For Batches 2015 & Onwards

Academic Autonomous Status vide letter No. F22-1/2014 (AC)

BEANT COLLEGE OF ENGINEERING & TECHNOLOGY, GURDASPUR

Scheme & Syllabus of
B. Tech. Biotechnology
[BT]

By

Department of Academics

BEANT COLLEGE OF ENGINEERING & TECHNOLOGY
GURDASPUR

Batch 2015 onwards

For Batches 2015 & Onwards
Academic Autonomous Status vide letter No. F22-1/2014 (AC)

Beant College of Engineering & Technology, Gurdaspur
Department of Bio Technology

Scheme of Syllabi
3rd semester

Contact Hours:30

Course code	Course name	Load allocation			Marks distribution		Total marks	Credits
		L	T	P	Internal	External		
BTBT 301*	Engineering Mathematics-I	4	1	-	40	60	100	5
BTBT 302	Foundations of Biotechnology	4	-	-	40	60	100	4
BTBT 303	Microbiology	4	-	-	40	60	100	4
BTBT 304	Biochemistry	3	1	-	40	60	100	4
BTBT 305	Transport Phenomena	4	1	-	40	60	100	5
BTBT 306	Biotech Lab-I (Microbiology and Biotechnology Lab)	-	-	4	30	20	50	2
BTBT 307	Biotech Lab-II (Biochemistry Lab)	-	-	4	30	20	50	2
BTBT 308	** Institutional Practical Training				60	40	100	1
Total		19	3	8	320	380	700	27

Minimum Subjects: 08 Maximum Subjects: 08
* This subject shall be taught by faculty of Mathematics Department.
** Institutional Practical Training (during summer vacations for 4 weeks) after second semester.

For Batches 2015 & Onwards

Academic Autonomous Status vide letter No. F22-1/2014 (AC)

Beant College of Engineering & Technology, Gurdaspur
Department of Bio Technology

Scheme of Syllabi

4th semester

Contact Hours: 30

Course code	Course name	Load allocation			Marks distribution		Total marks	Credits
		L	T	P	Internal	External		
BTBT 401	Biostatistics*	4	1	-	40	60	100	5
BTBT 402	Industrial Microbiology	3	-	-	40	60	100	3
BTBT 403	Immunology & Immunotechnology	4	-	-	40	60	100	4
BTBT 404	Cell and Molecular Biology	3	-	-	40	60	100	3
BTBT 405	Intellectual Property rights: Bioethics and Biosafety	3	-	-	40	60	100	3
BTBT 406	Biotech Lab-III (Industrial Microbiology Lab)	-	-	4	30	20	50	2
BTBT 407	Biotech Lab-IV (Immunology Lab)	-	-	4	30	20	50	2
BTBT 408	Biotech Lab-V (Cell and Molecular Biology Lab)	-	-	4	30	20	50	2
BTGF 400	General Fitness				100	-	100	1
Total		17	1	12	390	360	750	25

Minimum Subjects: 08 Maximum Subjects: 08

* This subject shall be taught by faculty of Mathematics Department.

For Batches 2015 & Onwards

Academic Autonomous Status vide letter No. F22-1/2014 (AC)

Beant College of Engineering & Technology, Gurdaspur

Department of Bio Technology

Scheme of Syllabi

5th semester

Contact Hours: 30

Course code	Course name	Load allocation			Marks distribution		Total marks	Credits
		L	T	P	Internal	External		
BTBT 501	Chemical Engineering Principles	3	1	-	40	60	100	4
BTBT 502	Bioinformatics	3	-	-	40	60	100	3
BTBT 503	Genetic Engineering	3	-	-	40	60	100	3
BTBT 504	Animal Cell Culture and Biotechnology	3	-	-	40	60	100	3
BTBT XXX*	DE-I	3	-	-	40	60	100	3
BTBT XXX*	OE-I	3	-	-	40	60	100	3
BTBT 505	Biotech Lab-VI (Genetic Engineering lab)	-	-	4	30	20	50	2
BTBT 506	Biotech Lab-VII (Animal Cell Culture Lab)	-	-	3	30	20	50	2
BTBT 507	Biotech Lab-VIII (Bioinformatics Lab)	-	-	4	30	20	50	2
BTBT 508	*** Industrial\Institutional Training				60	40	100	1
Total		18	1	11	390	460	850	26

Minimum Subjects : 10 Maximum Subjects : 10
*** There should be Industrial\ Institutional training of six weeks duration in summer vacation after fourth semester.
* These are Departmental and Open electives to be chosen by the student, whose codes are provided.

Beant College of Engineering & Technology, Gurdaspur
Department of Bio Technology

Scheme of Syllabi
6th Semester

Contact Hours: 30

Course code	Course name	Load allocation			Marks distribution		Total marks	Credits
		L	T	P	Internal	External		
BTBT 601	Fundamentals of Biochemical Engineering	3	1	-	40	60	100	4
BTBT 602	Plant Biotechnology	4	-	-	40	60	100	4
BTBT 603	Bioanalytical Techniques	3	-	-	40	60	100	3
BTBT 604	Food Process Technology	3	-	-	40	60	100	3
BTBT XXX*	OE-II	3	-	-	40	60	100	3
BTBT 605	Biotech Lab-IX (Plant Biotechnology Lab)	-	--	3	30	20	50	2
BTBT 606	Biotech Lab-X (Bioanalytical Techniques Lab)	-	-	4	30	20	50	2
BTBT 607	Biotech Lab-XI (Bioprocess Engineering Lab)	-	-	4	30	20	50	2
BTBT 608	Minor Project	-	-	2	30	20	50	1
BTGF 600	General Fitness				100	-	100	1
Total		16	1	13	420	380	800	25

Minimum Subjects: 10 Maximum Subjects: 10
* These are Open electives to be chosen by the student, whose codes are provided.

Scheme of Syllabi
7th / 8th Semester

Contact Hours: 30

Course code	Course name	Load allocation			Marks distribution		Total marks	Credits
		L	T	P	Internal	External		
BTBT 701	Enzymology and Enzyme Technology	3	1	-	40	60	100	4
BTBT 702	Downstream Processing	3	-	-	40	60	100	3
BTBT 703	Genomics and Proteomics	3	-	-	40	60	100	3
BTBT XXX	DE-II*	3	-	-	40	60	100	3
BTBT XXX	DE-III*	3	-	-	40	60	100	3
BTBT 704	Biotech Lab-XII (Enzymology and enzyme Technology Lab)	-	-	4	30	20	50	2
BTBT 705	Biotech Lab-XIII (Genomics and Proteomics)	-	-	3	30	20	50	2
BTBT 706	Biotech Lab-XIV (Downstream Processing Lab)	-	-	4	30	20	50	2
BTBT 707	Major Project	-	-	3	30	20	50	2
BTGF 800	General Fitness				100	-	100	1
Total		15	1	14	420	380	800	25

Minimum Subjects: 10 Maximum Subjects: 10
* These are Departmental electives to be chosen by the student, whose codes are provided.

Scheme of Syllabi
7th /8th Semester

Course code	Course name	Load allocation	Marks distribution		Total marks	Credits
			Internal	External		
BTBT 801	Industrial Training (one semester)	30hrs\ week	400	400	800	24

Minimum Subjects: 01 ***Maximum Subjects: 01***

Beant College of Engineering & Technology, Gurdaspur
Department of Bio Technology

Scheme of Syllabi
Departmental Elective I (5th Semester)

Course Code	Course Name	Load Distribution			Credits
		L	T	P	
BTBT 901	Stem cell Technology	3	-	-	3
BTBT 902	Advances in Drug Design and Pharmacogenomics	3	-	-	3
BTBT 903	Biological Waste Treatment	3	-	-	3

Departmental Elective-II (6th semester)

Course Code	Course Name	Load Distribution			Credits
		L	T	P	
BTBT 931	Protein Engineering	3	-	-	3
BTBT 932	Molecular Farming	3	-	-	3
BTBT 933	Environmental Biotechnology	3	-	-	3

Departmental Elective III (7th/8th semester)

Course Code	Course Name	Load Distribution			Credits
		L	T	P	
BTBT 934	Pharmaceutical Biotechnology	3	-	-	3
BTBT 935	Agricultural Biotechnology	3	-	-	3
BTBT 936	Computational Biology	3	-	-	3

Beant College of Engineering & Technology, Gurdaspur
Department of Bio Technology

Scheme of Syllabi

List of Open Electives (5th semester)

Course Code	Course Name	Load Distribution			Credits
		L	T	P	
BTBT 951	Industrial Waste Management	3	-	-	3
BTBT 952	Bioinformatics	3	-	-	3

List of Open Electives (6th semester)

Course Code	Course Name	Load Distribution			Credits
		L	T	P	
BTBT 961	Biomedical Instrumentation	3	-	-	3
BTBT 962	Human Disease and Control	3	-	-	3

Beant College of Engineering & Technology, Gurdaspur
Department of Bio Technology

Third Semester

BTBT 301 Mathematics-I

L	T	P
4	1	0

Internal Marks: 40
External Marks: 60
Total Marks: 100

Objective/s and Expected outcome

"Math and basic science are certainly the foundations of any engineering program. This fact will not change in the foreseeable future" said by Ellis et al. Engineering Mathematics is an essential tool for describing and analyzing engineering processes and systems. Mathematics also enables precise representation and communication of knowledge. Core mathematics courses have broader objectives than just supporting engineering programs. The learning objectives of core mathematics courses can be put into three categories: (1) Content Objectives: Students should learn fundamental mathematical concepts and how to apply them. (2) Skill Objectives: Students should learn critical thinking, modeling/problem solving and effective uses of technology. (3) Communication Objectives: Students should learn how to read mathematics and use it to communicate knowledge. The students are expected to understand the fundamentals of the mathematics to apply while designing technology and creating innovations.

1. **Differential Calculus:**
Curve tracing: Tracing of Standard Cartesian; Parametric and Polar curves (Astroids, Cycloids, Folium Tubes Cardiods, Lemniscate, Helix); Curvature of Cartesian, Parametric and Polar curves. (6)

2. Integral Calculus:
Rectification of standard curves; Areas bounded by standard curves, Applications of integral calculus to find centre of gravity and moment of inertia. (6)

3. Partial Derivatives:
Function of two or more variables; Partial differentiation; Homogeneous functions and Euler's theorem; Composite functions; Total derivative; Derivative of an implicit function; Change of variable; Jacobians (6)

4. Applications of Partial Differentiation:
Tangent and normal to a surface; Taylor's and Maclaurin's series for a function of two variables; Errors and approximations; Maxima and minima of function of several variables; Lagrange's method of undetermined multipliers (6)

5. Multiple Integrals:
Double and triple integral and their evaluation, change of order of integration, change of variable, Application of double and triple integration to find areas and volumes. (6)

6. Vector Calculus:
Scalar and vector fields, differentiation of vectors, velocity and acceleration. Vector differential operators: Del, Gradient, Divergence and Curl, their physical interpretations. Formulae involving Del applied to point functions and their products. Line, surface and volume integrals. (8)

7. Application of Vector Calculus:
Flux, Solenoidal and Irrotational vectors. Gauss Divergence theorem. Green‟s theorem in plane, Stoke‟s theorem (without proofs) and their applications. (4)

Suggested Readings / Books

1.Thomes, G.B, Finney, R.L. Calculus and Analytic Gemetry, Ninth Edition,Peason Education.
2.Kreyszig, E., Advanced Engineering Mathematics, Eighth edition, John wiley.
3.Jain, R.K and Lyengar, S.R.K., Advanced Engineering Mathematics, Narosa Publishing Company.
4.Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers,New Delhi.
5. B. V. Ramana, Higher Engineering mathematics,Tata Mcgraw Hills, New Delhi.

BTBT 302 Foundations of Biotechnology

L T P
4 0 0

Internal Marks: 40
External Marks: 60
Total Marks: 100

Objective: This course is focused on the basics of Biotechnology and its applications. This provides a brief preview of the scope of the field of Biotechnology.

Unit I: Introduction to Biotechnology, Historical Perspectives Modern and Old Biotechnology, Biotechnology an interdisciplinary Pursuit, Scope & Future of Biotechnology. (5)

Unit II: Introduction to basic unit of life i.e. cell structure of prokaryotic and eukaryotic cell in detail, cell division; Structure of chromosome and DNA; Basic Techniques used in biotechnology Principles and applications of centrifugation, electrophoresis, chromatography, sterilization (7)

Unit III: Application of biotechnology in medicine antibiotics, vaccines, monoclonal antibodies, gene therapy, bio pharmaceuticals. (6)

Unit IV: Application of Biotechnology in Environment- waste water and sewage treatment, bio fuels, Bioremediation with special reference to metals, oil spills, pesticides. (5)

Unit V: Application of Biotechnology in Food and beverage fermentations, plant and animal biotechnology, Biological control, Bio fertilizers. (6)

Unit VI: Enzyme technology - nature of enzymes, application of enzymes, genetic Engineering and Protein engineering of enzymes, Technology of enzymes production. (6)

Unit VII: Safety in Biotechnology- Problem of Organism Pathogenicity, Problem of Biologically Active Biotechnology Products, and Release of GMO's in the Environment (6)

Suggested Reading and Books:

1. Biotechnology by J.E Smith 3 rd Ed (1996), Published by Cambridge University Press.
2. Biotechnology by H.K. Das, 4 th edition 2010 Tata Mc Graw Hill
3. Biophysical Chemistry Upadhayay, Upadhayay and Nath 4 th edition 2007 Himalaya Publishing House
4. Molecular-Biotechnology by Glick & Pasternak 2 nd Edition ASM Press Washington DC
5. Text book of Biotechnology H.D. Kumar, 2 nd Edition

BTBT 303 Microbiology

L T P
4 0 0

Internal Marks: 40
External Marks: 60
Total Marks: 100

Objective: The course imparts the knowledge of different types of microorganisms that are invisible to our naked eyes. Discovery origin and evaluation of different forms of bacteria, fungi, protozoa and viruses constitute the basics of biotechnology.

Unit –I
Prokaryotic Cell Organization: General account of cell size, arrangement, shape, capsule, slime, pili, spores, structure and function of gram negative & gram-positive cell wall and membrane, periplasmic space. Brief account of viruses, mycoplasma and fungi. (5)

Unit –II
Bacteriological Techniques: Pure culture techniques, isolation, cultivation, maintenance and preservation of pure cultures and sterilization techniques. (5)

Unit –III
Bacterial Nutrition & Growth: Physical growth requirements viz. temperature, pH, oxygen concentration, water activity, light, pressure. Chemical growth requirements viz. nutrients, nutrient uptake in bacteria: Passive and facilitated diffusion, active transport. Growth curve, growth rate and generation time. Growth kinetics, mathematical nature and expression of growth, measurement of growth by quantitating cell mass, cell number and a cell constituent, concept of geometric & arithmetic nature of growth, asynchronous and synchronous cultures, diauxic growth. (7)

Unit –IV
Bacterial Reproduction: Asexual reproduction, DNA replication in bacterial cell, general principles of bacterial recombination - transformation, transduction and conjugation. (6)

Unit –V
Medical Microbiology: Characteristics of major pathogens (*Mycobacterium tuberculosis,* Plasmodium sp., etc) their modes of transmission, mechanisms of infection and growth. (6)

Unit –VI
Isolation of industrially important microbial strains, strain improvement, maintenance and preservation of industrial microbes. (5)

Unit –VII
Agricultural & Environmental Microbial Biotechnology: Basic understanding and large-scale production of microbial inoculants for agriculture, mycorrhiza, microbial insecticides; treatment of urban (sewage) and industrial effluents. (6)

Suggested Reading and Books:

1. Microbiology VI Edition, M.J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill Microbiology by Prescott.
2. Brock Biology of Microorganisms (12th Ed.) by Madigan MT, Martinko JM and Parker J, Pearson/Benjamin Cummings, 2009. Microbiology: An Introduction (9th Ed.) by Tortora GJ, Funke BR, and Case CL, Pearson Education, 2008. Prescott, Harley and Klein's Microbiology (7th Ed.) by Willey JM, Sherwood LM, and Woolverton CJ, McGraw Hill Higher Education, 2008.
3. Principles of Fermentation Technology (2nd Ed.) by Stanbury PF, Whitaker A and Hall SJ,

Elsevier Science Ltd, 2006.
4. Modern Industrial Microbiology & Biotechnology by N. Okafer, Scientific Publishers, Enfield, USA, 2007.
5. Environmental Microbiology (2nd Ed.) by R. Mitchel, Wiley-Blackwell, 2009.
6. Microbial Physiology (3rd Ed.) by Albert G. Moat and John W. Foster, John Wiley and Sons, 20 02.
7. Microbial Biotechnology: Fundamentals of Applied Microbiology by Glazer & Nikaido, W.H. Freeman and Co., New York, 1995.
8. Biotechnology - Applying the Genetic Revolution by Clark DP and Pazdernik NJ. Academic Press, USA, 2009.
9. Molecular Biotechnology (3rd Ed.) by Glick BR and Pasternak JJ, ASM Press, Washington D.C., 2003.

BTBT 304 Biochemistry

L T P
3 1 0

Internal Marks: 40
External Marks: 60
Total Marks: 100

Objective: The course aims on understanding of the relationships between structure and function in the major classes of biopolymers. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways. The theoretical background of biochemical systems helps to interpret the results of laboratory experiments.

Unit I
Biomolecules: Chemistry and Properties of Amino Acids, Proteins, Carbohydrates, Lipids, Purines, Pyrimidines and Vitamins. Chemical Bonds: Covalent Bonds, Ionic Bonds, Co- Ordinate Bonds, Hydrogen Bonds, Vander Waal Forces, Hydrophobic Interactions, Diode Interactions. (5)
Unit II
Proteins: Primary, Secondary, Tertiary and Quaternary Structure, Proteins Analysis, Methods for Isolation and Purification of Proteins. (6)
Unit III
Fat Metabolism: Oxidation of fatty acids, synthesis of fatty acids (fatty acid synthesis complex system), ketone bodies. Carbohydrates Metabolism: Glycolysis, glycogenolysis, glycogenesis and their regulations, citric acid cycle. (7)
Unit IV
Amino acid Metabolism: Oxidative degradation and synthesis of amino acids, estimation of amino acids. Nucleic Acid Metabolism: Biosynthesis of purines and pyrimidines, their regulation and catabolism (6)
Unit V
Mitochondria: Structure of mitochondria, organization of respiratory chain, oxidative phosphorylation and its inhibitors (6)
Unit VI
Plant & Microbial Biochemistry: Photosynthesis, differences in respiratory mechanisms and anaerobes. (4)
Unit VII
N_2- Fixation: Role of Various Enzymes in Nitrogen Cycle. (3)

Suggested Reading and Books:

1. A.L. Lehninger: Principles of Biochemistry, Worth Publishers, New York (2007)
2. L. Stryer: Biochemistry, W.H. Freeman and Company, New York (2006)
3. B.D. Hames et al: Instant Notes in Biochemistry, BIOS Sci. Pub. Ltd. U.K. (2001)
4. G. Zubay: Biochemistry, W.C. Brown Publishers, Oxford, England (2002).

BTBT 305 Transport Phenomena

L T P
4 1 0

Internal Marks: 40
External Marks: 60
Total Marks: 100

Objective: To impart knowledge of momentum, heat and mass transfer in chemical engineering system and their analogous behavior.

Unit–I
Molecular Transport Phenomena: Molecular transport of momentum, heat and mass, laws of molecular transport: Newton's law of viscosity, Fourier's law of conduction and Fick's law of diffusion. Transport coefficients – viscosity, thermal conductivity and mass diffusivity and their analogous behaviour. Estimation of transport coefficients and temperature/pressure dependence. (8)
Unit –II
Non-Newtonian Fluids: Time Dependent, Time Dependent and Visco-elastic fluids, Consecutive Equations and Rheological Characteristics. (5)
Unit –III
Equations of Change under Laminar Flow Conditions: Equation of Continuity, Motion, Mechanical Energy, Energy and Mass Transport. Simple Shell Balance Method for Momentum, Heat and Mass Transport, Velocity Distribution in Circular Conduits and Parallel Plates. Generalized form of Equations and Simplifications. (8)
Unit –IV
Turbulence Phenomena: Basic Theory of Turbulence, Time Averaging, Intensity and Correlation Coefficients, Isotropic Turbulence. Equation of continuity, motion and energy for turbulent condition. Reynolds stresses. Phenomenological theories of turbulence, velocity profile in circular conduits. (9)
Unit –V
Diffusion Phenomena: Diffusion of gases and liquids in porous solids, Knudsen diffusion, multicomponent diffusion and effective diffusivity. (6)
Unit –VI
Methods of Analysis of Transport Problems: General integral balance using macroscopic concepts, integral balance for mass, momentum and energy. (7)
Unit –VII
Convective Transport: Free and forced convective heat and mass transfer, interphase mass transport, mass transfer coefficients – individual and overall, mass transfer theories-film, penetration and surface renewal. (7)
Suggested Reading and Books:
1."Transport Phenomena", 2 nd Edition by Bird R.B., Stewart W.E. and Lightfoot E.N., John Wiley and Sons (2002).
2. "Transport Processes and Separation Process Principles", 4 th Edition, by Geankoplis C.J., Prentice-Hallof India. (2004).
3. Basic Concepts In Transport Phenomena, A Unified Approach". Vol.-I by Brodkey, R.S., Hershey H.C.,Brodkey Publishing (2003).

BTBT 306 Biotech Lab –I
(Microbiology and Biotechnology Lab)

L T P
0 0 4

Internal Marks: 30
External Marks: 20
Total Marks: 50

1. Microscopic Examination of Microorganisms :- Staining methods:
   - Simple staining of bacteria
   - Gram staining of bacteria
   - Endospore Staining
   - Capsule staining
2. Measurement of cell concentration of bacteria by counting chamber/Haemocytometer.
3. Preparation and Sterilization of Culture Media :
   - Preparation of basic liquid media (broth) for the routine cultivation of bacteria
   - Preparation of basic solid media, agar slants and agar deeps for the routine cultivation of bacteria
   - Preparation of selective and differential media
4. Isolation and Maintenance of Microorganisms :
   - Pour plate method
   - Spread plate method
   - Streak plate method
   - Sub culturing techniques
   - Preparation of glycerol stock

Suggested Reading and Books:
Experiments in Microbiology Plant Pathology and Biotechnolgy by K.R. Aneja
Laboratory Manual In Microbiology By P. Gunasekaran

BTBT 307 Biotech Lab –II
(Biochemistry Lab)

L T P
0 0 4

Internal Marks: 30
External Marks: 20
Total Marks: 50

1. Qualitative test for carbohydrates, proteins, amino acids and lipids
2. To test salivary amylase activity.
3. Quantitative estimation of proteins by lowery method or Bradford method.
4. Estimation of carbohydrates by anthrone method.
5. Estimation of amino acid by ninhydrin method.
6. Determination of saponification value and Iodine number of fats.
7. Titration curve for amino acids and determination of pK value.
8. Preparation of standard buffers & determination of pH.
9. Separation of amino acids & sugars using paper & thin layer chromatography

Beant College of Engineering & Technology, Gurdaspur
Department of Bio Technology

Fourth Semester

BTBT 401 Biostatistics

L T P
4 1 0

Internal Marks: 40
External Marks: 60
Total Marks: 100

Objective/s and Expected Outcome: The course provides students a firm foundation in statistical methods

Unit – I
Introduction: types of biological data (data on ratio scale, interval scale, ordinal scale, nominal scale, continuous and discrete data), frequency distribution and graphical representations (bar graph, histogram and frequency polygon), cumulative frequency distribution, populations, samples, random sampling, parameters and statistics (8)

Unit – II
Measures of central tendency and dispersion: Arithmetic mean, geometric mean, harmonic mean, median, quantiles, mode, range, variance, standard deviation, moments, coefficient of variation, Shannon-Weaver index (8)

Unit – III
Probability: Permutations and Combinations, Probability of an event, addition and multiplication of probabilities. (7)

Unit – IV
Distributions: Normal distribution, skewness and kurtosis, binomial distribution, Poisson distribution. (7)

Unit – V
Statistical hypothesis testing: Statistical testing, errors, one-tailed and two-tailed testing, t-test, Fisher exact test, chi square test, two sample hypothesis (testing difference between two means), Non parametric tests (Mann-Whitney test) (7)

Unit – VI
Paired sample hypothesis (testing mean difference), Wilcoxon paired sample test, single factor ANOVA, Kruskal-Wallis test, Tukey test, Newman-Keuls test, two factor ANOVA. (7)

Unit – VII
Correlation and Regression: Linear regression, correlation and Pearson coefficient of correlation, rank correlation and Spearman rank correlation coefficient. (6)

BOOKS RECOMMENDED:

1. Zar, JH, Biostatistical Analysis, Pearson-Prentice Hall (2007).
2. Rao K Visweswara, Biostatistics: A Manual of Statistical Methods for Use in Health, Nutrition & Anthropology, Jaypee Brothers Publishers (2007)
3. Pagano, M. and Gauvreau, K., Principles of Biostatistics, Thomson Learning (2005)
4. Mahajan BK, Methods in Biostatistics, Jaypee Brothers Publishers (2002)

BTBT 402 Industrial Microbiology

L T P
3 0 0

Internal Marks: 40
External Marks: 60
Total Marks: 100

Objective/s and Expected Outcome: The course is designed to develop the student's ability to apply the techniques used in the different phases of industrial microbiology: discovery, production (including fermentation and scale-up), bioprocessing and cell banking. It includes the principles and practices in the main applications of micro-organisms to the industrial production of foods, pure chemicals, proteins and other useful products, including the use of genetically modified organisms. This course aims to enable graduates to enter industry with an appropriate level of understanding of the need for both the science and business aspects to be achievable to make a viable product.

Unit-I
Introduction: aim and scope. Industrially important microbes, Strategies involved in the isolation of desired microbes from the environment. (3)
Unit-II
Fermentation Processes: Batch, fed-batch and continuous fermentations; solid state and submerged fermentations. Feed-stocks for industrial fermentation: Molasses, corn steep liquor, whey, malt, yeast extract and antifoams. (5)
Unit-III
Microbial Enzymes: desirable attributes of industrial grade enzymes like lipase, protease, cellulase, amylase; Immobilization of enzymes. (5)
Unit-IV
Biofuels: Criterion for selection of raw material: ethanol, biogas, biohydrogen and biodiesel. (4)
Unit-V
Health Care Products: Natural sources and underlying principles for the production of Antibiotics, vaccines, vitamins, amino acids, alkaloids, steroids. (4)
Unit-VI
Food and Beverages: Alcoholic Production: fermentative production of beer, whisky, wine, Bread; Dairy products: cheese, probiotics, yoghurt. SCP production, mass culture of Spirulina, Technology of mushroom production, uses , economic parameters and constraints. (5)
Unit-VII
Use of microbes in biodegradation of pollutants, Introduction, production and biochemical attributes of Bioplastics. Biosensors: role of various biomolecules their sources and applications. Production and applications of biofertilizers and bioinsecticides. (4)

Suggested Reading and Books:
1. Industrial Microbiology by Casida LE,1st Ed. Wiley Eastern Ltd., 2005
2.Industrial Microbiology: Michael J Waites, Neil L Morgan, Rockey & Higton.
3.Alcamo's Microbiology: J C Pommerville. 2010. Jones and Bartlett, USA
4.Microbiology: Prescott, Harley and Kleins. 2008. McGraw Hill, USA.

BTBT 403 Immunology and Immunotechnology

L T P
4 0 0

Internal Marks: 40
External Marks: 60
Total Marks: 100

Objective: The objective of this course is to provide students with a comprehensive overview of the immune system and its function as well as to introduce students to clinical situations in which the immune system plays an essential role. At the end of this course, students should be able to synthesize key concepts in immunology, understand the way in which different components of the immune system interact in a coordinated manner to fight infection and discuss the way the immune system reacts to various kinds of infectious agents.

Unit I

Introduction: Introduction to Immunology, Aims and Scope; Organization of the immune system, Structure and Functions of important immune cells & Immune organs, GALT, innate and acquired immunity, active and passive immunity. (6)

Unit II:

Antigens and Antibodies: Characteristics of an antigen, haptens, epitopes, adjuvants. Structure, types, properties and functions of antibodies; VDJ rearrangements. (5)

Unit III:

Immune Effector Mechanisms : Organization of MHC locus (mice & human); Structure and functions of MHC I and II molecules, Cytokines; Complement system; Leukocyte migration and inflammation. (5)

Unit IV:

Generation of Immune response : T-cell receptor, B-cell receptor, Antigen processing and presentation. Primary and Secondary Immune response; Generation of Humoral Immune Response; Generation of cell mediated Immune response; Killing mechanisms by CTL and NK cells. (8)

Unit V:

Immunotechnology: Antigen-antibody reactions, Immunodiffusion, Immunoelectrophoresis, ELISA, ELISPOT, , Immunofluorescence, Vaccines (conventional and recombinant: subunit vaccines, conjugate vaccines, Synthetic vaccines). (5)

Unit VI:

Applied Immunology: Immune system in health and disease, autoimmunity, hypersensitivity, tumor immunity, tissue and organ transplant, Immuno-toxins. (7)

Unit VII:

Hybridoma technology: Fusion of myeloma cells with lymphocytes, production of monoclonal antibodies and their application, chimeric antibodies. (4)

Suggested Reading and Books:

1.Immunology (6 th Ed.) by Thomas J. Kindt, Richard A. Goldsby, Barbara Anne Osborne, W.H. Freeman and Company,New York (2007)
2.Roitt's Essential Immunology (11 th Ed.) by Delves P, Martin S, Burton D, Roitt IM. Wiley-Blackwell Scientific Publication, Oxford (2006)
3.Immunology (6 th Ed) by Richard C, Geiffrey S. Wiley- Blackwell Scientific Publication, Oxford (2009)
4. Cellular and Molecular Immunology (6 th Ed.) by Abul K. Abbas, Andrew H. Lichtman, Shiv Pillai. Saunders Publication, Philadelphia, (2007)
5. Janeway's Immunobiology (7 Ed.) by Murphy K, Travers P, Walport M. Garland Science Publishers, New York, (2008).

BTBT 404 Cell and Molecular Biology

L T P
3 0 0

Internal Marks: 40
External Marks: 60
Total Marks: 100

Objective: Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles. Students will understand how these cellular components are used to generate and utilize energy in cells. Students will understand the cellular components underlying mitotic cell division. Students will apply their knowledge of cell biology to selected examples of changes orlosses in cell function. These can include responses to environmental or physiological changes, or alterations of cell function brought about by mutation.

Unit–I
Cell: Structural & functional unit of life, prokaryotic & eukaryotic. Cell organelles – structure & functions, Cytoskeleton & ECM. (5)

Unit–II
Cell Division: Binary fission, Mitosis & Meiosis, cell cycle & its regulation. (4)

Unit–III
Genetic Material: Architecture of Prokaryotic & Eukaryotic chromosome, Structure and functional properties (Chargaff's rules, sequence complementarity and other properties). (3)

Unit–IV
DNA replication–Phages, bacteria and eukaryotic systems: initiation, elongation & termination, replication errors & proof reading; DNA damage & repair systems, various models of recombination. (5)

Unit–V
Transcription: RNA polymerases & other proteins involved in initiation elongation & termination. Differences between prokaryotic & eukaryotic promoters, cis-regulatory sequence, enhancers/silencers. Cognate transcription factors; RNA processing : capping, tailing, splicing, RNA editing; Operon models & their regulation: the lac operon , The Trp – operon. (6)

Unit–VI
Translation: Genetic Code & Its important attributes, structure and functions of ribosomes, tRNA & mRNAs.; Prokaryotc & eukaryotic inititation, elongation & termination of transtation ; Post translational modifications: enzymatic cleavage, acetylation, phosphorytation, methylation, ubiquitization, function of signal peptide and transport. (4)

Unit–VII
Introduction to stem cells & cellular differentiation; RNA interference, epigenetic regulation of genes (DNA methylation & histone modifications), tumour suppressor genes & apoptosis, oncogenes & cancer. (3)

Suggested Reading and Books:
1.Cell and Molecular Biology, Sixth Edition, Gerald Karp.
2.Molecular cell biology, Fifth Edition, Lodish.
3.Molecular Biology of the Cell, Fifth Edition, Bruce Alberts, Alexander Johnson, Julian Lewis,
4.Martin Raff, Keith Roberts, Peter Walter, December 2007
5.James Watson, Molecular Biology of the Gene, Pearson, 6th Edition, 2008.

BTBT 405 Intellectual Property Rights, Bioethics & Biosafety

L T P
3 0 0

Internal Marks: 40
External Marks: 60
Total Marks: 100

Objective: Understand IP laws that directly affect the creation, transfer, and licensing of IP with specific reference to patenting issues in biotechnology and pharmaceuticals fields and International Agreements pertaining to IP protection and relate them to the current issues.

Unit–I
Introduction: General introduction, Patent claims, the legal decision-making process. Ownership of tangible and intellectual property (3)

Unit–II
Basic Requirement of Patentability: Patentable subject matter, novelty and public domain, non obviousness (3)

Unit–III
Special issue in Biotechnological Patents: Disclosure requirements, collaborative research, competitive research, plant biotechnology, foreign patents. (3)

Unit–IV
Patent Litigation: Substantive aspects of patent litigation, procedural aspects of patent litigation, recent developments in patent system and patentability of biotechnology invention. IPR issues in the Indian context current patent laws. (5)

Unit–V Public acceptance issue for Biotech, case studies/ experience from developing and developed countries. Biotechnology and hunger. Challenges for the Indian, biotechnological research and industries. (4)

Unit–VI
The Cartagena protocol on biosafety. (2)

Unit–VII
Biosafety Management: Key to the environmentally responsible use of biotechnology, ethical implications of biotechnological products and techniques (4)

Suggested Reading and Books:

1.Sign KC : Intellectual Property Rights on Biotechnology , BCIL, New Delhi
2.BAREACT, Indian Patent ACT 1970 Acts & Rules, Universal Law Publishing Co.Pvt Ltd., 2007.
3.Biotechnology and IPR by Dr. T. Ramakrishna, NLSIU, Bangalore.
4.Intellectual Property by Bently, Lionel, Oxford University Press, 2001.
5.T. M Murray and M.J. Mehlman,Encyclopedia of Ethical, Legal and Policy issues in
6.Biotechnology, John Wiley & Sons 2000.
7.Intellectual Property Rights in the WTO and developing country by Watal Jayashree, Oxford University Press, 2001.

BTBT 406 Biotech Lab –III
(Industrial Microbiology Lab)

L T P
0 0 4

Internal Marks: 30
External Marks: 20
Total Marks: 50

1. Isolation of cellulose/protease/lipase producing bacteria and fungi from soil
2. Purification and partial characterization of the desired microbes.
3. Quantification of the enzyme activity.
4. Preservation of the microbial culture.
5. Cell lysis techniques.
6. Batch culture fermentation-shake flask.
7. Solid state fermentation
8. Techniques used in Enzyme immobilization.

BTBT 407 Biotech Lab –IV
(Immunology Lab)

L T P

Internal Marks: 30
External Marks: 20
Total Marks: 50

0 0 4

1. Immunodiffusion (Ouchterlony)
2. Immunoelectrophoresis
3. Quantitative precipitation assay
4. Latex Agglutination test
5. Dot- ELISA
6. Hapten conjugation and quantization
7. To perform Plate ELISA
8. Western Blotting
9. RBCs, WBCs count, Hb estimation, Blood group determination.

BTBT 408 Biotech Lab –V
(Cell & Molecular Biology Lab)

L T P
0 0 4

Internal Marks: 30
External Marks: 20
Total Marks: 50

1. Microscopic study of shape and size of bacterial, fungal and plant cells.
2. Microscopic study of dividing cells in different phases of mitosis.
3. To study the cell membrane properties.
4. Genomic DNA isolation of E coli.
5. Qualitative and quantitative analysis of DNA by spectrophotometry.
6. Isolation and quantification of RNA from bacterial cells.
7. Isolation and quantification of total proteins of the cells.
8. Isolation and quantification of carbohydrates and lipids from different biological sources.
9. Demonstration of inducible expression of genes in bacteria.