effects, control measures for water, air, soil, marine, land, noise, thermal pollution, Climate change– Greenhouse effect and global warming, acid rain, ozone layer formation and depletion Impact on human health – water and air borne diseases, diseases induced by residual impurities in drinking water (fluoride and arsenic); Toxic wastes and carcinogens; Nuclear hazards.

UNIT- III: Environmental Protection through Assessment and Education

Indicators and Impact Assessment – Bio-indicators, Natural disasters and disaster management, Impact assessment through inventorying and monitoring. Environmental Protection– Role of individuals, organizations and government in pollution control. Laws, Conventions and Treaties–National legislation, issues in the enforcement of environmental legislation, initiatives by non- governmental organizations, global efforts in environmental protection.

Recommended Textbook:

Environmental Studies, J Krishnawamy , R J Ranjit Daniels, Wiley India.

Recommended Reference Books:

1. Environmental Science, Bernard J. Nebel, Richard T. Right, 9780132854467, Prentice Hall Professional 1993.
2. Environment and Ecology, R K Khandal, 978-81-265-4277-2, Wiley India.
3. Environmental Science, 8th Ed ISV, Botkin and Keller, 9788126534142, Wiley India.
4. Environmental Studies, R Rajagopalan, 978-0195673937, Oxford University Press
5. Textbook of Environmental Science and Technology, M.Anjireddy, BS Publications

BBT-152: Biology Lab-I

LTP

002

Credit: 1

1. Preparation and study of T.S. of dicot and monocot roots and stems.
2. Study of osmosis by potato osmometer.
3. Study of plasmolysis in epidermal peels (e.g. Rhoeo leaves)
4. Study of distribution of stomata in the upper and lower surface of leaves.
5. Comparative study of the rates of transpiration in the upper and lower surface of leaves.
6. Separation of plant pigments through paper chromatography.
7. To study the rate of respiration in flower buds/leaf tissue and germinating seeds
8. Study and identification of different types of inflorescence.

BBT-252: Biology Lab-II

LTP

002

Credit: 1

1. To test the presence of urea in urine.
2. To detect the presence of sugar in urine/blood sample.
3. To detect the presence of albumin in urine.
4. To detect the presence of bile salts in urine.
5. Study parts of a compound microscope
6. Study of specimens and identification with reasons- Amoeba, Hydra, Liver fluke, Ascaris, leech, earthworm, prawn, silkworm, honeybee, snail, starfish, shark, rohu, frog, lizard, pigeon and rabbit.
7. Study of different modifications in root, stem and leaves.
8. Study of imbibition in seeds/raisins.

BBT -104/ BBT -204: Introduction to Biotechnology

LTP

310

Credit: 4

Unit I

Introduction to Biotechnology

Fundamentals of Biochemical Engineering, Biotechnology and Society. Principles and Processes; Application in Health, food, medicine and Agriculture; genetically modified (GM) organisms; biosafety issues.

Unit II

Biomolecules

Building Blocks of Biomolecules-Structure and dynamics. Structure and function of Macromolecules (Carbohydrates, Proteins ,Lipids). Classification of Enzymes; Purification and characterization of enzymes from natural sources. Comparison of chemical and enzyme catalysis.

Unit III

Cell as a basic unit of life. Introduction: Definition, Study of Microbes, Types of microbes, Classification of microbes. Origin of microbiology. Application of microbes in fermentation Biotechnology. Cellular Techniques including chromatography.

Unit IV

History of Bioinformatics. Introduction and application. Biological databases (nucleotide and protein data bases, Structure databases) and their retrieval.. Sequence file formats . Information Sources Analysis using Bioinformatics tools.

Unit V

Genomics

Introduction Genome Sequencing Projects, Gene Prediction and counting, Genome similarity, SNP's and comparative genomics.

TEXT BOOKS:

1. Text book of Biotechnology by H.K.Dass (Wiley India publication)
2. Biotechnology by B.D.Singh (Kalyani Publishers)
3. Text book of Biotechnology by R.C.Dubey (S.Chand and company)

Reference books:

- 1) Introduction to Biotechnology by William J. Thieman, Michael A. Palladino, Publisher: Benjamin Cummings
- 2) Basic Biotechnology by Colin Ratledge Publisher: Cambridge University Press

BBT-102: Elementary Biology –I

LTP

310

Credit: 4

UNIT -I

Diversity in Living World

Diversity of living organisms Classification of the living organisms (five kingdom classification, major groups and principles of classification within each kingdom). Systematics and binomial System of nomenclature.

UNIT -II

Salient features of animal and plant classification, viruses, viroids, lichens, Botanical gardens, herbaria, zoological parks and museums.

UNIT -III

Structural Organisation

Tissues in animals and plants. Morphology, anatomy and functions of different parts of flowering plants: Root, stem, leaf, inflorescence, flower, fruit and seed.

UNIT - IV

Cell: Structure and Function

Cell: Cell theory; Prokaryotic and eukaryotic cell, cell wall, cell membrane. Nucleus and nuclear organization. Mitosis, meiosis, cell cycle (elementary idea). Basic chemical constituents of living bodies.

UNIT - V

Plant Physiology

Movement of water, food, nutrients and gases, Respiration, Photosynthesis, Plant growth and development.

Recommended Textbooks.

- 1) Biology - Textbook for Class XI, NCERT Publication
- 2) Biology - Textbook for Class XII, NCERT Publication

Reference book:

Biology by Peter H Raven, George B Johnson, Kenneth A. Mason, Jonathan Losos, Susan Singer
(Macgraw Hill)

BBT-202: Elementary Biology –II

LTP

310

Credit: 4

UNIT – I

Human Physiology-I

Digestion and absorption. Breathing and respiration. Body fluids and circulation.

UNIT-II

Human Physiology-II

Neural control and coordination, chemical coordination and regulation.

UNIT – III

Reproduction

Reproductive system in male and female, menstrual cycle, production of gametes, fertilization, embryo development.

UNIT –IV

Reproductive Health& human Welfare : Population and birth control, sexually transmitted diseases, infertility. Cancer and AIDS. Adolescence and drug / alcohol abuse. Basic concepts of immunology, vaccines.

UNIT -V

Evolution

Evolution: Origin of life, theories and evidences, adaptive radiation, mechanism of Evolution, origin and evolution of man

Recommended Textbooks.

- 1) Biology - Textbook for Class XI, NCERT Publication
- 2) Biology - Textbook for Class XII, NCERT Publication

Reference books:

- 1) Human anatomy and physiology by Marieb (Pearson Education)
- 2) Textbook of human physiology by Chakraborty and Ghosh (2nd ed. Calcutta, The New Bookstall)
- 3) Human Physiology by Pocock and Richards (Oxford University press)

BBT-101: Elementary Mathematics –I

L T P

3 1 0

Credits: -4

UNIT-I

Limits and Derivatives: Derivative introduced as rate of change both as that of distance function and geometrically, intuitive idea of limit. Definition of derivative, relate it to slope of tangent of the curve, derivative of sum, difference, product and quotient of functions. Derivatives of polynomial and trigonometric functions.

UNIT-II

Continuity and Differentiability: Continuity and differentiability, derivative of composite functions, chain rule, derivatives of inverse trigonometric functions, derivative of implicit function. Concept of exponential, logarithmic functions and their derivative. Logarithmic differentiation. Derivative of functions expressed in parametric forms. Second order derivatives. Rolle's and Lagrange's Mean Value Theorems (without proof) and their geometric interpretations.

Applications of Derivatives: Applications of derivatives: rate of change, increasing/decreasing functions, tangents & normal, approximation, maxima and minima (first derivative test motivated geometrically and second derivative test given as a provable tool). Simple problems (illustrate basic principles and understanding of the subject as well as real-life situations).

UNIT – III

Integrals: Integration as inverse process of differentiation. Integration of a variety of functions by substitution method, by partial fractions method and by parts method only simple integrals of the type to be evaluated. Definite integrals as a limit of a sum. Fundamental theorem of Calculus (without proof). Basic properties of definite integrals and its evaluation.

Applications of the Integrals: Applications in finding the area under simple curves, especially lines, areas of circles/parabolas/ellipses (in standard form only), area between the two above said curves (the region should be clearly identifiable).

UNIT –IV

Differential Equations: Definition, order and degree, general and particular solutions of a differential equation. Formation of differential equation whose general solution is given. Solution of differential equations by method of separation of variables, homogeneous differential equations of first order and first degree. Solutions of linear differential equation of the type: $+ p y = q$, where p and q are functions of x .

UNIT –V

Sequence and Series: Definition of sequence and series, Arithmetic progression (A. P.), arithmetic mean (A.M.) Geometric progression (G.P.), general term of a G.P., sum of n terms of a G.P., geometric mean (G.M.), relation between A.M. and G.M. Sum to n terms of the special series n_1 , n_2 and n_3 .

Permutations & Combinations: Fundamental principle of counting. Factorial n . (i.e., $n!$) Permutations & Combinations, formulae and simple applications

PROBABILITY: Random experiments: outcomes, sample spaces (set representation). Events: occurrence of events, 'not', 'and' and 'or' events, exhaustive events, mutually exclusive events Axiomatic (set theoretic) probability, connections with the theories of earlier classes. Probability of an event, probability of 'not', 'and' & 'or' events.

Recommended Textbooks.

- 1) Mathematics Part I - Textbook for Class XI, NCERT Publication
- 2) Mathematics Part II - Textbook for Class XI, NCERT Publication

Reference books:

- 1) Higher engineering mathematics by B.V.Ramana (Tata Macgraw Hill)
- 2) Advanced modern engineering mathemtics by Glyn james (pearson education)

BBT-201: Elementary Mathematics –II

LTP

310

Credits: -4

UNIT-I

Algebra: Statement of Fundamental Theorem of Algebra, solution of quadratic equations in the complex number system.

Linear Inequalities: Linear inequalities. Algebraic solutions of linear inequalities in one variable and their representation on the number line. Graphical solution of linear inequalities in two variables. Solution of system of linear inequalities in two variables- graphically.

UNIT –II

Matrix: Inverse of matrix by elementary transformations, Rank of matrix (Echelon & Normal form). Linear Dependence and Independence of matrices, Consistency of Linear System of Equations and their solution. Characteristic Equation, Eigen values and eigenvectors.

UNIT-III: Coordinate Geometry

1. Straight Lines: Brief recall of 2D from earlier classes. Slope of a line and angle between two lines. Various forms of equations of a line: parallel to axes, point-slope form, slope-intercept form, two point form, intercepts form and normal form. General equation of a line. Distance of a point from a line.

2. Conic Sections: Sections of a cone: circle, ellipse, parabola, hyperbola, a point, a straight line and pair of intersecting lines as a degenerated case of a conic section. Standard equations and simple properties of parabola, ellipse and hyperbola. Standard equation of a circle.

3. Introduction to Three -dimensional Geometry: Coordinate axes and coordinate planes in three dimensions. Coordinates of a point. Distance between two points and section formula.

UNIT-IV

Vectors and Scalars: Vectors and scalars, magnitude and direction of a vector. Direction cosines/ratios of vectors. Types of vectors (equal, unit, zero, parallel and collinear vectors), position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, position vector of a point dividing a line segment in a given ratio. Scalar (dot) product of vectors, projection of a vector on a line. Vector (cross) product of vectors.

UNIT – V

Three - Dimensional Geometry: Direction cosines/ratios of a line joining two points. Cartesian and vector equation of a line, coplanar and skew lines, shortest distance between two lines. Cartesian and vector equation of a plane. Angle between (i) two lines, (ii) two planes. (iii) a line and a plane. Distance of a point from a plane.

Reference books:

- 1) Higher engineering mathematics by B. V. Ramana (Tata Macgraw Hill)
- 2) Advanced modern engineering mathematics by Glyn james (pearson education)

BCS-101/BCS-201: Computer System and Programming in C

L T P
3 0 0

Credit-4

Unit-I

Introduction: Computer basics and classification of computers, operations of computer, components of a computer and operating system concepts.

Number System: Binary, Octal and hexadecimal number systems, Binary arithmetic.

Programming Concepts: Approaches of problem solving, computer algorithms and flow charts. Introduction of computer languages - machine language, assembly language and high level language.

Unit-II

Program Structure and Execution: Representing and manipulating information. Information storage: data sizes, addressing and representing strings. Integer representation and arithmetic, Boolean algebra, logical, shift and bit level operations.

Running Programs on a System

Concept of assembler, compiler, loader and linker, exceptional control flow, processes, process control, system calls, Error handling, program execution time.

Unit-III

Programming Concepts in C

Standard input and output in C, Fundamental data types and sizes: character, integer, short, long, unsigned, single and double floating point. Storage classes: automatic, register, static and external. Operators and expressions: arithmetic, relational and logical operators, operator precedence and order of evaluation.

Unit-IV

Control Flow: Statements and blocks, 'If-Else', 'Else-If', 'Switch', nesting 'If-Else', loops 'While', 'Do-while' and 'For', use of 'Break' and 'Continue', 'Goto' and 'Labels'.

Functions: Basics of functions, types of functions, functions with array, passing values to functions and recursive functions.

Unit-V

Pointers and Arrays: Pointers and addresses, pointers and functions arguments, pointers and arrays, Address arithmetic, pointers arrays, multidimensional arrays, pointers to functions.

Structure: Introduction, structures and functions, arrays and pointers of structures.

File Handling: Standard C preprocessors, file access, defining and calling macros and standard libraries.

Reference Book:

1. Programming in C – Gottfried B.S. (TMH).
2. let us C – Kanetkar Y. (BPB).
3. The C Programming Language - Kernighan B.W., Ritchie D.M. (PHI).
4. C++: The Complete Reference (4th Ed) – Schildt H. (TMH).
5. The C++ Programming Language – Stroustrup B. (Addison-Wesley)

BCS-151/BCS-251: Computer Programming Lab

L T P
0 0 2

Credit-1

S No	Name of the program
1	a)To evaluate algebraic $\exp(ax+b)/(ax-b)$ b)to Evaluate algebraic $\exp 2.5\log x+\cos 32+ x*x-y*y +\sqrt{2*x*y}$ c)to evaluate the algebraic $\exp a^p$ d)to evaluate algebraic $\exp x^5 + 10 x^4 + 8 x^3 + 4x^2$
2	To evaluate area of triangle $(\sqrt{s(s-a)(s-b)(s-c)})$
3	To swap 2 no
4	Greatest of 2 no
5	Greatest of 3 numbers
5	Greatest of 3 onto print the given no in ascending order
6	To perform the arithmetic expression using switch statement
7	Factorial of given no using do while statement
8	To print prime up to n no
9	Sum of n natural no
10	Total no. of even integers
11	Total no. of odd integers
12	Sum of even integers
13	Sum of odd integers
14	A program to print the product of two matrices of any order
15	Write a program to print Fibonacci series
16	Write a program to print o/p's a)1 b) 1 c) 1 d) 1 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3 3 4 5 6
17	Write a program to read n num of students and 5 sub marks
18	Write a program to find factorial of a num using 3 types of funs
19	Write a program to convert all lower case to uppercase characters.
20	Write a program to extract a string
21	Write a program to sort 5 city names in alphabetical order
22	Write a program to find the factorial of a number using recursion
23	A program to print address of variable
24	A program to access a variable using pointers
25	A program to print the element of array using pointers
26	A program to implement call by reference
27	A program to find greatest of 'n' num using funs
28	A program to print the elements of a structure using pointers
29	A program to display student information by initializing structures
30	A program to find total number of marks
31	Write a program to open a file.
32	Write a program to read a file.
33	Write a program to write a file.
34	Write a program to save a file.

BAS 102/ BAS 202: Engineering Chemistry

LTP
310

Credits: -4

UNIT-I

Molecular orbital theory and its applications in diatomic molecules. Band theory of solids. Liquid crystals & its application. Space lattice (only cubes), types of unit cell, calculation of density of unit cell. Types of hydrogen bonding and its applications. Structure and applications of Graphite and Fullerenes.

UNIT-II

Polymers, its classification and their applications. Thermoplastic and Thermosetting resins. Elastomers and synthetic fibres. Conducting and biodegradable polymers. Elementary ideas and simple applications Visible, UV, IR ¹HNMR and mass spectroscopic Techniques, Ziegler-Natta catalyst

UNIT-III

Stereochemistry with special reference to chirality, E - Z and R - S nomenclature. Elementary idea of inductive effect, mesomeric effect, reaction intermediate (carbocation, carbanion and free radical carbene). Types of organic reactions with special reference of nucleophilic substitution reaction. Grignard Reagent.

UNIT-IV

Hardness of water. Disadvantage of hard water. Techniques for water softening; Calgon, Zeolite, Lime-Soda, Ion exchange resin, Reverse osmosis. Fuels; Classification of fuels. Analysis of Coal. Determination of Calorific values. Biogas and Biomass.

UNIT-V

Rate, order and molecularity of reaction, Integrated rate equation of zero order, first order and second order reactions, activation energy. Galvanic cell, electrochemical theory of corrosion and its protection. Phase Rule and its application to one component system (water and sulfur).

Reference Books

1. Chemistry (9th ed), by Raymond Chang, Tata McGraw-Hill
2. Chemistry Concepts and Applications by Steven S. Zumdahl; Cengage Learning
3. Concise Inorganic Chemistry by J.D. Lee; Wiley India
4. Organic Chemistry (6 ed) by Morrison & Boyd; Pearson Education
5. Physical Chemistry by Gordon M. Barrow; Mc-Graw Hill

L T P

0 0 2

Credit:-1

List of Experiments:-

1. Determination of alkalinity in the given water sample.
2. Determination of Temporary and Permanent hardness in water sample using EDTA as standard solution.
3. Determination of available chlorine in bleaching powder.
4. Determination of chloride content in the given water sample by Mohr's method.
5. Determination of Iron content in the given Iron ore sample by using [$K_3 Fe (CN)_6$] as an external indicator.
6. Determination of solubility of salt (NaCl) at room temperature.
7. Determine the viscosity of a given solution.
8. Determination of Iron concentration in sample of water by colorimetric method. The method involves the use of KCNS as a colour developing agent and the measurement are carried out at λ_{max} 480 nm.
9. Element detection and Functional group identification in organic compounds.
10. Preparation of Bakelite & Urea Formaldehyde resin.

BAS-101: ENGINEERING PHYSICS-I

L T P

Credits: -3

3 0 0

Unit - I

Relativistic Mechanics

Inertial & non-inertial frames, Michelson- Morley experiment, Einstein's postulates, Lorentz transformation equations, Length contraction & Time dilation, Addition of velocities; Variation of mass with velocity, Mass energy equivalence.

Unit - II

Modern Physics

Wave Mechanics: Wave- particle duality, de-Broglie matter waves, Phase and Group velocities, Davisson-Germer experiment, Heisenberg uncertainty principle and its applications, Wave function and its significance, Schrödinger's wave equation - particle in one dimensional potential box, Eigen values and Eigen function.

Unit - III

Wave Optics

Interference: Interference of light, Interference in thin films (parallel and wedge shaped film), Newton's rings. Diffraction: Single, double and N- Slit Diffraction, Diffraction grating, Grating spectra, dispersive power, Rayleigh's criterion and resolving power of grating

Unit- IV

Polarization: Phenomena of double refraction, Nicol prism, Production and analysis of plane, circular and elliptical polarized light, Retardation Plate.

Unit - V

Laser: Spontaneous and stimulated emission of radiation, population inversion, concept of 3 and 4 level Laser, construction and working of Ruby, He-Ne lasers and laser applications. Fiber Optics: Fundamental ideas about optical fiber, Propagation mechanism, Acceptance angle and cone, Numerical aperture, Single and Multi Mode Fibers Holography: Basic Principle of Holography, Construction and reconstruction of Image on hologram and applications of holography.

Books:

1. Concepts of Modern Physics - Aurthur Beiser (Mc-Graw Hill)
2. Introduction to Special theory of - Robert Resnick - Wielly
3. Optical Fibre & Laser - Anuradha De. (New Age)
4. Optics -Aloy Ghatak (Tata McGraw Hill Education Private Ltd. New Delhi)

BAS-201: ENGINEERING PHYSICS-II

L T P

2 0 0

Credits: -2

Unit - I

Crystal Structures and X-ray Diffraction:

Space lattice, basis, Unit cell, Lattice parameter, Seven crystal systems and Fourteen Bravais lattices, Crystal-System Structure, Packing factor (cubic, body and face), Crystal structure of NaCl and diamond, Lattice planes and Miller Indices, Reciprocal Lattice, Diffraction of X-rays by crystal, Laue's experiment, Bragg's Law, Bragg's spectrometer.

Unit - II

Dielectric and Magnetic Properties of Materials:

Dielectric Properties: Dielectric constant and Polarization of dielectric materials, Types of Polarization (Polarizability). Equation of internal fields in liquid and solid (One- Dimensional), Clausius Mottott-Equation, Frequency dependence of dielectric constant, Dielectric Losses, Important applications of dielectric material,

Magnetic Properties: Magnetization, Origin of magnetic moment, Dia, para and ferro magnetism, Langevin's theory for diamagnetic material, Phenomena of hysteresis and its applications.

Unit - III

Electromagnetic Theory Displacement Current, Equation of continuity, Maxwell's Equations (Integral and Differential Forms), Poynting theorem and Poynting vectors, EM - Wave equation and its propagation characteristics in free space, non-conducting and in conducting media, Skin depth.

Unit - IV

Physics of some Technologically important Materials

Semiconductors: Band Theory of Solids, density of states, Fermi-Dirac distribution, free carrier density(electrons and holes), conductivity of semiconductors, Position of Fermi level in intrinsic and in extrinsic semiconductors.

Unit – V

Superconductors: Temperature dependence of resistivity in superconducting materials, Effect of magnetic field (Meissner effect), Temperature dependence of critical field, Type I and Type II superconductors, BCS theory (Qualitative), High temperature superconductors and Applications of Superconductors. Nano-Materials: Basic principle of nanoscience and technology, structure, properties and uses of Fullerene and Carbon nanotubes, Applications of nanotechnology.

Books:

1. Concepts of Modern Physics - Aurthur Beiser (Mc-Graw Hill)
2. Optical Fibre & Laser - Anuradha De. (New Age)
3. Optics -Aloy Ghatak (Tata McGraw Hill Education Private Ltd. New Delhi)

BAS-151/BAS-251: PHYSICS LAB

L T P

0 0 2

Credits: -1

List of Experiments-

Any ten experiments, at least four from each group.

Group -A

1. To determine the wavelength of monochromatic light by Newton's ring.
2. To determine the wavelength of monochromatic light with the help of Fresnel's biprism.
3. To determine the focal length of two lenses by nodal slide and locate the position of cardinal points.
4. To determine the specific rotation of cane sugar solution using polarimeter.
5. To determine the wavelength of spectral lines using plane transmission grating.

Group - B

6. To determine the specific resistance of a given wire using Carey Foster's bridge.
7. To study the variation of magnetic field along the axis of current carrying - Circular coil and then to estimate the radius of the coil.
8. To verify Stefan's Law by electrical method.
9. To calibrate the given ammeter and voltmeter by potentiometer.
10. To study the Hall effect and determine Hall coefficient, carrier density and - mobility of a given semiconductor using Hall effect set up.
11. To determine the energy band gap of a given semiconductor material.
12. To determine E.C.E. of copper using Tangent or Helmholtz galvanometer.
13. To draw hysteresis curve of a given sample of ferromagnetic material and from - this to determine magnetic susceptibility and permeability of the given specimen.
14. To determine the ballistic constant of a ballistic galvanometer.
15. To determine the coefficient of viscosity of a liquid.

BAS-104/BAS-204 : PROFESSIONAL COMMUNICATION

L T P

3 1 0

Credits: 4

UNIT- I: FUNDAMENTALS OF COMMUNICATION

Technical Communication: Features: Distinction between General and Technical communication; Language as a tool of communication; Levels of communication: Interpersonal, Organizational, Mass communication; The flow of communication: Downward, Upward, Lateral or Horizontal (peer group); Importance of technical communication; Barriers to Communication.

UNIT-II: WRITING CORRECT ENGLISH

The Sentence: Meaning and definition, Kinds of Sentences; Tenses; Present, Past and Future; Concord: Meaning; Concord of Numbers and Persons; Articles.

UNIT-III: CONSTITUENTS OF TECHNICAL WRITTEN COMMUNICATION

Words and Phrases: Word formation, Synonyms and Antonyms; Homophones; Select vocabulary of about 500- 1000 new words; Correct Usage; All Parts of Speech; Requisites of Sentence Construction: Paragraph Development: Techniques and Methods- Inductive, Deductive, Spatial, Linear, Chronological etc.

UNIT-IV: BUSINESS COMMUNICATION

Principles; Sales & Credit letters; Claim and Adjustment Letters; Job application and Resumes. Reports: Types; Significance; Structure, Style & Writing of Reports; Technical Proposal; Parts; Types; Writing of Proposal and its significance.

UNIT-V: PRESENTATION STRATEGIES AND SPEECH MECHANISM

Defining Purpose; Audience and Locale, Organizing Contents; Preparing Outline; Audio-Visual Aids; Nuance of Delivery; Body Language; Dimensions of Speech; Syllable; Accent Pitch; Rhythm; Intonation; Difference between stress and intonation; Paralinguistic features of voice;

Text books:

1. Technical Communication: Principles and Practice. Meenakshi Raman and Sangeeta Sharma, Oxford University Press, New Delhi.
2. Professional Communication. Dr. Malti Agarwal, Krishna Prakashan Media (P) Ltd., Meerut.
3. Gerson, Sharon J. & Gerson, Steven M., *Technical Writing- Process and Product* , Delhi, Pearson/ Education Publications.
4. Rizvi, Ashraf M., *Effective Technical Communication*, New Delhi, Tata Mc Graw Hill Publishing Company Ltd.

BAS-154/BAS-254 : PROFESSIONAL COMMUNICATION LAB

LTP
002

Credit: 1

LIST OF PRACTICALS

1. Introduction to sounds in English language. Practice of consonants, vowels and diphthongs (sounds).
2. Stress and intonation in speech.
3. Conversational skills: Group Discussion: Practical based on accurate and current grammatical patterns.
4. Conversational skills for interviews under suitable Professional Communication Lab conditions with emphasis on kinesics.
5. Official/Public speaking .Sample speeches by eminent people (video).
6. Theme- presentation/ Key-note presentation.
7. Individual speech delivery/conferences with skills to defend interjections/quizzes.
8. Role plays with argumentative skills/Role play presentation with stress and intonation.
9. Comprehension skills based on reading and listening. Practical based on a model audio-visual usage.

Text book:

1. Communication Lab (English). Dr. Malti Agarwal, Krishna Prakashan Media (P) Ltd. Meerut.

Reference books:

1. Kenjer,Hanif., *All the Right Answers*, New Delhi, Macmillan India Ltd.
2. Taylor,Grant., *English Conversation Practice*, New Delhi, Tata Mc Graw Hill Publishing Company Ltd.
3. Pandey, L.U.B., Singh, R.P., *A Manual of Practical Communication*, Delhi, A.I.T.B.S.Pub. India.Ltd.
4. Jones Daniel., *English Pronouncing Dictionary*, New Delhi, Cambridge University Press.
5. Sethi, J.,& Dhamija, P.V., *A Course in Phonetics and Spoken English*, New Delhi, Prentice Hall.

BME-101/BME-201: BASIC MANUFACTURING PROCESSES

LTP

200

Credit -2

Unit-I Introduction to Engineering Materials

Materials and Engineering, Classification of Engineering Materials. Industrial applications of common engineering materials, Metals & Alloys: Properties and Applications,. Steels and Cast Irons, Alloys of Non Ferrous metals.

Unit-II Basic Metal Forming & Casting Process.

Forming Processes: Basic metal forming operations & uses of such as: Forging, Rolling, Wire & Tube drawing/making and Extrusion, and their uses.

Press-work: Die & Punch assembly, cutting and forming, its applications. Hot-working versus cold-working

Casting: Pattern: Materials, types and allowances. Type and composition of Molding sands and their desirable properties. Mould making with the use of a core. Gating system. Casting defects & remedies. Cupola Furnace. Die-casting and its uses.

Unit-III Machining and Welding operations and their applications

Machining: Basic principles of Lathe-machine and operations performed on it. Basic description of machines and operations of Shaper-Planer, Drilling, Milling & Grinding.

Welding: Introduction, classification of welding processes. Gas-welding, types of flames and their applications. Electric-Arc welding. Resistance welding. Soldering & Brazing processes and their uses.

Unit-IV Misc. Topics

Quality: Introduction, basic concept about quality of a product.

Manufacturing Establishment: Plant location. Plant layout-its types. Types of Production. Production versus Productivity.

Non-Metallic Materials: Common types & uses of Wood, Cement-concrete, Ceramics, Rubber, Plastics and Composite-materials.

Misc. Processes: Powder-metallurgy process & its applications, Plastic-products manufacturing, Galvanizing and Electroplating.

Reference Books:

1. "Processes and Materials of Manufacture", Lindberg, PHI
2. "Manufacturing Engineering And Technology", Kalpakjian and Schmid, Pearson.

BWS-151/251: WORKSHOP PRACTICE

L T P

Credits: - 1

0 0 3

1. Carpentry Shop: 1. Study of tools & operations and carpentry joints. 2. Simple exercise using jack plane. 3. To prepare half-lap corner joint, mortise & tennon joints. 4. Simple exercise on woodworking lathe.

2. Fitting (Bench Working) Shop: 1. Study of tools & operations 2. Simple exercises involving fitting work. 3. Make perfect male-female joint. 4. Simple exercises involving Drilling/tapping/dieing.

3. Black Smithy Shop: 1. Study of tools & operations 2. Simple exercises based on black smithy operations such as upsetting, drawing down, punching, bending, fullering & swaging.

4. Welding Shop: 1. Study of tools & operations of Gas welding & Arc welding 2. Simple butt and Lap welded joints. 3. Oxy-acetylene flame cutting.

5. Sheet-metal Shop: 1. Study of tools & operations. 2. Making Funnel complete with 'soldering'.
3. Fabrication of tool-box, tray, electric panel box etc.

6. Machine Shop: 1. Study of Single point cutting tool, machine tools and operations. 2. Plane turning. 3. Step turning 4. Taper turning. 5. Threading

7. Foundry Shop: 1. Study of tools & operations 2. Pattern making. 3. Mould making with the use of a core. 4. Casting

BCE-151/251: Basic Engineering Drawing

L T P

0 0 3

Credits: 1

1. Introduction to Engineering drawing

Introduction, Drawing Instruments and their uses, BIS conventions, lettering Dimensioning and free hand practicing. Computer screen, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigational tools. Coordinate system and reference planes. Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. Dimensioning, line convention, material conventions and lettering.

2. Orthographic Projections

Introduction, Definitions- Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes (No application problems).

3. Orthographic Projections of Plane Surfaces

(First Angle Projection Only)

Introduction, Definitions-projections of plane surfaces-triangle, square rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change of position method only (No problems on punched plates and composite plates.)

4. Projections of Solids (First Angle Projection Only)

Introduction, Definitions- Projections of right regular- tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions. (No problems on octahedrons and combination solid)

5. Sections and Development of Lateral Surfaces of Solids

Introduction, Section planes, Sections, section views, Sectional views, apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP. (No problems on section of solids)

6. Isometric Projection (Using Isometric Scale Only)

Introduction, Isometric scale, Isometric Projection of simple plane figures, Isometric Projection of tetrahedron, hexahedron (cube), right regular prisms, pyramids, cylinders, cones, spheres, cut spheres and combination of solids (Maximum of three Solids). **1-Sheet**

7. Introduction to Auto CAD

Reference Books:

1. Engineering Drawing - N.D. Bhatt & V.M. Panchal, 48th edition, 2005-Charotar Publishing House, Gujarat.
2. Computer Aided Engineering Drawing - S. Trymbaka Murthy, -I.K. International Publishing House Pvt. Ltd., New Delhi, 3rd revised edition- 2006.
3. Engineering Graphics - K.R. Gopalakrishna, 32nd edition, 2005- Subash Publishers Bangalore.
4. Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production-Luzadder Warren J., Duff John M., Eastern Economy Edition, 2005-Prentice-Hall of India Pvt. Ltd., New Delhi.
5. Engineering Drawing - M.B. Shah, B.C.Rana, 2nd Edition.



RAMA UNIVERSITY UTTAR PRADESH, KANPUR

A meeting of the Board of Studies of the department of Biotechnology of Faculty of Engineering and Technology Rama University Uttar Pradesh, Kanpur was held on 5th July 2014 at 11 AM. The following members were present:

- | | |
|--------------------------------|-----------------|
| 1. Dr. Ajay Kumar | Convener |
| 2. Mr. Ajit Pratap Singh Yadav | Member |
| 3. Mr. Vachaspati Rao | Member |
| 4. | External Member |
| 5. | External Member |

The quorum of the meeting was complete.

Agenda of the meeting:

1. Assessment Criteria
2. Question Paper Format
3. Syllabus

The meeting resolved unanimously that attached Assessment Criteria, Question Paper Format and Syllabus are justified and approved.

Convener

Signature:

Name : Dr. Ajay Kumar

Date :

Internal Members

Signature: 1..... 2.....

Name: Mr. Ajit Pratap Singh Yadav Mr. Vachaspati Rao

Date:

External Members

Signature: 1..... 2.....

Name: Prof. (Dr.). Dr.

Date:

Faculty of Engineering & Technology

Rama University Uttar Pradesh, Kanpur

Course Detail and Evaluation Scheme

(Effective from the Session 2014-15)

B. Tech. Biotechnology

Year-2 SEMESTER-III

S. No.	Subject Code	Subject Name	Period			EVALUATION SCHEME			Subject Total	Credit
			L	T	P	CE	MTE	ETE		
Theory subjects										
1	BBT-301	Biochemistry-I	3	1	0	20	20	60	100	4
2	BBT-302	Cell Biology and Microbiology	3	1	0	20	20	60	100	4
3	BBT-303	Enzyme Technology	3	1	0	20	20	60	100	4
4	BCH-305	Fluid flow and solid handling	3	1	0	20	20	60	100	4
5	BAS-302	Statistical Techniques	3	1	0	20	20	60	100	4
Practicals / Project										
7	BBT-351	Biochemistry I Lab	0	0	3	30	20	50	100	1
8	BBT-352	Cell biology & Microbiology Lab	0	0	3	30	20	50	100	1
9	BBT-353	Enzyme Technology Lab	0	0	3	30	20	50	100	1
10	BBT-354	Fluid Mechanics Lab	0	0	2	30	20	50	100	1
		Total	15	5	11	220	180	500	900	24

BHU-001 Human Values & Professional Ethics (Audit Course) – Student can clear from 2nd year to Final year.

L-Lecture, T-Tutorial, P- Practical, CE- Continuous Evaluation, MTE-Mid Term Examination, ETE-End Term Examination

Evaluation Scheme:

• **Course without practical components**

For Continuous Evaluation (CE) is such as: 20 Marks

- a. Attendance: 5 Marks
- b. Assignments/Quiz / Seminar/Term paper /Project :15Marks

MTE - Mid Term Examination: 20 Marks

- a. First Mid Term Examination: 10 marks
- b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 60 Marks

• **Course with practical components only**

For Continuous Evaluation (CE) is such as: 30 Marks

Conduct / Perform/Execution /Practical File/ Viva-Voice

MTE - Mid Term Examination: 20 Marks

- a. First Mid Term Examination: 10 marks
- b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 50 Marks

Convener

Signature:

Name : Dr. Ajay Kumar

Date :

Internal Members

Signature: 1..... 2.....

Name: Mr. Ajit Pratap Singh Yadav Mr. Vachaspati Rao

Date:

External Members

Signature: 1..... 2.....

Name: Prof. (Dr.). Dr.

Date:

Faculty of Engineering & Technology

Rama University Uttar Pradesh, Kanpur

Course Detail and Evaluation Scheme

(Effective from the Session 2014-15)

B. Tech. Biotechnology

Year-2 SEMESTER-IV

S. No.	Subject Code	Subject Name	Period			EVALUATION SCHEME			Total	Credit
			L	T	P	CE	MTE	ETE		
Theory Subjects										
1	BBT-041/042	Departmental Elective-I*	3	1	0	20	20	60	100	4
2	BBT-401	Biochemistry-II	3	1	0	20	20	60	100	4
3	BBT-402	Immunology	3	1	0	20	20	60	100	4
4	BBT-403	Genetics & Molecular Biology	3	1	0	20	20	60	100	4
5	BBT-404	Bioinformatics	3	1	0	20	20	60	100	4
Practicals / Project										
6	BBT-451	Biochemistry-II Lab	0	0	3	30	20	50	100	1
7	BBT-452	Immunology Lab	0	0	3	30	20	50	100	1
8	BBT-453	Molecular Biology Lab	0	0	3	30	20	50	100	1
9	BBT-454	Bioinformatics Lab	0	0	2	30	20	50	100	1
		Total	15	5	11	220	180	500	900	24

BHU-001 Human Values & Professional Ethics (Audit Course) – Student can clear from 2nd year to Final year.

L-Lecture, T-Tutorial, P- Practical, CE- Continuous Evaluation, MTE-Mid Term Examination, ETE-End Term Examination

Evaluation Scheme:

• Course without practical components

For Continuous Evaluation (CE) is such as: 20 Marks

- Attendance: 5 Marks
- Assignments/Quiz / Seminar/Term paper /Project :15Marks

MTE - Mid Term Examination: 20 Marks

- First Mid Term Examination: 10 marks
- Second Mid Term Examination: 10 marks

ETE - End Term Examination: 60 Marks

• Course with practical components only

For Continuous Evaluation (CE) is such as: 30 Marks

Conduct / Perform/Execution /Practical File/ Viva-Voice

MTE - Mid Term Examination: 20 Marks

- First Mid Term Examination: 10 marks
- Second Mid Term Examination: 10 marks

ETE - End Term Examination: 50 Marks

Convener

Signature:

Name : Dr. Ajay Kumar

Date :

Internal Members

Signature: 1..... 2.....

Name: Mr. Ajit Pratap Singh Yadav Mr. Vachaspati Rao

Date:

External Members

Signature: 1..... 2.....

Name: Prof. (Dr.). Dr.

Date:

Faculty of Engineering & Technology

Rama University Uttar Pradesh, Kanpur

Course Detail and Evaluation Scheme

(Effective from the Session 2014-15)

B. Tech. Biotechnology

Year-3 SEMESTER-V

S. No.	Subject Code	Subject Name	Period			EVALUATION SCHEME			Total	Credit
			L	T	P	CE	MTE	ETE		
Theory Subjects										
1	BBT-051/052	Departmental Elective-II*	3	1	0	20	20	60	100	4
2	BBT-501	Genetic Engineering	3	1	0	20	20	60	100	4
3	BBT-502	Agriculture Biotechnology	3	1	0	20	20	60	100	4
4	BBT-503	Bioprocess Engineering-I	3	1	0	20	20	60	100	4
5	BBT-504	Biophysical tools & Techniques	3	1	0	20	20	60	100	4
Practicals / Project										
6	BBT-551	Genetic Engineering Lab	0	0	3	30	20	50	100	1
7	BBT-552	Agriculture Biotechnology Lab	0	0	3	30	20	50	100	1
8	BBT-553	Bioprocess Engineering Lab	0	0	2	30	20	50	100	1
9	BBT-554	Biophysical tools & Techniques Lab	0	0	3	30	20	50	100	1
		Total	15	5	11	220	180	500	900	24

BHU-001 Human Values & Professional Ethics (Audit Course) – Student can clear from 2nd year to Final year.

L-Lecture, T-Tutorial, P- Practical, CE- Continuous Evaluation, MTE-Mid Term Examination, ETE-End Term Examination

Evaluation Scheme:

- **Course without practical components**

For Continuous Evaluation (CE) is such as: 20 Marks

- a. Attendance: 5 Marks
- b. Assignments/Quiz / Seminar/Term paper /Project :15Marks

MTE - Mid Term Examination: 20 Marks

- a. First Mid Term Examination: 10 marks
- b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 60 Marks

- **Course with practical components only**

For Continuous Evaluation (CE) is such as: 30 Marks

Conduct / Perform/Execution /Practical File/ Viva-Voice

MTE - Mid Term Examination: 20 Marks

- a. First Mid Term Examination: 10 marks
- b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 50 Marks

Convener

Signature:

Name : Dr. Ajay Kumar

Date :

Internal Members

Signature: 1..... 2.....

Name: Mr. Ajit Pratap Singh Yadav Mr. Vachaspati Rao

Date:

External Members

Signature: 1..... 2.....

Name: Prof. (Dr.). Dr.

Date:

Faculty of Engineering & Technology

Rama University Uttar Pradesh, Kanpur

Course Detail and Evaluation Scheme

(Effective from the Session 2014-15)

B. Tech. Biotechnology

Year 3 SEMESTER-VI

S. No.	Subject Code	Subject Name	Period			EVALUATION SCHEME			Total	Credit
			L	T	P	CE	MTE	ETE		
Theory Subjects										
1	BHU-601	Engineering Economics & Industrial Management	3	1	0	20	20	60	100	4
2	BBT-061/062	Departmental Elective-III	3	1	0	20	20	60	100	4
3	BBT-601	Fermentation Technology	3	1	0	20	20	60	100	4
4	BBT-602	Food Biotechnology	3	1	0	20	20	60	100	4
5	BCH-606	Heat & Mass Transfer	3	1	0	20	20	60	100	4
Practicals / Project										
6	BBT-651	Fermentation Technology Lab	0	0	3	30	20	50	100	1
7	BBT-652	Food Biotechnology Lab	0	0	3	30	20	50	100	1
8	BCH-656	Heat Transfer Lab	0	0	2	30	20	50	100	1
		Total	15	5	8	190	160	450	800	23

BHU-001 Human Values & Professional Ethics (Audit Course) – Student can clear from 2nd year to Final year.

L-Lecture, T-Tutorial, P- Practical, CE- Continuous Evaluation, MTE-Mid Term Examination, ETE-End Term Examination

Evaluation Scheme:

- Course without practical components**

For Continuous Evaluation (CE) is such as: 20 Marks

- Attendance: 5 Marks
- Assignments/Quiz / Seminar/Term paper /Project :15Marks

MTE - Mid Term Examination: 20 Marks

- First Mid Term Examination: 10 marks
- Second Mid Term Examination: 10 marks

ETE - End Term Examination: 60 Marks

- Course with practical components only**

For Continuous Evaluation (CE) is such as: 30 Marks

Conduct / Perform/Execution /Practical File/ Viva-Voice

MTE - Mid Term Examination: 20 Marks

- First Mid Term Examination: 10 marks
- Second Mid Term Examination: 10 marks

ETE - End Term Examination: 50 Marks

Convener

Signature:

Name : Dr. Ajay Kumar

Date :

Internal Members

Signature: 1..... 2.....

Name: Mr. Ajit Pratap Singh Yadav Mr. Vachaspati Rao

Date:

External Members

Signature: 1..... 2.....

Name: Prof. (Dr.). Dr.

Date:

Faculty of Engineering & Technology

Rama University Uttar Pradesh, Kanpur

Course Detail and Evaluation Scheme
(Effective from the Session 2014-15)

B. Tech. Biotechnology
Year 4 SEMESTER-VII

S. No.	Subject Code	Subject Name	Period			EVALUATION SCHEME			Total	Credit
			L	T	P	CE	MTE	ETE		
Theory Subjects										
1	BBT-701	Down Stream Processing	3	1	0	20	20	60	100	4
2	BBT-702	Bioethics, Biosafety & IPR	3	1	0	20	20	60	100	4
3	BBT-703	Bioprocess Engineering II	3	1	0	20	20	60	100	4
4	BBT-071/072	Departmental Elective-IV*	3	1	0	20	20	60	100	4
5	BOE-071/075/077	Open Elective*	3	1	0	20	20	60	100	4
Practicals / Project										
6	BBT-751	Down Stream Processing Lab	0	0	3	30	20	50	100	1
7	BBT-752	Mini Project	0	0	3	30	20	50	100	1
8	BBT-753	Seminar	0	0	2	30	20	50	100	1
9	BBT-754	Industrial Training Viva-Voice	0	0	2	30	20	50	100	1
Total			15	5	10	220	180	500	900	24

BHU-001 Human Values & Professional Ethics (Audit Course) – Student can clear from 2nd year to Final year.L-Lecture, T-Tutorial, P- Practical, CE- Continuous Evaluation, MTE-Mid Term Examination, ETE-End Term Examination

Evaluation Scheme:

• **Course without practical components**

For Continuous Evaluation (CE) is such as: 20 Marks

- a. Attendance: 5 Marks
- b. Assignments/Quiz / Seminar/Term paper /Project :15Marks

MTE - Mid Term Examination: 20 Marks

- a. First Mid Term Examination: 10 marks
- b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 60 Marks

• **Course with practical components only**

For Continuous Evaluation (CE) is such as: 30 Marks

Conduct / Perform/Execution /Practical File/ Viva-Voice

MTE - Mid Term Examination: 20 Marks

- a. First Mid Term Examination: 10 marks
- b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 50 Marks

Convener

Signature:

Name : Dr. Ajay Kumar

Date :

Internal Members

Signature: 1..... 2.....

Name: Mr. Ajit Pratap Singh Yadav Mr. Vachaspati Rao

Date:

External Members

Signature: 1..... 2.....

Name: Prof. (Dr.). Dr.

Date:

Faculty of Engineering & Technology

Rama University Uttar Pradesh, Kanpur

Course Detail and Evaluation Scheme

(Effective from the Session 2014-15)

B. Tech. Biotechnology

Year 4 SEMESTER-VIII

S. No.	Subject Code	Subject Name	Period			EVALUATION SCHEME			Total	Credit
			L	T	P	CE	MTE	ETE		
Theory Subjects										
1	BBT-081/082	Departmental Elective-V*	3	1	0	20	20	60	100	4
2	BBT-084/085/086	Departmental Elective-VI*	3	1	0	20	20	60	100	4
3	BBT-801	Environmental Biotechnology	3	1	0	20	20	60	100	4
Practicals / Project										
4	BBT-851	Major Project	0	0	21	200	---	400	600	16
		Total	9	3	21	260	60	580	900	28

BHU-001 Human Values & Professional Ethics (Audit Course) – Student can clear from 2nd year to Final year.

L-Lecture, T-Tutorial, P- Practical, CE- Continuous Evaluation, MTE-Mid Term Examination, ETE-End Term Examination

Evaluation Scheme:

• Course without practical components

For Continuous Evaluation (CE) is such as: 20 Marks

- Attendance: 5 Marks
- Assignments/Quiz / Seminar/Term paper /Project :15Marks

MTE - Mid Term Examination: 20 Marks

- First Mid Term Examination: 10 marks
- Second Mid Term Examination: 10 marks

ETE - End Term Examination: 60 Marks

• Course with practical components only

For Continuous Evaluation (CE) is such as: 30 Marks

Conduct / Perform/Execution /Practical File/ Viva-Voice

MTE - Mid Term Examination: 20 Marks

- First Mid Term Examination: 10 marks
- Second Mid Term Examination: 10 marks

ETE - End Term Examination: 50 Marks

Convener

Signature:

Name : Dr. Ajay Kumar

Date :

Internal Members

Signature: 1..... 2.....

Name: Mr. Ajit Pratap Singh Yadav Mr. Vachaspati Rao

Date:

External Members

Signature: 1..... 2.....

Name: Prof. (Dr.). Dr.

Date:

3rd Semester

BBT-301: Biochemistry I

L T P

Credit:

4

3 1 0

UNIT I:

Carbohydrate: Classification & properties of mono, di, oligo and polysaccharides. Mutarotation, Anomer, Epimer. Structure of Glucose, Fructose, Sucrose, Maltose, Lactose. Structure and role of polysaccharides: starch, cellulose, chitin, heparin, glycogen. [8]

UNIT II:

Classification and physico-chemical properties of amino acids and proteins. Peptide bond conformation. Isoelectric point. Structure of protein: primary, secondary, tertiary and quaternary structures. Ramchandran plot. [8]

UNIT III:

Vitamins: classification and role of water soluble and fat soluble vitamins, animal hormones and Phytohormones their roles. [8]

UNIT IV:

Classification, properties and functions of lipids. Biological importance of choline, lecithine, lipoproteins, VLDL, LDL, HDL. [8]

UNIT V:

Different forms of DNA (A,B and Z) and RNA (mRNA, t-RNA and r-RNA, mi-RNA and sn-RNA). [8]

Text/Reference Books:

1. Biochemistry and molecular biology by Elliot and Elliot. (Oxford university Press)
2. Biochemistry by trehan (New age international)
3. Biochemistry by Lehninger (CBS Publication)
4. Biochemistry by Voet and Voet (Wiley New York)
5. Biochemistry by Stryer (Freeman Int. Edition)

BBT-302: Cell biology & Microbiology

L T P

Credit:

4

3 1 0

UNIT I:

The structural and Functional relation of cellular organelles: Plasma membrane, cell wall, cytoskeleton. Mitochondria, chloroplast, endoplasmic reticulum, Golgi bodies, ribosome, lysosomes, nucleus, and other organelles and their organization. [8]

UNIT II:

Biological membranes- Physicochemical properties of cell membranes and their structural constitution. Transport of nutrients across the membranes – passive transport: simple, facilitated diffusion and Active transport: Na-K pump.

UNIT III:

History, development and scope of microbiology: Doctrine of spontaneous generation; controversy over spontaneous generation; contribution of Antony Van Leeuwenhoek, Lazzaro Spallanzani, John Tyndall, Louis Pasteur, Joseph Lister, Iwanowsky, Robert Koch in the development of microbiology, Microbiology in the 20th century. [8]

UNIT IV:

Methods of inoculation and medium preparation, Microbial Growth kinetics: generation time, arithmetic and exponential growth, Batch, continuous and synchronous culture, Factors affecting microbial growth: P^H, Temp, Oxygen etc. Microbial control: Methods and dynamics of sterilization, mechanisms of control (physical, chemical, and radiation etc). [8]

UNIT V:

Structural and functional relation of prokaryotes. Cell wall, cell membrane, capsule, flagella, pili, Tactic movements, storage granules, endospore structure and process of sporulation. transformation, conjugation, transduction. Plasmids: F plasmids, R plasmids, Col plasmids etc. [8]

Text/Reference Books:

1. Microbiology by Pelczar (W C Brown publication)
2. General Microbiology by stainer (Mac Millan Publication)
3. Microbiology by Pawar and Dagniwala (Himalaya publishing House)
4. Microbiology –an introduction by Tortora (Pierson education Publication)
5. Industrial microbiology by Prescott and Dunn

BBT-303: Enzyme Technology

L T P

Credit:

4

3 1 0

UNIT I:

Historical perspective, Enzyme Classification, Enzyme Chemistry: Isolation and Purification of Enzymes, Criteria for Enzyme homogeneity, General Properties, Enzyme Activity , Specific Activity and Turnover Number, Marker Enzymes. [8]

UNIT II:

Enzyme Kinetics: Enzyme-Substrate Interaction, ES Complex, Binding Site, Active Site. Specificity, Steady-State, Pre Steady State and Equilibrium-State Kinetics, Michael-Menten Equation and its derivation, Graphical Methods for determination of K_m , V_{max} . Significance. Enzyme Inhibition and Activation: types of inhibition, and activation, Competitive non-competitive and Uncompetitive inhibition. [8]

UNIT III:

Mechanism of Enzyme action: enzyme-substrate complementary, Stereochemistry of enzyme substrate action, Interaction between enzyme and substrate- lock and key model, induced fit model. Factors associated with catalytic efficiency. Enzyme regulation: Partial proteolysis, Phosphorylation, disulphide reduction, Allosteric enzyme and, Proenzymes-Zymogens and activation. [8]

UNIT IV:

Enzyme Immobilization: Adsorption, Matrix entrapment, Encapsulation, Cross linking, Covalent binding and their examples; Advantages and disadvantages of different immobilization techniques. Structure & stability of immobilized enzymes, kinetic properties of immobilized enzymes- partition effect, diffusion effect. Overview of applications of immobilized enzyme systems. [8]

UNIT V:

Isoenzyme, Ribozymes, Abzymes. Industrial, Agricultural and Clinical Applications of Enzymes: Comprehensive Account. [8]

Text/Reference Books:

1. Fundamentals of enzymology by Nicolas C. price and Lewis stevens . Oxford University Press
2. Enzymes by Trevor palmer, East west Press
3. Enzyme Technology by Messing
4. Enzymes: Dixon and Webb. (IRL Press)
5. Enzyme technology by Chaplin and Bucke. Cambridge Univerity Press

BBT-305: Fluid Flow and Solid Handling

L T P

Credit:

4

3 1 0

UNIT I:

Properties of fluids-Types of Fluid, Capillarity, Cavitation, surface tension. Fluid statics: Euler's equation, Hydrostatic Law and Pressure Measurement, Transport of fluids, pipe fittings, minor losses in pipe flow. [8]

UNIT II:

Flow measurements-Bernoulli's Equation and its application, Orifice meter, venturi meters, rotameter and pitot tube. [8]

UNIT III:

Pumps: reciprocating pumps, rotary pumps, centrifugal Pumps, Characteristic curve, Efficiency, Minimum Operating speed, Net positive suction Head Introduction of fluidization and types of Fluidisation. [8]

UNIT IV:

Properties of solids, screening, industrial screening equipment, screen analysis, size reduction of solids, stages of reduction. Intermediate and fine size reduction, power requirement and mechanism. Power driven machines: Crushers, grinders and conveyers. [8]

UNIT V:

Filtration theory, continuous and batch equipments. Flow of solids through fluids, classification and sedimentation. [8]

Text/Reference Books:

1. Introduction of Fluid Mechanics by Robert W. Fox
2. Fluid Mechanics by R.K.Bansal /R.K.Rajput
3. Unit Operations in Chemical Engineering by McCabe Smith
4. Chemical Engineering by Coulson and Richardson

BAS-302: Statistical Techniques

L T P

Credit: 4

3 1 0

UNIT I:

Data type, classification and summarization of data, diagrams and Graphs, Measures of Central tendency: mean, median and mode, Measures of Dispersion: range, variance, standard deviation and standard error, Skewness and Kurtosis, Curve fitting, Method of Least Squares, Moment, Moment generating functions. [8]

UNIT II:

Introduction to probability, Laws of probability, Conditional Probability, Baye's Theorem, discrete and continuous random variables, Probability mass function (pmf) and probability density function (pdf), Mathematical Expectation of random variables, Binomial distribution Poisson distribution, Normal distribution and Gaussian distribution. [8]

UNIT III:

Pearson and Mathew correlation coefficient, Positive and Negative correlation, Rank correlation, Receiver operating characteristics (ROC) curve, Linear and Non linear regression, multiple regression, Non parametric tests. [8]

UNIT IV:

Simple random sampling with and without replacement, Sampling theory (small and large samples), Hypothesis tests and errors. Test of Significance: Chi square tests, t-tests and F-tests, Variant, One way and two way analysis of variants, ANOVA. [8]

UNIT V:

Principles of experimental design and analysis, CRD, RBD and Latin Square Design, Introduction of SPSS software. [8]

Text/References Books:

1. Geogr W. and William G., Statistical Methods; IBH Publication.
2. Ipsen J et al; Introduction to Biostatistics, Harper & Row Publication.
3. N.T.J. Baily; Statistical methods in Biology; English University Press.
4. R.Rangaswami; A Text book of Agricultural statistics; New Age Int. Pub.
5. P.S.S.Sundar Rao; An Introduction to Biostatics; Prentice Hall.
6. Zar J; Biostatistics; Prentice Hall, London.
7. M.R. Spiegel; Theory and Problems of Statistics; Schaum's Series.
8. G.K. Bhattacharyya & R.A. Johnson; John Wiley & Sons Pub.

BBT-351: Biochemistry I Lab

L T P
0 0 3

Credit: 1

1. Estimation of Glucose.
2. Estimation of proteins by Lowry and Bradford method.
3. Isolation of lipids from seeds.
4. Separation of amino acids/lipids by thin layer chromatography
5. Separation of amino acids by paper chromatography.
6. Estimation of Bilirubin by human serum.
7. Salting out and salting in of protein.

BBT 352: Cell Biology & Microbiology Lab

L T P
0 0 3

Credit: 1

1. Demonstration of Osmosis.
2. Demonstration of Pinocytosis process.
3. Isolation of Chloroplasts from spinach Leaves.
4. Study of Mitosis with the help of microscope.
5. Preparation of nutrient agar slants, plates and nutrient broth and their sterilization.
(Microwave Oven, Heating mantles, Fridge, Heating Oven, Tube racks)
6. Inoculation of agar slants, agar plate and nutrient broth
(Incubators, Water bath, Laminar hood, dry heat sterilizer i.e. bead sterilizer)
7. Culture of microorganisms using various techniques.
(Shakers i.e. Cooling and Open shaker).
8. Simple and differential staining procedures, endospore staining, flageller staining, cell wall staining, capsular staining, negative staining, Gram staining.

Practical/Reference Books:

1. Lab Manual in microbiology by P Gunasekaran (New Age Int. Pub.)

BBT-353: Enzyme Technology Lab

L T P
0 0 3

Credit: 1

1. Isolation of Enzyme from different microorganism.
2. Isolation of alpha amylase from plant source.
3. Determination of Enzyme activity.
4. Effect of pH on Enzyme kinetics.
5. Effect of temperature on Enzyme kinetics.
6. Identification of Enzyme by different assay.
7. Purification of enzymes.
8. Immobilization of Enzyme by sodium Alginate method.

BBT-354 : Fluid Mechanics Lab

L T P
0 0 2

Credit: 1

1. Experiments related to measurement of flow by venturi meter, orifice meter, notches, rotameter, velocity measurement by pitot tube.
2. Verification of Bemoulli's theorem. Vortex, friction factor, equivalent length of fittings, pump characteristics, Streamlines.

Convener

Signature:

Name : Dr. Ajay Kumar

Date :

Internal Members

Signature: 1..... 2.....

Name: Mr. Ajit Pratap Singh Yadav Mr. Vachaspati Rao

Date:

External Members

Signature: 1..... 2.....

Name: Prof. (Dr.). Dr.

Date:

4th Semester

Departmental Elective-I

1. BBT-041 Microbial Biotechnology.
2. BBT-042 Molecular Dynamics & Bioenergetics

BBT-041: Microbial Biotechnology

L T P

Credit: 4

3 1 0

UNIT I:

Introduction to Industrial Bioprocess-An overview of industrial fermentation process and products. Process flow sheeting - a brief survey of microorganisms, processes, products and market economics relating to modern industrial biotechnology, screening, and fermentation media for industrial fermentation. [8]

UNIT II:

Production of Primary & Secondary Metabolites- A brief outline of processes for the production of some commercially important organic acids (e.g. citric acid, lactic acid), amino acids (glutamic acid, lysin); alcohols, steroids, vitamin B12. [8]

UNIT III:

Study of production process for various classes of low molecular weight secondary metabolites-Antibiotics-beta-lactams (Penicillins), aminoglycosides (streptomycin), macrolids (erythromycin), quinines. [8]

UNIT IV:

Production of commercially important enzymes-Proteases, amylases lipases, cellulases, pectinases, isomerases and other commercially important enzymes for the food, pharmaceutical and detergent industries. [8]

UNIT V:

Production of other commercially important products and strain improvement-Production of natural biopreservatives (nisin), and biopolymers (xanthan gum), single cell protein, high fructose com syrup; bioconversion of vegetable oils. Strain improvement through physical and chemical mutation and molecular tools. [8]

Text/ Reference Books:

1. Biotechnology by John E. Smith., Cambridge Low Price Edition.
2. Industrial Microbiology by J.E. Casida.

BBT-042; Molecular Dynamics & Bioenergetics

L T P

Credit: 4

3 1 0

UNIT I:

Biological membrane: structure, permeability, properties, passive transport and active transport, facilitated transport, energy requirement, mechanism of Na⁺/ K⁺, glucose and amino acid transport; Organization of transport activity in cell; Active potentials; Role of transport in signal transduction processes, Signal Transduction.

UNIT II:

Cell Movement: Structure and organization of Actin Filament. Association of actin filament with Plasma Membrane. Protrusions of cell surface Actin, Myosin and Cell Movement, Muscle Contraction, Cell Crawling

UNIT III:

Metabolism and bioenergetics; Generation and utilization of ATP; Metabolism of Nitrogen containing compounds, nitrogen fixation, amino acids and nucleotides; Energetics of Metabolic Pathways; Electron- Transferring Reactions, Energy Coupling (ATP & NADH).

UNIT IV:

Stoichiometry and energetic analysis of Cell Growth and Product Formation, Electron Flow as source of ATP Energy, Site of Oxidative Phosphorylation, ATP synthetase, Electron- Transferring Reactions, Standard Oxidation, Electron Carrier, electron transport, Complexes Incomplete reduction of Oxygen, Mechanism of Oxidative Phosphorylation

Text/Reference Books:

- 1-Cell – A molecular approach: Geoffrey M. Cooper.
- 2-Biochemical Engineering Fundamentals: Bailey & Ollis, Tata McGraw –Hill.
3. Biochemistry: Stryer, W. H. Freeman
4. Biochemistry: Voet and Voet, John Wiley and Sons, Inc. USA
5. Cell: Bruice Albert.
7. Biochemistry: Garrett and Grisham, Harcourt.
8. <http://themedicalbiochemistrypage.org>.
9. Full.chemistry.uakron.edu/biochemistry.

BBT-401: Biochemistry II

L T P
3 1 0

Credit: 4

UNIT I:

Application of thermodynamics: first law of thermodynamics, second law of thermodynamics, Enthalpy, entropy, free energy, High energy compounds, Role of water as solvent , pH, pKa ,Buffer solution, Henderson Hasselbalch equation. [8]

UNIT II:

Metabolism of carbohydrates & its regulation-Glycolysis, Gluconeogenesis, TCA, ETS, Pentose Phosphate Pathway, Glyoxylate cycle. Regulatory mechanism of glycolysis, TCA and ETS [8]

UNIT III:

Biosynthesis of fatty acids, Elongation of fatty acids, Unsaturation of fatty acids, Regulation of fatty acids, beta –oxidation, Comparison of fatty acid synthesis and fatty acid degradation, Ketone bodies Disorders of lipid metabolism. [8]

UNIT IV:

Biosynthesis of amino acids: Reductive amination, Transamination, catabolism of amino acids and urea cycle, metabolic disorders of amino acids. [8]

UNIT V:

Nucleotide biosynthesis: De-novo and Salvage pathway for purines and pyrimidines, Ribonucleotide reductase, conversion of nucleoside mono phosphate to nucleoside di and tri phosphate. Nucleotide catabolism, disorders of nucleotide metabolism: Lesch-Nyhan Syndrome, Gout, Adenosine deaminase deficiency.

Text/Reference Books:

1. Harper's Illustrated Biochemistry, (26th Edition) – R.K. Murray, D.K. Garner, P.A. Mayers & V.W. Rockwell, Pub: McGraw Hill International Edition.
2. Principles of Biochemistry (4th Edition) – Lehninger, Nelson & Cox. Pub: Macmillan
3. Biochemistry (3rd Edition) – G. Zubay., Pub: Wm. C. Brown Pub.
4. General Biochemistry (5th Edition, 1996) – Weil, Pub: New Age Intl. Ltd.
5. Biochemistry (5th Edition) – Lubert Stryer. Pub: W.H. Freeman & Com., NY.
6. Biochemistry – D. Voet and J.G. Voet Pub: John Willy & Sons
7. Biochemistry (4th Edition, 1974) – West & Todd Pub: Oxford IBH,
8. Biochemistry (9th Edition) – Debjyoti Das.–Pub: Academic Publishers Kollkata
9. Practical Biochemistry (3rd Edition) – David Plummer. Pub: Tata McGraw Hill

BBT-402: Immunology

L T P

Credit: 4

3 1 0

UNIT I:

Introduction to immunity, Characteristics of innate and adaptive immunity, Humoral and Cell mediated immune response, Cells and Molecules of the immune system, Primary and Secondary lymphoid organs.

UNIT II:

Characteristics and types of Antigens, Factors affecting the immunogenicity, Haptens and adjuvants, ABO blood group antigens, Epitopes, Structure, functions and characteristics of different classes of antibodies. Antigen antibody interactions, cross reactivity, precipitation reactions – their principles and applications serological techniques–ELISA, RIA and western blotting.

UNIT III:

MHC structure and function; MHC –polymorphism; disease susceptibility, MHC restriction. Antigen processing and presentation: generation of MHC class-I and class-II peptides and their association with antigenic peptides. Generation of immunological response and its genetic control.

UNIT IV:

Hypersensitivity reactions: Types of hypersensitive reactions. Autoimmunity–systemic and localized autoimmunity. Immunodeficiency; primary, secondary immunodeficiency; SCID and AIDS.

UNIT V:

Vaccines: Historical perspective; bacterial, viral vaccines and vaccines against cancer and birth control vaccines. Antibody engineering: monoclonal and polyclonal sera their role in clinical diagnosis; production of monoclonal antibodies.

Text/Reference Books:

1. Richard A Goldsby, Thomas J Kindt, Barbara S Osborne : Kuby's Immunology. 5th Edition , W.H.Freeman & Coy , New York
2. Abbas , Basic Immunology: Functions & disorders of the immune system , WB Sanders Co. Philadelphia.
3. William Paul : Fundamental Immunology , Lippincot Raven, Philadelphia
4. Roitt : Essential Immunology :9th Edition, Blackwell Science ltd. London.
5. DP Stites, AL Terr, TG Parslow : Medical Immunology, 10th Edition, Appleton and Lange , New York

BBT- 403: Genetics and Molecular Biology

L T P

Credit: 4

3 1 0

UNIT I:

Mendelian genetics: Mendel's work, Laws of heredity (Law of segregation, Law of independent assortment), Test cross, back cross, Mono, and di hybrid cross. Alleles: codominant alleles, multiple alleles, Rh blood group system, lethal alleles [8]

UNIT II:

Interaction of genes; epistasis, dominant and recessive epistasis, dominant and recessive gene interaction, genetic linkage, Sex chromosomes and sex determination; sex chromosomes, chromosomal basis of sex determination in humans, plants, and Drosophila, non chromosomal basis of sex determination, sex linked traits and sex linked inheritance [8]

UNIT III:

DNA as the genetic material, structure & types of DNA transposable elements; Central Dogma, Cell type regulation. DNA replication process in prokaryotes & Eukaryotes, Activity of DNA polymerases and topoisomerases, DNA repairing, regulation of replication, Reverse transcriptase. [8]

UNIT IV:

Transcriptional process in prokaryotes and eukaryotes, Post transcriptional modification processes, open reading frames, transcriptional regulation. [8]

UNIT V:

Genetic Code, Wobble hypothesis, translation process in Prokaryotes and Eukaryotes. Regulation of gene expression in prokaryotes (lac). Hormonal control of gene expression in eukaryotes. [8]

Text/Reference Books:

1. Albert B, Bray Denis et al.: Molecular Biology of The Cell, latest ed.
2. Watson, Hopkin, Roberts et al.: Molecular Biology of the Gene, 4 th ed.
3. Genetics- Strickberger, 2 nd.
4. Microbial Genetics – D. Frifielder.
5. Baltimore- Molecular Biology of the Cell.
6. Benjamin Levin – Genes VIII, 8th ed.

BBT-404: Bioinformatics

L T P

Credit: 4

3 1 0

UNIT I:

Introduction to Bioinformatics: History of Bioinformatics; Objectives and areas of Bioinformatics; Genome sequencing projects; Human Genome Project -History, Techniques and insights.(8)

UNIT II:

Introduction to databases: Basic concept of database, Type of databases; Literature Databases- PUBMED, MEDLINE; Nucleic acid and protein databases- GenBank, EMBL, DDBJ, SWISS PROT. Structural databases - PDB, etc; Motifs and Pattern Databases - PROSITE, Pfam, etc. Database Retrieval systems - SRS, Entrez, Bankit, Seqin. (8)

UNIT III:

Sequence alignment Local and global alignment, Sequence Homology, Scoring matrices, Database searches for homologous sequences- FASTA, BLAST, PSI-BLAST and PHI-BLAST; Multiple sequence alignment: Evolutionary analysis- Concept of phylogeny and trees. Gene prediction: Gene prediction in prokaryotes. Protein structure prediction: Prediction of protein secondary structure from the amino acid sequence-Chou-Fasman/GOR method. (8)

UNIT IV:

Introduction to the concepts of molecular modeling: Conformational analysis; Use of molecular graphics packages- Rasmol, MOLMOL, Pymol, Computer Aided drug design: Drug discovery process; (8)

UNIT V:

Applications of Bioinformatics: Comparative Genomics; Proteomics; Gene expression informatics. (8)

Text/Reference Books:

1. Mount D. W. (2004). Bioinformatics & Genome Analysis. Cold Spring Harbor Laboratory Press.
2. C. Braden and C. Toozee (1991). Introduction to Protein Structure” Garland Publishing Inc., New York.
3. S.C.Rastogi, N.Mendiratla and P.Rastogi (2004)., Bioinformatics methods and applications-Genomics, Proteomics and Drug Discovery, Prentice Hall (India).,
4. T.B.Kitano (2003), Handbook of Comparative Genomics: Principles and Methodology, Graziano Pesole.
5. Dov Stekal (2003) Microarray Bioinformatics, Cambridge University Press, Cambridge.
6. Brown TA. (2002) Genomes. John Wiley & Sons (Asia) Pvt. Ltd. Singapore.
7. P.Clate & R.Backofen (1998), Computational Molecular Biology, Willy Publication,
8. T.K.Atwood and D.J. Parry Smith, Introduction to Bioinformatics. Biological databases: chapters 3 and 4.

BBT-451: Biochemistry II Lab

L T P
0 0 3

Credit: 4

1. Estimation of blood sugar.
2. Estimation of blood urea.
3. Estimation of hemoglobin content of human blood.
4. Determine the number of RBC count in the human blood.
5. Determine the number of WBC count in the human blood.
6. Determine erythrocyte sedimentation rate (ESR) of human blood.
7. Estimate SGPT/SGOT activity.

BBT- 452: Immunology Lab

L T P
0 0 3

Credit: 1

1. Different types of antigen –antibody cross reaction
2. Isolation, purification and identification of immunoglobulin from goat blood.
3. Double diffusion techniques for identification of antigen-antibody samples
4. Immunoelectrophoresis techniques.
5. ELISA (Enzyme linked Immunosorbent Assay)
6. RIA (Radio Immuno Assay)
7. Immunoblotting using ELISA-dot or Western blot techniques.

Practical/Reference Books

1. Handbook of Experimental Immunology, Vol. I & II, IV- Blackwell Scientific Publications.
2. Practical Immunology- Hudson L. and Hay H. C. Blackwell Scientific Publications.
3. Hybridoma Techniques: A Lab Course- Muthukkaruppan Vr, Basker S and F. Singilia.
Macmillan India Ltd.

BBT- 453: Molecular Biology Lab

L T P

Credit: 1

0 0 3

1. Estimation of DNA content in the given sample by diphenylamine method.
1. (Nitrogen cylinders, -200C fridge, grinders, cooling centrifuges, etc.)
2. Estimation of RNA content by the Orcinol method.
3. Determination of T_m of DNA and RNA.
4. Isolation of Plasmid DNA.
5. Isolation of bacterial/fungal genomic DNA.
6. Isolation of plant DNA.
7. (Sorval, Cyclomixer, Electrophoresis units both vertical & horizontal, transilluminator,
8. U.V. Torch, Gel documentation system, Thermal cycler etc.)

BBT- 454: Bioinformatics Lab

L T P

Credit: 1

0 0 2

1. Construction of database for specific class of proteins/enzymes, genes/ ORF/ EST/Promoter sequences/ DNA motifs or protein motifs using oracle.
2. Access and use of different online protein and gene alignment softwares.
3. Gene finding related search for a given nucleotide sequence in order to predict the gene
4. ORF prediction for different proteins out of some given nucleotide sequences.
5. Exon identification using available softwares for a given nucleotide sequences.
6. Secondary structure prediction for amino acid sequences of a given protein.

Convener

Signature:

Name : Dr. Ajay Kumar

Date :

Internal Members

Signature: 1..... 2.....

Name: Mr. Ajit Pratap Singh Yadav Mr. Vachaspati Rao

Date:

External Members

Signature: 1..... 2.....

Name: Prof. (Dr.). Dr.

Date:

5th Semester

Departmental Elective-II*

1. BBT-051 Enzyme & Protein Engineering.
2. BBT-052 Animal Biotechnology.

BBT-051: Enzyme & Protein Engineering

L T P

Credit: 4

3 1 0

UNIT I:

Introduction of enzymes: Enzyme stabilization by selection and genetic engineering, protein engineering, Reaction environment, chemical modification, intra-molecular Cross linking and immobilization. Molecular structure and function of enzymes. Phenomena of allosterism and allosteric kinetics.

UNIT II:

Various techniques used for the immobilization of enzymes, chemical modifications. Applications of immobilized enzyme in Biotechnology. Mass transfer effects on immobilized enzyme system. Different types of enzyme reactors, Heterogeneous reaction systems. Process design and operational strategies of immobilized enzyme reactors.

UNIT III:

Biosynthesis of proteins. Conformation studies of different proteins. Effect of amino acids on structure of proteins. Energy status of a protein molecule, structure , function relation of enzymes.

UNIT IV:

Basic information for X-ray crystallography for determination of protein structure. Site directed mutagenesis for specific protein function. Basic concept for designing a new protein/enzyme molecule. Specific examples of enzyme engineering, Tryesyl t RNA synthetase.

Text/Reference Books:

1. Enzymes-Dixon and Webb
2. Practical Chemical Biochemistry Ed. H. V. Varley, A. H. Goven Lock and M. Bell William Heinemann Medical Books Ltd. London.
3. Biochemistry- A. L. Lehninger- Kalyani Publication
4. Biochemical Engg. Aiba, Humphrey & Miller, Academic Press.
5. Fermentation & Enzyme Technology- Wangs & Humphrey, Wiley International
6. Microbial Enzymes & Bioconversions- A. H. Rose, Academic Press.

BBT-052: Animal Biotechnology

L T P

Credit: 4

3 1 0

UNIT I:

Animal Cell Culture: Equipments and materials for animal cell culture technology. Various systems of tissue culture, their distinguishing features, advantages and limitations. Culture medium: natural media, synthetic media, sera. Introduction to balanced salt solutions and simple growth medium. Characteristics of cells in culture: Cell senescence; cell and tissue response to trophic factors.

UNIT II:

Primary Culture: Behavior of cells, properties, utility. Explant culture; suspension culture. Definition of cell lines, maintenance and management; cell adaptation. Measurement of viability and cytotoxicity. Cell cloning. Various methods of separation of cell types, advantages and limitations; flow cytometry.

UNIT III:

Scaling up of animal cell culture. Cell transformation. Stem cell cultures, embryonic stem cells and their applications. Somatic cell genetics. Apoptosis: Measurement of cell death.

UNIT IV:

Commercial applications of cell culture: Tissue culture as a screening system; cytotoxicity and diagnostic tests. Mass production of biologically important compounds (e.g. Vaccines). Harvesting of products, purification, and assays.

UNIT V:

Cell culture reactors; Scale-up in suspension; Scale and complexity; Mixing and aeration; Rotating chambers; Fluidized bed reactors for suspension culture; Scale-up in monolayers; Multisurface propagators; Multiarray disks, spirals and tubes; Roller culture; Microcarriers; Growth monitoring.

Texts/References Books:

1. B. Hafez and E.S.E Hafez, Reproduction in farm animals, 7th Edition, Wiley Blackwell, 2000
2. G.E. Seidel, Jr. and S.M. Seidel, Training manual for embryo transfer in cattle (FAO Animal Production and Health Paper-77), 1st Edition, W.D. Hoard and sons FAO, 1991
3. I. Gordon, Laboratory production of cattle embryos, 2nd edition, CAB International, 2003.
4. Louis-Marie Houdebine, Transgenic Animals: Generation and Use 5th Edition, CRC Press.

BBT-501: Genetic Engineering

L T P

Credit: 4

3 1 0

UNIT I:

Gene cloning -concept and basic steps; application of bacteria and viruses in genetic engineering; Molecular biology of *E. coli* and bacteriophages in the context of their use in genetic engineering, Cloning vectors: Plasmid vector, PBR322,; –Bacteriophage- λ and other phage vectors; Cosmids, Phagemids; YAC and BAC, Expression vector.

UNIT II:

Restriction modification, enzymes used in recombinant DNA technology endonucleases, ligases and other enzymes useful in gene cloning, PCR technology for gene/DNA detection, cDNA, Use of *Agrobacterium* for genetic engineering in plants; Use of marker genes. DNA delivery methods.

UNIT III:

Gene library: Construction cDNA library and genomic library, Screening of gene libraries – screening by DNA hybridization, Tissue specific promoter, Strong and regulable promoters; increasing protein production; Selectable markers.

UNIT IV:

Origins of organismal cloning in developmental biology. Cloning of sheep (Dolly) & other mammals; applications in conservation; therapeutic vs. reproductive cloning; ethical issues and the prospects for human cloning; Site Directed mutagenesis; Site specific recombination.

UNIT V:

Creation of genetically engineered microbes for environmental application, creation of recombinant vaccine; live, attenuated and killed vaccine, edible vaccine, DNA vaccine and other vaccines.

Text/Reference Books:

1. DNA cloning 1 and 2. Glover, D.M. and Hames, B.D. 1995. IRL Press (Oxford University Press, USA).
2. Molecular Cloning, A laboratory Manual. Sambrook, J., Fritsch, E.F., Mariatis.3rd edition. 2001. Cold Spring Harbor Laboratory, USA.
3. Recombinant DNA. Watson.
4. Molecular Biology of the Cell (4th edition). Alberts, Johnson, Lewis, Raff, Roberts and Walter.
5. Advanced Genetics, G.S. Miglani, Narosa Publishing House.
6. DNA Science, David A. Micklos, Grog. A Freyer, I.K. International Pvt. Ltd.
7. Frontiers in Plant Science, K.G. Mukerji etal, I.K. International Pvt. Ltd.
8. Schaum's - Molecular & Cell Biology, Gregory B. Ralston,William D. Stan's field, TMH Publication,
9. Schaum's – Genetics, Susan Elrod, William Stan's field, TMH Publication.

BBT-502: Agriculture Biotechnology

L T P

Credit: 4

3 1 0

UNIT I:

World Food Security: Causes of food insecurity, social economic issues, ensuring food security, BIS regulations, GM food.

UNIT II:

Molecular farming: Use of plants and animals for production of nutraceuticals, edible vaccines and other desired products. Biotech feeds. Mushroom Cultivation.

UNIT III:

Biofertilizer: Mass cultivation of microbial inoculants, green manuring, algalization, Azolla. Microbial products and plant health: PGPR (plant growth promoting rhizobacteria), significance of mycorrhizae, toxin producing microbes (antibiotics, aflatoxin, and others), microbial herbicides. Transgenic animals and plants.

UNIT IV:

Organic Farming: Organic farming and sustainable use of natural and bioresources, Organic standards and certification of organic produce and products, Biological control, Global initiatives and future prospects.

UNIT V:

Microbial decomposition of organic matter cellulose, hemicelluloses, and lignin. Degradation of pesticides: Xenobiotics, Plastics, biodegradable plastics, and biopesticides. Microbiology of water, algal bloom, waste water treatment, biogas generation.

Text/Reference Books:

1. Agricultural Biotechnology by Arie Altman. *Marcel Dekker, Inc.* (2001).
2. Plants, Genes and Crop Biotechnology (2003) 2nd Edition by Chrispeels, M.J. & Sadava D.E. American Society of Plant Biologists, *Jones and Bartlett Publishers*, USA.
3. Biochemistry and Molecular Biology of Plants: Edited by Buchanan B.B., Gruissem W, and Jones RL (2000), *American Society of Plant Biologists, USA*.
4. Soil Microorganisms and Plant Growth by Rao Subba S.M. 1977.

BBT-503: Bioprocess Engineering I

L T P

Credit: 4

3 1 0

UNIT I:

Media design and optimization. Microbial growth in closed, semi-open and open cultivation systems. Maintenance energy and yield concepts, parameters of growth and analysis of growth data, estimation of biomass.

UNIT II:

Sterilization: concept and methods. Sterilization of medium. Kinetics of thermal death of microorganisms. Batch sterilization. Continuous sterilization. Sterilization of air: Methods, filters and design of depth filters.

UNIT III:

Microbial kinetics of growth and substrate utilization. Product formation in batch, plug flow and chemostat culture., Microbial pellet formation. Flocculation. Kinetics and dynamics of pellet formation.

UNIT IV:

Material and energy balance in steady and unsteady reaction systems. Oxygen transfer in bioreactors, measurement of KLa. Oxygen transfer in large vessels. Control of physical, chemical and biological environment of the bioreactor.

UNIT V:

Advanced control strategies viz. PID controllers, fuzzy logic based controllers and artificial neural network based controllers, Biosensors; components of biosensors, Role of physical, chemical & biological sensors, application of biosensors in health care and environment.[8]

Text/References Books:

1. Principles of Microbe and cell cultivation- S. John Pirt, Butterworth Publication.
2. Bioprocess Engineering Principles – P. M. Doran, 5th ed.
3. Hand Book Of Bioengineering- Skalak R & Shu Chien, 4th ed.
4. Biochemical Engg. Bailly & Ollis, Academic Press
5. Introduction to Chemical Engg. Series, MCH Int. Series.
6. Biochemical & Biological Engg. Science, N. Blakebraugh, Academic Press

BBT-504: Biophysical Tools and Techniques

L T P

Credit: 4

3 1 0

UNIT I:

Microscopic techniques for observing cell structure: Principles and applications of Microscopy
Light microscopy: Bright field, Dark field, phase contrast, fluorescence microscopy, scanning and transmission electron microscopy, flow cytometry.

UNIT II:

Chromatographic Techniques: Types of chromatography: Planar(TLC and Paper chromatography) Column chromatography and its type - Gel permeation, Ion exchange, Hydrophobic, Reverse-phase and Affinity chromatography; HPLC and FPLC.

Electrophoretic techniques: Theory and application of Polyacrylamide gel electrophoresis and Agarose gel electrophoresis; Capillary electrophoresis; 2D Electrophoresis; Disc gel electrophoresis; Gradient electrophoresis; Pulsed field gel electrophoresis, SDS PAGE.

UNIT III:

Centrifugation: Basic principles; Mathematics & theory (RCF, Sedimentation coefficient etc); Types of centrifuge - Microcentrifuge, High speed & Ultracentrifuges; Preparative centrifugation; Differential & density gradient centrifugation, Analytical centrifugation.

UNIT IV:

Spectroscopic Techniques: Basic principles and application of NMR, Mass spectroscopy, UV-Visible spectroscopy. X-ray diffraction. Nanoparticles; their application in medicine and biology.

UNIT V:

Radioactivity: Radioactive & stable isotopes, Pattern and rate of radioactive decay, Units of radioactivity. Measurement of radioactivity: Geiger-Muller counter, Solid & Liquid scintillation counters (Basic principle, instrumentation & technique), autoradiography. Applications of isotopes in biochemistry.

Text/Reference Books:

1. Handbook of Analytical Techniques Published Online: 2008. Helmut Günzler, Alex Williams. Wiley Inter Science
2. Fundamentals of Analytical Chemistry (with CD-ROM and InfoTrac) by Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, Hardcover: 992 pages, Publisher: Brooks Cole.
3. Biosensors and modern biospecific analytical techniques, 44. I. Gorton. Elsevier. 2005
4. Wilson, K, Walker, J.: Principles and Techniques of Practical Biochemistry. 5th Ed. - Cambridge University Press, Cambridge 1999.

BBT-551: Genetic Engineering Lab

L T P

Credit:1

0 0 3

1. Isolation of the DNA, by dinitrophenyleamine methods.
2. Isolation of RNA by Orcinol method.
3. Restriction mapping of the DNA isolated from plant, bacteria and fungi.
4. Isolation of the plasmid from the bacterial sample.
5. Transformation of the bacterial cell.
6. Estimation of T_m in given sample of DNA.
7. PAGE electrophoresis of the given sample of DNA

BBT- 552: Agriculture Biotechnology Lab

L T P

Credit:1

0 0 3

1. Isolation of Vesicular-Arbuscular Mycorrhizal (VAM) spores from the soil.
2. Isolation of *Azotobacter* species from soil.
3. Isolation of microorganisms from rhizosphere.
4. Isolation of microorganisms from the phyllosphere(phyllplane).
5. Isolation of cyanobacteria(blue green algae) from paddy fields.
6. Cultivation of white button mushroom(*Agaricus bisporus*).

BBT-553: Bioprocess Engineering Lab

L T P

Credit:1

0 0 3

1. Determination of kinetic parameters for batch cultivation of yeast under stationary and shake flask conditions.
2. Growth kinetic studies of yeast in a bench top lab Fermentor under controlled conditions.
3. Determination of volumetric oxygen transfer coefficient ($K_L a$), effect of aeration and agitation speed etc.
4. Determination of specific thermal death rate constant (K_d) and activation energy for microbial strains.
5. Optimization of Bioprocess for production of Enzyme using specific experimental design.
6. Preparation of immobilized enzymes & cells and evaluation of kinetic parameters.
7. Computational Design of Fermentative Process for l-Lysine production.

BBT-554: Biophysical tools & Techniques Lab

L T P
0 0 3

Credit:1

1. Introduction to quality control. Use concepts of accuracy and precision.
2. Compute component of given percentage solution, molarity solution, PRN, PPS solution and stock solution.
3. List uses of pH meter, measurement, detailed diagram of pH electrode and reference electrode (combined electrode also), find pH of a solution giving detailed account of pH meter operation, troubleshooting. Preparation of solution using pH meter. Demonstration of the effect of the solution.
4. To determine maximum absorption spectra of mixtures (potassium dichromate and potassium permanganate) solution.
5. Measure components and working of centrifuges, solving g and RPM of centrifuge with respect to various heads. Rotors. Isolation of cellular organelles by differential centrifugation.
6. Solvent-solvent extraction of plant pigments,
7. Use of paper chromatography for separation of plant pigments
8. Use of thin-layer chromatography for amino acid (TLC)
9. Electrophoresis of protein by SDS-PAGE
10. Demonstration of Sterilization of solution by filtration.
11. PCR
12. Demonstration of Dialysis

Convener

Signature:

Name : Dr. Ajay Kumar

Date :

Internal Members

Signature: 1..... 2.....

Name: Mr. Ajit Pratap Singh Yadav Mr. Vachaspati Rao

Date:

External Members

Signature: 1..... 2.....

Name: Prof. (Dr.). Dr.

Date:

6th SEMESTER

Departmental Elective-III

BBT-061 Bioreactor and design engineering

BBT-062 Plant Biotechnology.

BHU-601: Engineering Economics and Industrial Management

L T P

Credit: 4

3 1 0

UNIT I:

Introduction: Meaning, Nature and Scope of Economics, Meaning of Science, Engineering and Technology Managerial Economics and its scope in engineering perspective. Basic Concepts Demand Analysis, Law of Demand, Determinates of Demand, Elasticity of Demand-Price, and Income and cross Elasticity .Uses of concept of elasticity of demand in managerial decision.

UNIT II:

Demand forecasting: Meaning, significance and methods of demand forecasting, production function, Laws of returns to scale & Law of Diminishing returns scale. An overview of Short and Long run cost curves – fixed cost, variable cost, average cost, marginal cost, Opportunity cost.

UNIT III:

Market Structure: Perfect Competition, Imperfect competition, features of price determination and various market conditions. National Income, Inflation and Business Cycles Concept of N.I. and Measurement. Meaning of Inflation, Type causes & prevention methods, Phases of business cycle.

UNIT IV:

Introduction: Concept, Development, application and scope of Industrial Management. Management Function: Principles Production requirements. Productivity: Definition, measurement, productivity index, types of production system, Industrial of Management-Management Tools – time and motion study, work simplification- process charts and flow diagrams, Production Planning, Specification of Ownership.

UNIT V:

Inventory control: Inventory, cost, Deterministic models, Introduction to supply chain Management. Quality control: Meaning, process control, SQC control charts, single, double and Sequential sampling, Introduction to TQM. Environmental Issues: Environmental Pollution – various management techniques to Control Environmental pollution – Various control acts for Air, Water, Solid waste and Noise pollution. [8]

Text/Reference Books

1. Koutsoyiannis A: Modern Microeconomics, ELBS.
2. Managerial Economics for Engineering: Prof. D.N. Kakkar

BBT-061: Bioreactor and Design Engineering

L T P

Credit: 4

3 1 0

UNIT I:

Bioreactor Types and operation control- batch reactors, fed-batch reactors, CSTR reactors, various types of bioreactors for microbial, animal , plant cell culture, fluidized bed reactor, bubble column, air lift fermenter, packed bed, trickle bed etc. parallel and series bioreactor. Impellers, stirrer, glands and bearings, packed gland seal, mechanical seal, magnetic drives, baffles, different types of spargers.

UNIT II:

Bioreactor Design-Introduction, general design information, design of bioreactors, basic function of a bioreactor design, mass and energy balance, materials of construction for bioprocess plant, mechanical design of process equipment, utilities for biotechnology production plants. 5(L)

UNIT III:

Reactor engineering-Ideal reactors, concept of holding and space time, performance equations for single reactors; multiple reactor systems, design of multiple reactors: kinetics of series and parallel reaction, residence time distributions (RTD), exit age distribution, recycle reactors, recycle ratio for auto catalytic reactions.

UNIT IV:

Scale Up process- Operation, analysis and scale-up criterion: dimensional analysis, scale-up of stirred tank bioreactors.

UNIT V:

Instrumentation and Control-Introduction, measurement of physical and chemical parameters in bioreactors, on-line, in-line and off-line sensors, temperature- pressure measurement and control, foam sensing and control, inlet and exit gas analysis, pH and dissolve oxygen probes. Computer Interfaces and peripheral devices, data logging, data analysis, process control.

Text/Reference Books:

1. Biochemical engineering by Aiba, Humphrey and Mells, Academic press.
2. Bioprocess engineering principles by Pauline M. Doran, Academic Press.
3. Biochemical Engineering by H.W. Blanch and D.S. Clark, Marcel Dekker.
4. Bioseparations Science and Engineering by Roger. H. Harrison., Oxford University press.
5. Applied instrumentation in the Process Industries, Vols I, II, III Andrew W G., Gulf Publishing Company.
6. Bioseparations-Downstream processing for Biotechnology by Paul. A. Belter, E.L.Cussler and Wei-Shou Hu., John Wiley and sons.

BBT-062: Plant Biotechnology

L T P

Credit: 4

3 1 0

UNIT I:

Introductory history: Laboratory organization; Nutrition of plant cells; Media composition –solid and liquid; Biology plant cell in culture, Tissue and organ culture; Establishment and maintenance of callus and suspension cultures.

UNIT II:

Haploid production- Androgenesis; Anther and microspore culture; Gynogenesis; Embryo culture; Protoplast isolation; Culture – regeneration; Somatic hybrid-cybrids; *In vitro* selection of mutants –mutants for salts, disease, cold, drought, herbicide and other stress conditions.

UNIT III:

Plant micropropagation: Application of micropropagation in forestry and crops, Meristem culture and; callus culture, Shoot tip culture. Improved crop varieties through somaclonal variation in *in vitro* cultures. Application of tissue culture for crop improvement in agriculture, horticulture and forestry.

UNIT IV:

Introduction to Plant genetic Engineering: Methodology; Plant transformation with Ti plasmid of *Agrobacterium tumifaciens*; Ti plasmid derived vector systems; Physical methods of transferring genes to plants - Microprojectile bombardment, Electroporation; Manipulation of gene expression in plants; Production of marker free transgenic plants.

UNIT V:

Developing insect-resistance, disease-resistance, herbicide resistance; stress and senescence tolerance in plants-oxidative, salt and submergence stress, fruit ripening. Wild plant relatives as a source of novel genes, Plants as bioreactor.

Text/Reference Books:

1. Principles and Practices in Plant Science. Walton, P.D. Prentice Hall 1988.
2. Plant Tissue Culture: Application and Limitations. Bhowjwani, S.S. 1990.
3. Plant Cell Culture: A practical approach. Dixon. 1994.
4. Plant Biotechnology and Development, SRC Series of Current Topics in Plant molecular Biology. Gresshoff, P.M.
5. Plant Cell Culture, Advances in Biochemical Engineering and Biotechnology. Anderson, L.A.,
6. Plant Biotechnology. Mantell and Smith, 1984.
7. Genetic Engineering of Plants. Kosuge, 1983.

BBT-601: Fermentation Technology

L T P

Credit: 4

3 1 0

UNIT I:

History and development of fermentation industry: Introduction to submerged and solid state fermentation, Primary and secondary metabolite.

UNIT II:

Raw material availability, quality, processes and pretreatment of raw materials.

UNIT III:

Different regulatory mechanisms involved in controlling the catabolic and anabolic processes of microbes. Induction, nutritional repression, carbon catabolite repression, crabtree effect, feedback inhibition and feedback repression.

UNIT IV:

Creation/procedures for developing mutants of the desired microbes with the stable capacity of producing desired metabolites. Isolation and preservation of different types of mutants induction resistant, feedback inhibition resistant. Concept for overproduction of metabolites.

UNIT V:

Fermentations of recombinant microbial cells for large-scale production of genetically engineered primary and secondary metabolites.

Text/Reference Books:

1. Murray Moo -Young , Comprehensive Biotechnology, Vol. 1 & III-latest ed.
2. Microbes & Fermentation, A. Lel and Kotlers Richard J. Mickey, Oriffin Publication
3. Industrial Fermentations- Leland, N. Y. Chemical Publishers.
4. Prescott and Dunn's- Industrial Microbiology, 4 th, ed.
5. Biotechnology Series, Rehm, Reed & Weinheim, Verlag-Chemie.
6. Biochemical Engg., Aiba, Humphrey & Miller, Academic Press.
7. Fermentations & Enzyme technology,Wang & Humphrey, Wiley & Inter Science

BBT-602: Food Biotechnology

L T P

Credit: 4

3 1 0

UNIT I:

History of Microorganisms in food, Historical Developments. role and significance of microorganisms in foods. Parameters of Foods that affect microbial growth. Basic principles, unit operations, and equipment involved in the commercially important food processing methods and unit operations.

UNIT II:

Microorganisms in fresh meats and poultry, processed meats, seafood's, fermented dairy products and miscellaneous food products; Cheeses, beer, wine , SCP, medical foods, probiotics and health benefits of fermented milk and foods products. Brewing, malting, mashing, hops and primary fermentation.

UNIT III:

Nutritional boosts and flavor enhancers: Emerging processing and preservation technologies for milk and dairy products. Microbiological Examination of surfaces, Air Sampling, Metabolically Injured Organisms. Enumeration and Detection of Food-borne Organisms.

UNIT IV:

Food Preservation, Food Preservation Using Irradiation, Characteristics of Radiations of Interest in Food Preservation. Principles Underlying the Destruction of Microorganisms by Irradiation, Processing of Foods for Irradiation, Application of Radiation, Effect of Irradiation of Food constituents.

UNIT V:

Storage Stability Food Preservation with Low Temperatures, Food Preservation with High Temperatures, Preservation of Foods by Drying, Indicator and Food-borne Pathogens, Other Proven and Suspected Food-borne Pathogens.

Text/Reference Books:

1. Frazier, W.S. and Weshoff, D.C., 1988. Food Microbiology, 4th Edn., McGraw Hill Book Co., New York.
2. Mann & Trusswell , 2007. Essentials of human nutrition. 3rd edition .oxford university press.
3. Jay, J.M., 1987. Modern Food Microbiology, CBS Publications, New Delhi.
- 4 Lindsay, 1988. Applied Science Biotechnology. Challenges for the flavour and Food Industry. Willis Elsevier.
4. Roger, A., Gordon, B. and John, T., 1989. Food Biotechnology.

BCH-606: Heat and Mass Transfer

L T P

Credit: 4

3 1 0

UNIT I:

Conduction and Convection: Introduction, Conduction: Basic concepts of conduction in solids, liquids and gases, One and two dimensional heat conduction. Critical and optimum insulation thickness. Introduction to unsteady state heat transfer. Principles of convection, Equations of forced and free convection. [8]

UNIT II:

Radiation Basic laws of heat transfer by radiation, black body and gray body concepts, solar radiations, combined heat transfer coefficients by convection and radiation. Introduction of Heat Transfer Equipments: Heat Exchangers, Evaporators, Condenser. [8]

UNIT III:

Diffusion Molecular and turbulent diffusion, Diffusion coefficient, Fick's Law of diffusion, Dependence of diffusion coefficient on temperature, pressure and composition. Diffusion in solids: Molecular, Knudsen & surface diffusion Inter- phase mass transfer, Mass transfer coefficients, Diffusion between phases, Equilibrium solubility of gases in liquids, Mass Transfer theories, Mass transfer in fluidized beds, flow past solids and boundary layers, Simultaneous heat and mass transfer. [8]

UNIT IV:

Drying and Crystallization Solid-gas equilibrium, Different modes of drying operation, Types of batch and continuous dryer Definitions of moisture contents, Rate of batch drying, Time of drying, Mechanism of batch drying, Continuous drying. Equilibrium yield of crystallization, Heat and mass transfer rates in crystallization, Theories of crystallization, Factors governing nucleation and crystal growth rates, controlled growth of crystal, Classification of crystallizers. [8]

UNIT V:

Absorption and Adsorption Gas-Liquid equilibria. Henry's Law, Selection of solvents, Absorption in tray column, Graphical and analytical methods, Absorption in packed column, Design equation for packed column, HTU, NTU and HTEP concepts, Equipments. Description of adsorption process and their application, Types of adsorption Nature of adsorbents, Adsorption equilibrium and adsorption hysteresis, Stage wise and continuous contact adsorption operation operations, Determination of number of stages, Equipments. [8]

Text/References Books:

1. Holman, J.P.: "Heat Transfer" 9 th ed. McGraw Hill (1989).
2. Treybal, R "Mass Transfer Operations", 3rd ed. New York: McGraw-Hill, (1980).

BBT-651: Fermentation Technology Lab

L T P

Credit: 1

0 0 3

1. Fermentative production of Penicillin Antibiotics using *Penicilium chrysogenum*.
2. To study the induction effect of β -galactosidase enzyme in *E.coli*.
3. Citric acid production by (a) solid state and (b) submerged fermentation.
4. Microbial production of enzymes by (a) solid state and (b) submerged fermentation.
5. Fermentative production of Ethanol using *Saccharomyces cerevisiae*.
6. Wine Fermentation.
7. Microbial production of Biosurfactant using suitable strain.
8. Microbial production of Biopolymer using suitable Strain.

BBT-652: Food Biotechnology Lab

L T P

Credit: 1

0 0 3

1. Isolation and Characterization of food fermenting organism from idli batter.
2. Estimation of ascorbic acid from given food sample by titrimetric method.
3. Analysis of mycotoxin (Aflatoxin) in fungus contaminated food material.
4. Microscopic examination of Food/Milk by breed method.
5. Estimation of lactose from milk.
6. Quality characterization of pasteurized milk by MBRT method.
7. To judge efficiency of pasteurization of milk by Phosphatase test.
8. Detection of microbial count in Milk by SPC method.
9. Determination of Minimum Inhibitory Concentration (MIC) of Antibiotic.

Practical /Reference Books:

1. Gaud R.S. (2000), Practical biotechnology, Nirali Prakashan.
2. Sadashivam S. and Manickam A. (1996), Biochemical Methods, 2nd Edi. New age International (P) Ltd., Publications, New Delhi.
3. Schmauder Hans Peter (1997), Methods in Biotechnology, Taylor and Francis, London.
4. Sharma P.K and Dandiya P.C (2004), Pharmaceutical Biochemistry: Theory and Practicals, Vallabh Prakashan , Delhi.

BCH- 656: Heat Transfer Lab

L T P

Credit: 1

0 0 2

List of Experiments

Any 10 experiments are compulsory for lab work.

1. To find out the thermal conductivities of all layers of Composite wall.
2. To find the thermal conductivity of Composite cylinder.
3. To find out the thermal conductivity of insulating powder.
4. To find the thermal conductivity of liquid / gases.
5. To find the temperature profile of any regular shaped thermal conductor for steady and unsteady state conduction.
6. Any Experiment on natural convection.
7. Experiment on Heat Pipe.
8. Any experiment on determination of emissivity.
9. Heat load and Overall heat transfer coefficient for parallel flow condition.
10. Heat load and Overall heat transfer coefficient for Counter flow condition.
11. To study the Plate heat exchanger and Double Pipe Heat Exchange.
12. To study the shell & Tube heat exchanger.

7th Semester

BBT-701: Down Stream Processing

L T P

Credit: 4

3 1 0

UNIT I:

An overview of Bioseparation. Role of Downstream Processing in Biotechnology. Problems and requirement of bioproduct purification. Cost cutting strategies. [8]

UNIT II:

Primary separation and Recovery Process: Cell Disruption methods (Physical, chemical and Enzymatic) for intracellular products. Removal of insoluble biomass. Separation techniques – Flocculation, Sedimentation, Centrifugation and Filtration. [8]

UNIT III:

Product Isolation - Extraction and adsorption methods, Solid- Liquid , Liquid –liquid Separation, Distillation. Enrichment operation-Membrane based Separation-micro and Ultrafiltration, Precipitation methods- Ammonium Sulphate , organic solvents. [8]

UNIT IV:

Product Purification: Electrophoresis and Chromatography principle for product purification, Different Electrophoresis technique –Isoelectric, focusing, chromatographic technique with special reference to ion-exchange, affinity, GLC, HPLC. [8]

UNIT V:

Product Polishing: Crystallization, Drying. A Few case studies: Citric acid, Glutamic acid, Penicillin G, Extracellular Enzymes, Intracellular enzymes, Antibodies. [8]

Text/Reference Books:

1. Comprehensive biotechnology- Murray Moo-Young, Vol. II-latest ed., Pergan Publishers.
2. H. J. Rehm and G. Reed, Biotechnology- Vol. 3, 4, 5, Verlag Publishers
3. Stanbury & Whitteker, Principles Of Fermentation Technology, Pergamon Press
4. A Biologist's Guide to Principles & Techniques of Practical Biochemistry- Wilson and Golding, Cambridge University Press
5. Humphrey, Aiba & Miller, Biochemical Engg., Academic Press.
6. Biochemical Engg. -Bailly & Ollis, Academic Press.
7. Product Recovery in Bioprocess Technology, Heinemann, Butterworth Publication.
8. Electrophoresis in Practice, Westermeier- Wiley Publications.
9. Handbook of Analytical techniques-H. Gunzler, Wiley Publications.
10. International Methods of Analysis- Willard et al., CBS Publication.

BBT-702: Bioethics, Biosafety & IPR

L T P

Credit: 4

3 1 0

UNIT I:

Jurisprudential definition and concept of property, rights, duties and their correlation. History and evolution of IPR- like patent, design and copy right, Indian patent act 1970 (amendment 2000), international convention in IPR, major changes in Indian patent system as post TRIPS effects (i) obtaining patent (ii) geographical indication. [8]

UNIT II:

Distinction among various forms of IPR, Requirement of a patentable novelty, invention step and prior art and state of art, procedure. [8]

UNIT III:

Rights/protection, infringement or violation, remedies against infringement—civil and criminal. [8]

UNIT IV:

Detailed information on patenting biological products, Biodiversity, Budapest treaty, Appropriate case studies. [8]

UNIT V:

Biosafety and Bioethical issues in Biotechnology. [8]

Text/Reference Books:

1. Patent Strategy For Researchers & Research Managers- Knight, Wiley Publications.
2. Agriculture & Intellectual & Property Rights, V. Santaniello & R E Evenson, University Press.
3. Intellectual Property Protection & Sustainable Development, Phillippe Cullet, Ldexix Nexis Butterworths.
4. Biotechnology & Safety Assessment, Thomas, Ane/Rout Publishers.
5. Biotechnology in Comparative Perspective, Fuchs, Ane/Rout Publishers.

BBT-703: Bioprocess Engineering-II

L T P

Credit:

4

3 1 0

UNIT I:

Introduction of engineering calculations; unit conversion, measurement conventions, errors in data calculations, presentation of experimental data, data analysis, general procedures for plotting data, process flow diagrams [8]

UNIT II:

Material balances, material balances with recycle, bypass and purge streams, stoichiometry of growth and product formation, electron balances, biomass yield, maximum possible yield, theoretical oxygen demand, stoichiometry of single cell protein synthesis, mass transfer; role of diffusion in bioprocessing, convective mass transfer, oxygen uptake in cell cultures, factors affecting cellular oxygen demand. [8]

UNIT III:

Design and operation of various bioreactors, viz CSTR, fed batch systems, air-lift bioreactors, fluidized bed bioreactors. Scale up of bioreactors. Criteria for selection of bioreactors. Ideal bioreactors; fed-batch reactor, enzyme –catalysed reactions in CSTRs, CSTR reactors with recycle and wall growth, the ideal plug flow tubular reactor, dynamics model and stability of bioreactor,. Reactor with non ideal mixing: mixing time in agitated tanks, resident time distributions, models for no-ideal reactors, mixing -bio reaction interactions. [8]

UNIT IV:

Scale up of bioprocess; general aspects, criteria and basic principle of scale-up of bioreactor, practical considerations for bioreactor construction. [8]

UNIT V:

Control of physical, chemical and biological environment of the bioreactor, advanced control strategies viz. PID controllers, fuzzy logic based controllers and artificial neural network based controllers, role of physical, chemical & biological sensors.

Text/Reference Books:

1. Principles of Microbe and cell cultivation- S. John Pirt, Butterworth Publication.
2. Bioprocess Engineering Principles – P. M. Doran, 5th ed.
3. Hand Book Of Bioengineering- Skalak R & Shu Chien, 4th ed.

Departmental Elective-IV*

BBT-071: Cancer Biology.

BBT-072: Nano Biotechnology.

BBT-073: Biofuels & Alcohol Technology

BBT-071: Cancer Biology

L T P

Credit: 4

3 1 0

UNIT I:

Fundamentals of Cancer Biology :Regulation of Cell cycle, Mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, Modulation of cell cycle-in cancer, Different forms of cancers, Diet and cancer.

UNIT II:

Principles of Carcinogenesis :Chemical Carcinogenesis, Metabolism of Carcinogenesis, Natural History of Carcinogenesis, Targets of Chemical Carcinogenesis, Principles of Physical Carcinogenesis, X-Ray radiation – Mechanism of radiation Carcinogenesis.

UNIT III:

Principles of Molecular Cell Biology of Cancer: Oncogenes, Identification of Oncogenes, Retroviruses and Oncogenes, detection of Oncogenes, Growth factor and Growth factor receptors that are Oncogenes. Oncogenes / Proto Oncogenes activity. Growth factors related to transformations.

UNIT IV:

Principles of Cancer Metastasis: Clinical significances of invasion, heterogeneity of metastatic phenotype, Metastatic cascade, Basement membrane disruption, Three step theory of invasion, Proteinases and tumour cell invasion.

UNIT V:

New Moleculus for Cancer Therapy :Different forms of therapy, Chemotherapy, Radiation Therapy, Detection of Cancers, Prediction of aggressiveness of Cancer, Advances in Cancer detection.

Text/Reference Books:

1. King R.J.B., Cancer Biology, Addison Wesley Longmann Ltd, U.K., 1996.
2. Rudson.R.W., Cancer Biology, Oxford University Press, Oxford, 1995.
3. Maly B.W.J., Virology a practical approach, IRL press, Oxford, 1987.
4. Dunmock. N.J and Primrose S.B., Introduction to modern Virology, Blackwell Scientific Publications, Oxford, 1988.

BBT-072: Nanobiotechnology

L T P

Credit: 4

3 1 0

UNIT I:

Basic biology principles and practice of micro fabrication techniques, Atomic force microscopy, biological production of metal nano particles, macro molecular assemblies. [8]

UNIT II:

Application in Biomedical and biological research, nano particles, viruses as nano-particles , nano chemicals and application., tumor targeting and other diagnostic applications. [8]

UNIT III:

Developing drug delivery tools through nano biotechnology, nano particle based immobilization assays, quantum dots technology and its application. [8]

UNIT IV:

Synthesis and characterization of different classes of biomedical polymers- their uses in pharmaceutical, cardiovascular ophthalmologic orthopedic areas. [8]

UNIT V:

Biosensors and nano biotechnology principles used in construction of micro electronic devices sensors and macro mechanical structures.and their functioning, immuno-nanotechnology. [8]

Text/Reference Books:

1. Nanobiotechnology- concepts, applications and perspectives, niemeyer, christof m. Mirkin, chad a., wiley publishers.
2. Nanobiotechnology of biomimetic membranes, martin, donald (edt), springer verlag publishers.

BBT-073: Biofuels & Alcohol Technology

L T P

Credit: 4

3 1 0

UNIT I:

Introduction to Alcohol Technology, Raw Material of Alcohol Industry, Storage & handling of Raw material in detail, Study of different yeast strains used in alcohol industries, Study of yeast production as single protein cell. [8]

UNIT II:

Study of different alcoholic fermentation techniques, Batch fermentation, Continuous fermentation, Modern techniques of Continuous fermentation, Bio still fermentation, Penicillium process Wet milling of grain for alcohol production, Grain dry milling cooking for alcohol production, Use of cellulosic feed stocks for alcohol production, Scaling in distilleries, Fusel oil separation. [8]

UNIT III:

Study of different recycling process, Biochemistry of alcohol production, The management of fermentation in the production of alcohol. [8]

UNIT IV:

Alcohol distillation-The fundamental, Parameters & affecting alcoholic fermentations, By product of alcoholic fermentation, Distillery quality control, Alcoholometry. [8]

UNIT V:

Various biofuels/bioenergy from biomass. Biomass conversion to heat and power: thermal gasification of biomass, anaerobic digestion. Biomass conversion to biofuel: thermochemical conversion, syngas fermentation. [8]

Text/Reference Books:

1. Chemical Process Principles – Part I, Material and Energy Balances by Olaf A Hougen, Kenneth M. Watson, and Roland A Ragatz, CBS Publishers and Distributors (1995).
2. Text books of alcohol tech by T. P. Lyons.
3. Product Recovery in Bioprocess Technology ", BIOTOL Series, VCH, 1990
4. Shreve's Chemical Process Industries, 5th Ed. Reference
5. Out lines of Chemical Technology by Chmles E.

Open Elective*

BOE-071 Non-Conventional Energy Resources

BOE-075 Operations Research

BOE-076 Quality Management

BOE-077 Nuclear Science

BOE-071: Non-Conventional Energy Resources

L T P

Credit: 4

3 1 0

UNIT I:

Introduction Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. Solar Cells: Theory of solar cells. solar cell materials, solar cell array, solar cell power plant, limitations.

UNIT II:

Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.

UNIT III:

Geothermal Energy: Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

UNIT IV:

Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. performance and limitations of energy conversion systems.

UNIT V:

Bio-mass: Availability of bio-mass and its conversion theory. Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants.

Text/Reference Books:

1. Raja et al, "Introduction to Non-Conventional Energy Resources" Scitech Publications.
2. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006.
3. M.V.R. Koteswara Rao, " Energy Resources: Conventional & Non-Conventional " BSP Publications,2006.
4. D.S. Chauhan,"Non-conventional Energy Resources" New Age International.
5. C.S. Solanki, "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning. (14)
6. Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.

BOE-075: Operations Research

L T P

Credit: 4

3 1 0

UNIT I:

Introduction: Definition and scope of operations research (OR), OR model, solving the OR model, art of modelling, phases of OR study. Linear Programming: Two variable Linear Programming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, sensitivity analysis. (8)

UNIT II:

Transportation Problems: Types of transportation problems, mathematical models, transportation algorithms, Assignment: Allocation and assignment problems and models, processing of job through machines. (8)

UNIT III:

Network Techniques: Shortest path model, minimum spanning Tree Problem, Max-Flow problem and Min-cost problem. Project Management: Phases of project management, guidelines for network construction, CPM and PERT. (8)

UNIT IV:

Theory of Games: Rectangular games, Minimax theorem, graphical solution of $2 \times n$ or $m \times 2$ games, game with mixed strategies, reduction to linear programming model. Quality Systems: Elements of Queuing model, generalized poisson queuing model, single server models. (8)

UNIT V:

Inventory Control: Models of inventory, operation of inventory system, quantity discount.

Replacement:

Replacement models: Equipments that deteriorate with time, equipments that fail with time. (8)

Text/Reference Books:

1. Wayne L. Winston, "Operations Research" Thomson Learning, 2003.
2. Hamdy H. Taha, "Operations Research-An Introduction" Pearson Education, 2003.
3. R. Panneer Seevam, "Operations Research" PHI Learning, 2008.
4. V.K.Khanna, "Total Quality Management" New Age International, 2008.

BOE-076: Quality Management

L T P

Credit:4

3 1 0

UNIT I:

Quality Concepts: Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of proto type. Control on Purchased Product Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure. Manufacturing Quality Methods and techniques for manufacture, inspection and control of product, quality in sales and services, guarantee, analysis of claims. (8)

UNIT II:

Quality Management Organization structure and design, quality function, decentralization, designing and fitting, organization for different type products and company, economics of quality value and contribution, quality cost, optimizing quality cost, seduction program. Human Factor in quality Attitude of top management, cooperation of groups, operators attitude, responsibility, causes of apparatus error and corrective methods. (8)

UNIT III:

Control Charts Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts. Attributes of Control Chart Defects, construction and analysis of charts, improvement by control chart, variable sample size, construction and analysis of C charts. (8)

UNIT IV:

Defects diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability, MTTF, calculation of reliability, building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle. (8)

UNIT V:

ISO-9000 and its concept of Quality Management ISO 9000 series, Taguchi method, JIT in some details. (8)

Text books and references:

1. Lt. Gen. H. Lal, "Total Quality Management", Eastern Limited, 1990.
2. Greg Bounds, "Beyond Total Quality Management", McGraw Hill, 1994.
3. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992.

BOE-077: Nuclear Science

L T P

Credit: 4

3 1 0

UNIT I:

Nucleus and Its Basic Features: Nuclear structure; nuclear forces and their properties, nuclear stability, nuclear radius and its measurement, nuclear spin, nuclear magnetic and electrical moments. (8)

UNIT II:

Nuclear Models: Single particle model, liquid drop model and semi-empirical mass formula, nuclear potential and shell model, collective model. (8)

UNIT III:

Nuclear Reaction: Nuclear reaction and laws of conservation, types of nuclear reaction, mechanism of nuclear reaction, nuclear fission & binuclear fusion and their explanation by liquid drop model. (8)

UNIT IV:

Nuclear Decay: Decay constant, half life period and mean life, alpha decay, beta decay, gamma decay, interaction of nuclear radiation with matter. Nuclear Instruments-I Mass spectrograph,: General principle, Aston's Mass Spectrograph. (8)

UNIT V:

Nuclear Instruments-II Accelerators: Van de Graph Generator, Cyclotron, Synchrotron. Detectors: G M Counter, Scintillation counter, cloud chamber, Bubble Chamber, production and detection of neutrons and Gamma-photon. Application of Nuclear Techniques: Nuclear magnetic resonance, positron emission topography, radiotracer techniques and applications in material science and agriculture. (8)

Text/Reference Books:

1. Tayal, "Nuclear Physics" Himalaya Publishing House.
2. S.N. Ghosal, "Nuclear Physics" S. Chand & Co.
3. S. B. Patel, "Nuclear Physics: An Introduction New Age International.
4. H. B. Lal, "Introductory Nuclear Physics" United Book Depot.
5. Wang, "Introductory Nuclear Physics", PHI Learning Reference Books:
6. Roy & Nigam, "Nuclear Physics" John Wiley & sons.
7. W.E. Burcham, "Nuclear Physics" Longmans Publications.
8. Green, "Nuclear Physics" McGraw Hill.

BBT -751: Down Stream Processing Lab

L T P

Credit: 1

0 0 3

1. Cell disruption techniques.
2. Solid separation methods-filtration, sedimentation techniques.
3. Centrifugation techniques.
4. Product enrichment operations (precipitation, ultra filtration, two-phase aqueous extraction).
5. Thin layer chromatography.
6. Analytical liquid chromatographic techniques demonstration/operation.
7. Product crystallization and drying.

BBT-752: Mini Project

Students have to perform a mini project work related to their respective stream in B. Tech. The project work may be software or hardware based. /it may be extendable to major project.

BBT-753: Seminar

Each student has to present a seminar on a latest topic related to their subject.

BBT-754: Industrial Training and Viva Voce

Each student has to deliver a presentation on their topic of industrial training.

Convener

Signature:

Name : Dr. Ajay Kumar

Date :

Internal Members

Signature: 1..... 2.....

Name: Mr. Ajit Pratap Singh Yadav Mr. Vachaspati Rao

Date:

External Members

Signature: 1..... 2.....

Name: Prof. (Dr.). Dr.

Date:

8th Semester

Departmental Elective-V*

BBT-081 Medical Biotechnology

BBT-082 Biomedical Instrumentation

BBT-083 Stem Cell Science

Departmental Elective-VI*

BBT-084 Genomics & Proteomics

BBT-085 Advanced Virology

BBT-086 -Vaccine Technology & Immunoinformatics

BBT-081: Medical Biotechnology

L T P

Credit: 4

3 1 0

UNIT I:

Therapeutic Aspects of Bio-macromolecules: Introduction, Endogenous peptides and proteins, Modification of endogenous peptides and proteins.

Immune System: Overview, Antibody-mediated response, Vaccines, Cell-mediated immune response, Cancer immunotherapy. [8]

UNIT II:

Oligonucleotides: Overview, Gene therapy, Antisense therapy, Ribozymes.

Oligosaccharides: Overview, Oligosaccharide synthesis, Heparin, Glycoproteins, Polysaccharide bacterial vaccines, Approaches to carbohydrate-based cancer vaccines. [8]

UNIT III:

Radiological Agents: Radiosensitizers and Radioprotective agents.

Cardiovascular Drugs: Myocardial infarction agents, Endogenous vasoactive peptides, Hematopoietic agents, Anticoagulants, antithrombotics and hemostatics.[8]

UNIT IV:

Chemotherapeutic Agents: Synthetic antibacterial agents, Lactam antibiotics, Anthelmintic agents, Anthelmintic agents, Antiamoebic agents, Antiviral agents.

Endocrine Drugs: Female sex hormones and analogs, Agents affecting the immune Response. [8]

UNIT V:

Drug Targeting Organ-Specific Strategies: Basic concepts and novel advances, Brain-specific drug targeting strategies, Pulmonary drug delivery, Cell specific drug delivery. [8]

Text/Reference Books:

1. Pharmaceutical Chemistry by Christine M. Bladon. John Wiley & Sons, Ltd. (2002).
2. Burger's Medicinal Chemistry and Drug Discovery (5th edition) by Manfred E. Wolff. A Wiley & Sons, Inc. (2000).
3. Drug Targeting Organ-Specific Strategies by Grietje Molema and Dirk K. F. Meijer. Wiley-VCH. (2002).

BBT-082: Biomedical Instrumentation

L T P

Credit: 4

3 1 0

UNIT I:

Introduction to biomedical instrumentation, Basic transducer principles, Sources of bioelectric potentials, Electrodes. [8]

UNIT II:

The Cardiovascular system, Cardiovascular measurements, Patient care and monitoring, Measurements in the respiratory system. [8]

UNIT III:

Noninvasive diagnostic instrumentation, the nervous system, Instrumentation for sensory measurements and the study of behaviors, Biotelemetry. [8]

UNIT IV:

Instrumentation for the clinical laboratory, X-ray and radioisotope instrumentation. [8]

UNIT V:

The computer in biomedical instrumentation, Electrical safety of medical equipment. [8]

Text/Reference Books:

1. Biomedical Instrumentation and Measurement by Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer
2. Biomedical Instrumentation: Technology and Applications by Raghbir Singh
3. Medical Instrumentation for Health Care by Leslie Cromwell
4. Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation by Robert B. Northrop
5. Introduction to Bioinstrumentation: With Biological, Environmental, and Medical Application by Clifford D. Ferris.

BBT-083: Stem Cell Science

L T P

Credit: 4

3 1 0

UNIT I:

Stem Cell Basics: Unique properties of stem cells – embryonic stem cells - adult stem cells – umbilical cord stem cells – similarities and differences between embryonic and adult stem cells. Properties of stem cells – pluripotency – totipotency. [8]

UNIT II:

Embryonic Stemcells: *In vitro* fertilization –culturing of embryos-isolation of human embryonic stem cells – blastocyst – inner cell mass – growing ES cells in lab – laboratory tests to identify ES cells – stimulation ES cells for differentiation – properties of ES cells. [8]

UNIT III:

Adult Stem Cells: Somatic stem cells – test for identification of adult stem cells – adult stem cell differentiation – trans differentiation – plasticity – different types of adult stem cells. [8]

UNIT IV:

Stem Cell In Drug Discovery And Tissue Engineering: Target identification – Manipulating differentiation pathways – stem cell therapy Vs cell protection - stem cell in cellular assays for screening – stem cell based drug discovery, drug screening and toxicology. [8]

UNIT V:

Genetic Engineering And Therapeutic Application Of Stem Cells: Gene therapy – genetically engineered stem cells – stem cells and Animal cloning – transgenic animals and stem cells – Therapeutic applications – Parkinson disease - Neurological disorder – limb amputation – heart disease - spinal cord injuries – diabetes –burns - HLA typing- Alzheimer’s disease –tissue engineering application – production of complete organ - kidney – eyes - heart – brain. [8]

Text/Reference Books:

1. Embryonic Stem cells by Kursad and Turksen. 2002.Humana Press.
2. Stem cell and future of regenerative medicine. By committee on the Biological and Biomedical applications of Stem cell Research.2002.National Academic press

BBT-084: Genomics & Proteomics

L T P

Credit: 4

3 1 0

UNIT I:

Introduction: Structural organization of genome in Prokaryotes and Eukaryotes; Organelle DNA-mitochondrial, chloroplast; DNA sequencing-principles and translation to large scale projects; Recognition of coding and non-coding sequences and gene annotation; Tools for genome analysis-RFLP, DNA fingerprinting, RAPD, PCR, Linkage and Pedigree analysis-physical and genetic mapping.

UNIT II:

Genome sequencing projects: Microbes, plants and animals; Accessing and retrieving genome project information from web; Comparative genomics, Identification and classification using molecular markers-16S rRNA typing/sequencing, ESTs and SNPs.

UNIT III:

Proteomics: Protein analysis (includes measurement of concentration, amino-acid composition, N-terminal sequencing); 2-D electrophoresis of proteins; Microscale solution isoelectric focusing; Peptide fingerprinting; LC/MS-MS for identification of proteins and modified proteins; MALDI-TOF; SAGE and Differential display proteomics, Protein-protein interactions, Yeast two hybrid system.

UNIT IV:

Pharmacogenetics: High throughput screening in genome for drug discovery-identification of gene targets, Pharmacogenetics and drug development.

UNIT V:

Functional genomics and proteomics: Analysis of microarray data; Protein and peptide microarray-based technology; PCR-directed protein in situ arrays; Structural proteom

Text/Reference Books:

1. Introduction to Genomics . Arthur Lesk. Oxford University Press, 2008
2. Brown TA, Genomes, 3rd Edition, Garland Science, 2006.
3. Campbell AM & Heyer LJ, Discovering Genomics, Proteomics and
4. Bioinformatics, 2nd Edition, Benjamin Cummings, 2007.
- 5 Primrose S & Twyman R, Principles of Gene Manipulation and Genomics, 7th Edition, Blackwell, 2006.
6. Glick BR & Pasternak JJ, Molecular Biotechnology, 3rd Edition, ASM Press, 1998.

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BBT-085: Advanced Virology

L T P

Credit: 4

310

UNIT I:

Introduction: History and origin of viruses. General characteristics and structural components of virus: viral proteins, nucleic acids, lipids, carbohydrates and genome. **Viral Taxonomy:** Classification and nomenclature of different groups of viruses infecting microbes, plants and animals.

UNIT II:

Animal viruses: DNA virus transcription and replication, Positive-strand RNA virus replication, Negative-strand RNA virus replication, ds RNA viruses, Regulation of retrovirus replication.

UNIT III:

Bacteriophages: Replication and regulation, classification, lytic and lysogenic phages (lambda and P1 phage), regulation of transcription in lambda phage and applications of bacteriophages. Plant viruses. Insect viruses: Baculoviruses.

UNIT IV:

Oncogenic viruses: DNA and RNA tumor viruses. Oncogenes, protooncogenes and tumor suppressor genes. Molecular mechanisms of activation of proto-oncogenes. **Viral multiplication and replication strategies:** Attachment, penetration, uncoating, replication, assembly, maturation and release of virions. Replication strategies of viruses.

UNIT V:

Viral diseases: Prevention and control, antiviral compounds, interferons, structure based drug designing and screening for antivirals, mechanisms of action, replicons, vaccines, pseudoviruses, chimericviruses, antiviral libraries, antiretrovirals—mechanism of action, drug resistance. **Applications of Virology:** Uses of viral vectors: recombinant DNA technology, gene therapy and development of vaccines, viral nanoparticles, drug delivery, biological warfare

Text/Reference Books:

1. Fundamental Virology: Fields and Knipe, ed. Raven Press 19912. Strauss, E. G. and Strauss, 2. J. H., "Viruses and Human Disease", Academic Press 2002.
3. Matthews., "Plant Virology", Academic Press 1992.
4. Paul F. Torrence., (Editor), "Antiviral Drug Discovery for Emerging Diseases and Bioterrorism Threats", Wiley, John & Sons, Incorporated 2005.
5. Vaccines. Stanley A. Plotkin, Walter A. Orenstein. Elsevier Health Sciences. 2003.

BBT-086: Vaccine Technology & Immunoinformatics

L T P

Credit: 4

3 1 0

UNIT I:

Vaccines: Introduction to immunity, Fundamental concepts in vaccination and traditional methods of vaccine production (production of DPT and Rabies vaccine), Production of Modern Vaccines (production of Hepatitis vaccine). [8]

UNIT II:

Applications of immunological methods in diagnosis. [8]

UNIT III:

Reverse vaccinology and immunoinformatics . Databases in Immunology. [8]

UNIT IV:

B-cell epitope prediction methods

T-cell epitope prediction methods

Resources to study antibodies, antigen-antibody interactions. [8]

UNIT V:

Structure Activity Relationship – QSARs and QSPRs, QSAR Methodology, Various Descriptors used in QSARs: Electronics; Topology; Quantum Chemical based Descriptors. Use of Genetic Algorithms, Neural Networks and Principle Components Analysis in the QSAR equations. [8]

Text/Reference Books:

1: Kuby Immunology 4e by Richard A. Goldsby, Thomas J. Kindt and Barbara A. Osborne

2. Immunoinformatics: Predicting Immunogenicity in Silico By Darren R Flower

Publisher: Humana Press

3: Immunoinformatics (Immunomics Reviews:)By Shoba Ranganathan ,Vladimir Brusic, Christian Schonbach. Publisher: Springer

BBT- 801: Environmental Biotechnology

L T P

Credit: 4

3 1 0

UNIT I:

Environmental pollution: Land, water, air, and noise (introduction, sources, effects and measurements). Types of wastes, properties and steps involved in aerobic and anaerobic treatments of solid waste ,sewage and industrial effluents and their reuse.

UNIT II:

Biological waste treatments and biofuel production. Methanogenesis: methanogenic, acetogenic , and fermentative bacteria – anaerobic and aerobic digestion processes and conditions . Minimal national standards for waste disposal.

UNIT III:

Principles and design aspects of various waste treatments methods, with advanced bioreactor configuration : activated sludge process , trickling filter, fluidized expanded bed reactor , upflow anaerobic sludge blanket reactor , contact process , fixed / packed bed reactor , hybrid reactor , sequential batch reactor.

UNIT IV:

Kinetic models for biological waste treatment :bioconversion of agricultural and other highly organic waste materials into gainfully utilizable products – biogas, H₂, cellulases and food and feed stocks. Economical and social aspects of waste treatment.

UNIT V:

Bioremediation : land , water , industries , organic contaminants , heavy metals and nitrogenous wastes.

Text/Reference Books:

1. Ecology & Environment- P. D. Sharma, 8th ed.
2. Waste Water Engineering- Metcalf & Fuddy, 3rd ed.
3. Environmental Processes I-III, J. Winter, 2nd ed., Wiley Publications
4. Introduction to Waste Water Treatment- R. S. Ramalho, Academic Press.
5. Global Environmental Biotechnology, Wise, Elsevier Ex. Publishers
6. Environmental Biotechnology, B.C. Bhattacharya & Ritu Banerjee, Oxford Press, 2007.
7. Essentials of Ecology & Environmental Science, S.V.S. Rana, Prentic-Hall India, 2006.
8. Environmental Biotechnology & Cleaner Bioprocesses, Olguin, Ane/Rout Publishers.

BBT-851: Major Project

A group of students have to make a latest technology based project in their respective stream. It may be hardware or software based.

Convener

Signature:

Name : Dr. Ajay Kumar

Date :

Internal Members

Signature: 1.....

2.....

Name: Mr. Ajit Pratap Singh Yadav

Mr. Vachaspati Rao

Date:

External Members

Signature: 1.....

2.....

Name: Prof. (Dr.).

Dr.

Date: