SYLLABUS FOR
BACHELOR OF SCIENCE IN BIOTECHNOLOGY (HONOURS)
UNDER CHOICE BASED CREDIT SYSTEM

ACADEMIC SESSION
w.e.f. 2020-2023

FOR

ALL CONSTITUENT/AFFILIATED COLLEGES UNDER

BINOD BIHARI MAHTO KOYALANCHAL UNIVERSITY, DHANBAD

Members of Board of studies of CBCS under Graduate Syllabus as per Guide lines of the Binod Bihari Mahto Koyalanchal University, Dhanbad

01	**Chairman**	Dr. S. K. SINHA	Associate Professor, Head, University Department Of Zoology, BBMKU, Dhanbad.
02	**External Expert Members**	Dr. H. P. SHARMA	Professor , Pro vice chancellor, SKMU, Dumka.
		Dr. P. K. MISHRA	Associate Professor, Head, University Department Of Biotechnology, VBU, Hazaribagh.
03	**Members**	Dr. L. B. SINGH	Dean Student's Welfare, BBMKU, Dhanbad.
		Dr. KALPANA PRASAD	Associate Professor, Head, University Department Of Botany BBMKU, Dhanbad.
		Dr. NAVITA GUPTA	Associate Professor, Co-ordinator, Department of Biotechnology PKRM college, Dhanbad.
		Dr. PALLAVI PRAVEEN	Assistant Professor, Co-ordinator, Department of Biotechnology B.S .CITY college, Dhanbad.
04	**Invited Members**	Dr. B. K. KUMAR	Associate Professor, Dean faculty of science, BBMKU, Dhanbad.

CONTENTS

BIOTECHNOLOGY CURRICULUM

FIRST SEMESTER

COURSE CODE	TITLE OF THE COURSE	CREDITS	LECTURES	DISTRUBUTION OF MARKS					TOTAL PASS MARKS
				INTERNAL EXAM	P.M	EXTERNAL EXAM	P.M.	TOTAL MARKS	
BIO-H-C-101-T	BIOCHEMISTRY & METABOLISM	04	60	15	06	60	24	75	30
BIO-H-C-102-T	CELL BIOLOGY	04	60	15	06	60	24	75	30
BIO-H-C- 101&102-P	PRACTICAL BASED ON BIO-H-C- 101&102	04	60	10	04	40	16	50	20
BIO-H-AECC-101-T	LANGUAGE (ENGLISH/HINDI /NH+MB)	02	30	10	04	40	16	50	20
BIO-H-GE-101-T	BOTANY/ ZOOLOGY	04	60	15	06	60	24	75	30
BIO-H-GE-101-P	PRACTICAL BASED ON BIO-H-GE-101	02	30	05	02	20	08	25	10

TOTAL CREDITS : 20 FULL MARKS :350

SECOND SEMESTER

COURSE CODE	TITLE OF THE COURSE	CREDITS	LECTURES	DISTRUBUTION OF MARKS					TOTAL PASS MARKS
				INTERNAL EXAM	P.M	EXTERNAL EXAM	P.M.	TOTAL MARKS	
BIO-H-C-203-T	BIO ANALYTICAL TOOLS	04	60	15	06	60	24	75	30
BIO-H-C-204-T	MAMMALIAN PHYSIOLOGY	04	60	15	06	60	24	75	30
BIO-H-C-203&204-P	PRACTICAL BASED ON BIO-H-C- 203&204	04	60	10	04	40	16	50	20
BIO-H-AECC-202-T	ENVIRONMENTAL SCIENCE	02	30	10	04	40	16	50	20
BIO-H-GE-202-T	BOTANY/ ZOOLOGY	04	60	15	06	60	24	75	30
BIO-H-GE-202-P	PRACTICAL BASED ON BIO-H-GE-202	02	30	05	02	20	08	25	10

TOTAL CREDITS : 20 FULL MARKS :350

THIRD SEMESTER

COURSE CODE	TITLE OF THE COURSE	CREDITS	LECTURES	DISTRUBUTION OF MARKS					TOTAL PASS MARKS
				INTERNAL EXAM	P.M	EXTERNAL EXAM	P.M.	TOTAL MARKS	
BIO-H-C-305-T	GENETICS	04	60	15	06	60	24	75	30
BIO-H-C-306-T	GENERAL MICROBIOLOGY	04	60	15	06	60	24	75	30
BIO-H-C-307-T	CHEMISTRY-1	04	60	15	06	60	24	75	30
BIO-H-C-305,306 & 307-P,	PRACTICAL BASED ON BIO-H-C-305,306 &307.	06	90	15	06	60	24	75	30
BIO-H-SEC-301-T	ENVIRONMENT & PUBLIC HEALTH,	02	30	10	04	40	16	50	20
BIO-H-GE-303-T	BOTANY/ ZOOLOGY	04	60	15	06	60	24	75	30
BIO-H-GE-303-P	PRACTICAL BASED ON BIO-H-GE-303	02	30	05	02	20	08	25	10

TOTAL CREDITS : 26 FULL MARKS :450

FOURTH SEMESTER

COURSE CODE	TITLE OF THE COURSE	CREDITS	LECTURES	DISTRUBUTION OF MARKS					TOTAL PASS MARKS
				INTERNAL EXAM	P.M	EXTERNAL EXAM	P.M.	TOTAL MARKS	
BIO-H-C-408-T	MOLECULAR BIOLOGY	04	60	15	06	60	24	75	30
BIO-H-C-409-T	IMMUNOLOGY	04	60	15	06	60	24	75	30
BIO-H-C-410-T	CHEMISTRY-2	04	60	15	06	60	24	75	30
BIO-H-C-408,409 & 410-P	PRACTICAL BASED ON BIO-H-C-408,409&410	06	90	15	06	60	24	75	30
BIO-H-SEC-402-T	ENTERPRENEUSHIP DEVELOPMENT/	02	30	10	04	40	16	50	20

	SCIENCE & LIFE								
BIO-H-GE-404-T	**BOTANY/ ZOOLOGY**	**04**	**60**	**15**	**06**	**60**	**24**	**75**	**30**
BIO-H-GE-404-P	**PRACTICAL BASED ON BIO-H-GE-404**	**02**	**30**	**05**	**02**	**20**	**08**	**25**	**10**

TOTAL CREDITS : 26 FULL MARKS :450

FIFTH SEMESTER

COURSE CODE	TITLE OF THE COURSE	CREDITS	LECTURES	DISTRUBUTION OF MARKS					TOTAL PASS MARKS
				INTERNAL EXAM	P.M	EXTERNAL EXAM	P.M.	TOTAL MARKS	
BIO-H-C-511-T	**INDUSTRIAL FERMENTATION**	**04**	**60**	**15**	**06**	**60**	**24**	**75**	**30**
BIO-H-C-512-T	**RECOMBINANT DNA TECHNOLOGY**	**04**	**60**	**15**	**06**	**60**	**24**	**75**	**30**
BIO-H-C-511&512P	**PRACTICAL BASED ON BIO-H-C-511 & 512**	**04**	**60**	**10**	**04**	**40**	**16**	**50**	**20**
BIO-H-DSE-501A-T/ **BIO-H-DSE-501B-T/** **BIO-H-DSE-501C-T**	**PLANT BIOTECHNOLOGY/** **DEVELOPMENTAL BIOLOGY/** **ANIMAL DIVERSITY-I**	**04**	**60**	**15**	**06**	**60**	**24**	**75**	**30**
BIO-H-DSE-502A-T/ **BIO-H-DSE-502B-T/** **BIO-H-DSE-502C-T**	**ENVIRONMENTAL BIOTECHNOLOGY/ INTELLECTUAL PROPERTY RIGHTS (IPR), BIOETHICS,BIOSAFETY/** **MEDICAL MICROBIOLOGY**	**04**	**60**	**15**	**06**	**60**	**24**	**75**	**30**
BIO-H-DSE-501 A/B/C –P & 502A/B/C-P.	**PRACTICAL BASED ON BIO-H-DSC-511A/B/C & 512A/B/C**	**04**	**60**	**10**	**04**	**40**	**16**	**50**	**20**

TOTAL CREDITS : 24 FULL MARKS :400

SIXTH SEMESTER

COURSE CODE	TITLE OF THE COURSE	CREDITS	LECTURES	DISTRUBUTION OF MARKS					TOTAL PASS MARKS
				INTERNAL EXAM	P.M	EXTERNAL EXAM	P.M	TOTAL MARKS	
BIO-H-C-613-T	MICROBIAL & PLANT PHYSIOLOGY	04	60	15	06	60	24	75	30
BIO-H-C-614-T	BIOSTASTISTICS & BIOINFORMATICS	04	60	15	06	60	24	75	30
BIO-H-C-613 & 614-P	PRACTICAL BASED ON BIO-H-C-613 & 614	04	60	10	04	40	16	50	20
BIO-H-DSE-603A-T/ BIO-H-DSE-603B-T/ BIO-H-DSE-603C-T	ANIMAL BIOTECHNOLOGY/ MOLECULAR DIAGNOSTICS/ ANIMAL DIVERSITY-II	04	60	15	06	60	24	75	30
BIO-H-DSE-603 A/B/C	PRACTICAL BASED ON BIO-H-DSC-603	02	30	05	02	20	08	25	10
BIO-H-DSE-604-DISSERTATION PAPER *	DISSERTATION	06	90	DISSERTATION WORK		PRESENTATION INTERNAL		100	40
				70		30			

*** Dissertation of the project work to be carried out by the candidates either in the departmental laboratory or other suitable industries / Institutions /Laboratories to have real on the spot knowledge by technological applications of Biotechnological skill.**
Dissertation /Project on the job training should be submitted in bound form for evaluation.
Presentation and defense of project work : Students will be judged on the basis of :
i) Quality of work
ii) Preparation of Dissertation
iii) Delivery and Quality of talk
iv) Defense in response to audience queries.

TOTAL NUMBER OF CREDITS IN SIX SEMESTERS = 140 (T= THEORY, P= PRACTICAL)
TOTAL MARKS=2400 (END SEM. 1920 AMD MID SEM.480)

***According To U.G.C Guidelines for Minimum Course Curriculum For U.G. Courses Under CBCS (Page no.-06)**

DETAILS OF CURRICULUM

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-C-101-T **FIRST SEMESTER**

CREDIT – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two groups of questions. Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

BIOCHEMISTRY & METABOLISM

UNIT I

1.1. Amino acids

1.1.1. Definition, structure and classification of Amino acids
1.1.2. Basics of essential and non-essential amino acid
1.1.3. Acid-base properties and solubility properties
1.1.4. Amino acids sequencing of protein

1.2. **Metabolism**

1.2.1 Biosynthesis of amino acids

1.3 Proteins

1.3.1. Types of proteins and their classification, Biological function.
1.3.2. Forces stabilizing protein structure and shape
1.3.3. Different Level of structural organization of proteins
1.3.4. Denaturation and renaturation of proteins
1.3.5. Protein folding and chaperones.

UNIT II

2.1 Carbohydrates

2.1.1. Definition, Classification of Carbohydrates
2.1.2. Chemical structure and properties & examples of Monosaccharide
2.1.3. Structure of glucose- up to Haworth's projection formula
2.1.4. Disaccharides, Oligosaccharides and Polysaccharides
2.1.5. Glycoproteins and their biological functions.

2.2. Metabolism

2.2.1. Glycolysis and its energetics.
2.2.2. Fate of pyruvate under aerobic and anaerobic conditions
2.2.3. Pentose phosphate pathway and its significance
2.2.4. Gluconeogenesis, Glycogenolysis and glycogen synthesis
2.2.5. Kreb's cycle and its energetics.
2.2.6. Electron Transport System, Oxidative phosphorylation

UNIT III

3.1. Nucleic acids

3.1.1**.** Component of nucleic acids
3.1.2. Structure, properties and functions of Nucleic acids
3.1.3. Double helical model of DNA structure
3.1.4. DNA forms (A, B and Z), their characteristics
3.1.5. Denaturation and renaturation of DNA
3.1.6. Different types of RNA, their structure and function

3.2. Lipids

3.2.1. Definition, classification, Nomenclature and properties of fatty acids
3.2.2. Saturated and Unsaturated Fatty Acids
3.2.3. Structure and properties of waxes, steroids, lipo-proteins and lipo-polysaccharides
3.2.4 Secondary metabolites- alkaloids, Terpenoids and Phenols

3.3. Metabolism

3.3.1. Biosynthesis of fatty acids, β-oxidation

UNIT IV

4.1. Enzymology

4.1.1. Definition, nomenclature, Classification and properties of enzymes
4.1.2. Co-enzymes and Cofactor
4.1.3. Introduction to Active site and Enzyme specificity
4.1.4. Factors affecting the enzyme action - temperature, pH, activators, inhibitors, Substrates
4.1.5. Enzyme-substrate interaction: Fisher lock-key hypothesis and Koshland induced fit Hypothesis
4.1.6. Enzyme kinetics- Michaelis-Menten equation
4.1.7. Enzyme inhibition

SUGGESTED READINGS

1. Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co.
2. Buchanan, B., Gruissem, W. and Jones, R. (2000) Biochemistry and Molecular Biology of Plants. American Society of Plant Biologists.
3. Nelson, D.L., Cox, M.M. (2004) Lehninger Principles of Biochemistry, 4th Edition, WH Freeman and Company, New York, USA.
4. Hopkins, W.G. and Huner, P.A. (2008) Introduction to Plant Physiology. John Wiley and Sons.
5. Salisbury, F.B. and Ross, C.W. (1991) Plant Physiology, Wadsworth Publishing Co. Ltd.

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-C-102-T **FIRST SEMESTER**

CREDITS – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

CELL BIOLOGY

UNIT I

1.1. Cell

1.1.1 Definition – Prokaryotic cell and Eukaryotic cell
1.1.2 Classification of organisms by cell structure, cytosol, cell fractionation
1.1.3 Discovery of cell and Cell Theory and exceptions

1.2. Comparison between plant and animal cells
1.3. Structure- Plant Cell wall

UNIT II

2.1. Cell Membrane:

2.1.1. Chemical components of biological membranes
2.1.2. Models of membrane structure
2.1.3. Modification of plasma membrane, membrane as a dynamic entity, cell recognition.

2.2. Membrane transport across plasma membrane

2.2.1. Passive transport - Simple diffusion, Facilitated diffusion
2.2.2. Active transport
2.2.3. Transport of macromolecule across the plasma membrane –endocyosis and exocytosis.

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UNIT III

3.1. Structural Organization and function of cellular organelles

3.1.1. Nucleus,
3.1.2. Mitochondria,
3.1.3. Endomembranous system-- Golgi bodies, Lysosomes, Endoplasmic reticulum.
3.1.4. Plastids and Chloroplast.
3.1.5 Peroxisomes,
3.1.6. Cytoskeleton and its role in motility

UNIT IV

4.1. Cell cycle

4.1.1. An overview of cell cycle
4.1.2. Components of cell cycle control system
4.1.3. Cell cycle check points and its regulation
4.1.4. Mechanism of cell division – mitosis and meiosis

4.2. Programmed cell death (Apoptosis)- intrinsic & extrinsic pathways of cell death.

4.3. Cancer:

4.3.1. Carcinogenesis
4.3.2. Agents promoting carcinogenesis
4.3.3. Type of cancer
4.3.4. Molecular basis of Cancer

4.4. Cell signaling:

4.4.1. Hormones & their receptors
4.4.2. Cell Surface receptors - Signaling through G-Protein coupled receptors
4.4.4. Signal transduction pathways – Role of Secondary messengers
4.4.5. Regulation of signaling pathways
4.4.6. Bacterial Chemotaxis

SUGGESTED READINGS

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition.Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASMPress & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

BIO-H-C- 101&102-P BIOCHEMISTRY & METABOLISM AND CELL BIOLOGY PRACTICAL

Credit - 04 Lectures - 60 F.M – 40 Time - 03 Hrs.

1. To study the effect of pH, temperature on the activity of salivary amylase enzyme.
2. Estimation of blood glucose by glucose oxidase method
3. Principles of Colorimetry:
   (i) Verification of Beer's law, estimation of Protein
   (ii) To study relation between absorbance and % transmission.
4. Preparation of buffers.
5. Separation of Amino acids by paper chromatography.
6. Qualitative tests for Carbohydrates, lipids and proteins.
7. Study of plasmolysis and de-plasmolysis.
8. Study of structure of any Prokaryotic and Eukaryotic cell.
9. Squash preparation of onion root tip/ insect gonads to study different stages of mitosis and meiosis.
10. Permanent slides of mitosis and meiosis

BIO-H-C- 101&102-P BIOCHEMISTRY & METABOLISM AND CELL BIOLOGY PRACTICAL EXAMINATION(FORMAT)

F.M - 40 Time - 03 Hrs.

All Questions are compulsory.

01. One practical from C-101	**7**
02. One practical from C-102	**7**
03. Spotting (C-101 & C-102)	**2x5 = 10**
04. Model , Chart Display	**06**
05.Practical Record	**05**
06. Viva-Voce	**05**

BIO-H-AECC-101-T **ENGLISH/MIL COMMUNICATION ***

*** Syllabus will be obtained from respective Department**

BIO-H-GE-101-T (BOTANY / ZOOLOGY) *

*** Syllabus will be obtained from respective Department.**

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-C-203-T **SECOND SEMESTER**

CREDIT – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

BIOANALYTICAL TOOLS

UNIT I

1.1. Thermoregulation

1.1.1. Thermometric properties

1.1.2. Types of thermometers (clinical, thermocouple, bimetallic, platinum resistance, thermistor - thermometers)

UNIT II

2.1. Separation & Identification of Materials

2.1.1. Concept of Chromatography

2.1.2. Partition Chromatography, Paper Chromatography, TLC.

2.1.3. Adsorption Chromatography

2.1.4. Ion Exchange Chromatography

2.1.5. Gel Chromatography

2.1.6. HPLC, GLC.

2.1.7. Affinity Chromatography

UNIT III

3.1. Centrifugation

3.1.1. Basic Principle of Centrifugation and Application of centrifugation.
3.1.2. Relative centrifugal field
3.1.3. Differential centrifugation
3.1.4. Density gradient centrifugation

3.2. Electrophoresis

3.2.1. Introduction to electrophoresis
3.2.2. Starch-gel
3.2.3. Polyacrylamide gel (native and SDS-PAGE)
3.2.4. Agarose gel electrophoresis
3.2.5. Pulse field gel electrophoresis
3.2.6. Immuno- electrophoresis
3.2.7. Isoelectric focusing
3.2.8. Western blotting

UNIT IV

4.1. X-Ray Crystallography

4.1.1. Introduction, Principles and Technique and application of X - Ray diffraction.
4.1.2. X - Ray Diffraction (crystal structure, determination of crystal structure.

4.2. **Spectroscopy**

4.2.1. General spectroscopy and Principle and law of absorption fluorimetry
4.2.2. Colorimetry
4.2.3. Spectrophotometry
4.2.4. UV-Visible spectroscopy
4.2.5. Infra-Red Fluorescence spectroscopy
4.2.6. Atomic absorption spectroscopy (AAS) and ICPMS.
4.2.7. Raman spectroscopy

4.3. Introduction to Biosensors and Nanotechnology and their application

SUGGESTED READINGS

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-C-204-T **SECOND SEMESTER**

CREDIT – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

MAMMALIAN PHYSIOLOGY

UNIT I

1. Digestion and Respiration

1.1. Digestion:

1.1.1. Mechanism of digestion of carbohydrates, Proteins, Lipids and nucleic acids.
1.1.2. Mechanism of absorption of different nutrients,
1.1.3. Assimilation of protein, carbohydrate and fats,

1.2. Respiration:

1.2.1. Exchange of gases,
1.2.2. Transport of O_2 and CO_2,
1.2.3. Oxygen dissociation curve, factor affecting oxygen haemoglobin dissociation curve,
1.2.4. Chloride Shift, Haldane effect,
1.2.5. ATP synthesis

UNIT II

2. Circulation

2.1. Body fluids:-

2.1.1. Composition of blood - Plasma proteins and blood cells & their role
2.1.4. Blood Groups (ABO system),Rh factor
2.1.5. Mechanism of coagulation of blood;
2.1.6. Lymph – definition ,composition and function.

2.2 Hearts: -

2.2.1. Structure of human heart,
2.2.2. Mechanism of working of heart:
2.2.3. Origin & conduction of heart beat,
2.2.4. Regulation of heart beat.
2.2.4. Heart rate, Cardiac output, cardiac cycle, heart sound.
2.2.5. ECG.

UNIT III

3. Muscle physiology and Osmo- regulation.

3.1. Muscle;-

3.1.1. Structure of cardiac, smooth & detailed structure of skeletal muscle,
3.1.2. Mechanism of muscle contraction,
3.1.3. Isotonic and Isometric contraction,
3.1.3. Cori's cycle.

3.2.Excretion

3.2.1. Modes of excretion,
3.2.2. Ornithine cycle,
3.2.3. Mechanism of urine formation.

UNIT IV

4. Nervous and endocrine coordination.

4.1. Structure of Neuron.

4.1.1. Types of neuron,
4.1.2. Mechanism of generation & propagation of nerve impulse ,Action Potential
4.1.3. Saltatory conduction,
4.1.4. Synaptic Transmission of impulses,
4.1.5. Neurotransmitters.

4.2. Mammalian Endocrine glands.

4.2.1. Thyroid, Parathyroid and Adrenals, Hypothalamus, Pituitary, Pineal, Thymus, Pancreas.
4.2.2. Mechanism of action of hormones (insulin and steroids)

Practicals:

Credit - 04 **Lectures - 60** **F.M - 40** **Time - 03 Hrs.**

1. Determine the coagulation and bleeding time of blood in own blood.
2. Determination of blood groups.
3. Counting of mammalian RBCs.
4. Determination of TLC and DLC.
5. Estimation of Haemoglobin Percentage.

SUGGESTED READINGS

1. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. /W.B. Saunders Company.
2. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition. John wiley & sons,Inc.

BIO-H-C-203&204-P BIO-ANALYTICAL TOOLS AND MAMMALIAN PHYSIOLOGY
PRACTICAL EXAMINATION

F.M - 40 **Time - 03 Hrs.**

All questions are compulsory.

1.One practical from C-201	**7**	
2.One practical from C-202	**7**	
3. Spotting (C-201 & C-202)	**2x5 = 10**	**4.**
Model , Chart Display	**06**	
5. Practical Record	**05**	
6. Viva-Voce	**05**	

BIO-H-AECC-202-T **EVS/MIL COMMUNICATION (AECC2)***

*** Syllabus can be obtained from the respective department.**

BIO-H-GE-202-T & Practical*

*** Syllabus can be obtained from the respective department.**

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-C-305-T **THIRD SEMESTER**

CREDIT – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

GENETICS

UNIT I

1.1. Mendelian genetics:Classical Genetics

1.1.1.Mendel's experimental design- monohybrid, dihybrid , tri hybrid crosses
1.1.2 Mendel's laws of inheritance- Law of Segregation and Law of Independent Assortment, Exceptions to Mendelian Inheritance
1.1.3 Verification of segregates by test and back crosses
1.1.4 Incomplete Dominance and Co-Dominance
1.1.5 Chromosome Theory of inheritance

1.2. Genetic Linkage & Crossing over and chromosome mapping

1.2.1 Cytological basis of Crossing over and types of crossing over.
1.2.2 Linkage and recombination of genes in a chromosome in crossing over.
1.2.3 Linkage Mapping.

UNIT II

2.1. Extensions to Mendel's Inheritance

2.1.1 Allelic Variation, Multiple Genes
2.1.2 Genetic interaction
2.1.3 Penetrance (complete & incomplete) and Expressivity
2.1.4 Pleiotropism

2.2 Non- Allelic interaction

2.2.1 Epistasis(Dominant and recessive)
2.2.2 Duplicate genes and inhibitory genes.

3.1**. Cytoplasmic or Extra-nuclear inheritance in eukaryotes- maternal inheritance**

3.1.1 Extra-nuclear inheritance by cellular organelles (chloroplast, mitochondria)

3.1.2 Extra-nuclear inheritance by Endosymbiosis.

UNIT III

3.1 Chromosome and genome organization

3.1.1 Genetic organization of prokaryotic and viral genome.

3.1.2 Structure and characteristics of Eukaryotic chromosome- Euchromatic and heterochrmatic

3.1.3 Eukaryotic nuclear genome nucleotide sequence composition- unique and repetitive DNA , Satellite DNA

3.1.4 Centromere and telomere DNA

3.1.5 Ultra structure of chromatin fiber – Nucleosome, packaging ratio of DNA.

3.2. Cytogenetics

3.2.1. Human karyotype,

3.2.2. Chromosome banding.

3.2.3 Giant chromosome – Polytene , Lampbrush and their significance.

UNIT IV

4.1.Chromosome and Gene mutation

4.1.1.Definition and types of mutations, causes of mutation and mutagenic agents 4.1.2 Molecular basis of Mutation

4.1.3 Numerical changes in chromosome-Euploidy, Polyploidy and its applications

4.1.4 Genotypic effects and Phenotypic effects of polyploidy , Induced Polyploidy in plants and animals.

4.2. Structural change in chromosomes –

4.2.1. Deletion, duplication, insertion, inversion, translocation(reciprocal and Robertsonian)

4.2.2. Position effects of gene expression

4.2.3 Chromosomal aberrations in human being- Aneuploidy and Euploidy

4.3. Sex determination and Sex Linkage

4.3.1. Mechanism of Sex determination, Environmental factors and sex determination and sex differentiation .

4.3.2. Genic balance theory.

4.3.3.Barr bodies and Dosage compensation.

4.3.4. Sex –linked inheritance.

SUGGESTED READINGS

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons.
2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. IX Edition. Benjamin Cummings.
4. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
5. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition. Introduction to Genetic Analysis, W. H. Freeman & Co.

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-C-306-T **THIRD SEMESTER**

CREDIT – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

GENERAL MICROBIOLOGY

UNIT I

1.1. Fundamentals, History and Evolution of Microbiology

1.1.1 Classification of microorganisms --Microbial taxonomy, criteria used including molecular approaches

1.1.2 Microbial phylogeny and current classification of bacteria

1.1.3 Microbial Diversity: Distribution and characterization Prokaryotic and Eukaryotic cells

1.1.4 Morphology and cell structure of major groups of microorganisms eg. Bacteria, Algae, Fungi, Protozoa and Unique features of viruses

1.1.5Gram positive and Gram negative bacteria, kinds of flagella, Ultra structure of flagella

UNIT II

2.1**. Cultivation and Maintenance of micro organism**

2.1.1 Nutritional categories of microorganisms

2.1.2 Methods of Isolation, Purification and Preservation

2.1.3. Concept of sterilization

2.4. Methods of sterilization of media and equipments /glassware

UNIT III

3.1**. Microbial growth**:

3.1.1 Growth curve, Generation time, synchronous batch and continuous culture

3.1.2.Measurement of growth and Factors affecting growth – pH, temperature, O_2 requirement.

3.2**. Microbes in extreme environments** –Thermopiles, psychrophiles and alkalophiles.

3.3. **Bacterial Reproduction:**

3.3.1 Transformation
3.3.2 Transduction
3.3.3 Conjugation.
3.3.4 Endospores and sporulation in bacteria.

UNIT IV

4.1. **Control of Microorganisms :**

4.1.1 By Physical ,
4.1.2 Chemical and
4.1.3 Chemotherapeutic agents.

4.2 Water Microbiology :

4.2.1 Bacterial pollutants of water.
4.2.2 Coliforms and non-coliforms
4.2.3 Sewage composition and its disposal.

4.3 Food Microbiology:

4.3.1 Important microorganisms in food microbiology- Moulds, yeast and Bacteria
4.3.2 **Major food borne infectious and intoxications** Spoilage of food by microbes
4.3.3 Methods of food preservation
4.3.4 Preservation by food additives
4.3.5 Fermented food

SUGGESTED READINGS

1. Alexopoulos CJ, Mims CW, and Blackwell M. (1996). Introductory Mycology. 4 th edition. John and Sons, Inc.
2. Jay JM, Loessner MJ and Golden DA. (2005). *Modern Food Microbiology*. 7thedition, CBS Publishers and Distributors, Delhi, India.
3. Kumar HD. (1990). Introductory Phycology. 2nd edition. Affiliated East Western Press.
4. Madigan MT, Martinko JM and Parker J. (2009). Brock Biology of Microorganisms. 12th edition. Pearson/Benjamin Cummings.
5. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company.
6. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). General Microbiology. 5th edition. McMillan.
7. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9 th edition. Pearson Education.
8. Willey JM, Sherwood LM, and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. 7th edition. McGraw Hill Higher Education.

BIO-H-C-305 & 306P **GENETICS & GENERAL MICROBIOLOGY PRACTICAL**

Credit - 04 **Lectures - 60** **F.M - 40** **Time - 03 Hrs.**

1. Permanent and temporary mount of mitosis.
2. Permanent and temporary mount of meiosis.
3. Mendelian deviations in dihybrid crosses
4. Demonstration of - Barr body -*Rhoeo* translocation.
5. Karyotyping with the help of photographs
6. Pedigree charts of some common characters like blood group, color blindness and PTC tasting.
7. Study of polyploidy in onion root tip by colchicine treatment.
8. Isolation of bacteria & their biochemical characterization.
9. Staining methods: simple staining, Gram staining, spore staining, negative staining, hanging drop.
10. Preparation of media & sterilization methods, Methods of Isolation of bacteria from different sources.
11. Determination of bacterial cell size by micrometry.
12. Enumeration of microorganism - total & viable count.

BIO-H-C-305 & 306-P **GENETICS & GENERAL MICROBIOLOGY PRACTICAL EXAMINATION.**

F.M - 40 **Time - 03 Hrs.**

All questions compulsory.

1.One practical from C-301 **7**

2.One practical from C-302 **7**

3. Spotting (C-301 & C-302) **2x5 = 10** **4.**

Model , Chart Display **06**

5.Practical Record **05**

6. Viva-Voce **05**

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-C-307-T **THIRD SEMESTER**

CREDIT – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

CHEMISTRY

Group –A (INORGANIC)

UNIT – I

1.1 Atomic Structure: -

1.1.1. Electromagnetic waves, Matter wavers and their difference,
1.1.2. Problems based on de-Brogaliaes relationship.
1.1.3. Heisenberg's uncertainty Principle.
1.1.4. Time independent Schrodinger's equation for hydrogen like atom (derivation not required).

UNIT – II

2.1. Periodic Properties

2.1.1. Periodicity in the following properties: 0 Atomic and ionic radii, Ionization energy, electron affinity and electronegativity.

UNIT – III

3.1. Covalent Bonding

3.1.1. Polar and Non-polar covalent bonds,
3.1.2. Properties of covalent compounds,
3.1.3. Bond theory,
3.1.4. Hybridization,
3.1.5. Shapes of inorganic molecules and ions
(a) Without lone pair(s) on central atom
(b) With lone pair (s) on central atom.

Group –B (ORGANIC)

UNIT – I

1.1. Classification of carbon atoms in organic compounds alkyl, alkenyl and alkynyl groups, Functional groups, relative seniority of functional groups ,
1.2. IUPAC system of nomenclature.
1.3. Polarization of covalent bonds,
1.4. Hybridization of carbon σ and π bonds,
1.5. Polarization of covalent bonds, Inductive effect, electrometric effect,
1.6. Resonance, condition of Resonance,
1.7. Hyperconjugation,
1.8. Hydrogen bond its effect on physical properties of organic compounds.
1.9. Effect of inductive effect resonance effect on physical properties molecules.

UNIT – II

2.1. An idea of reaction mechanism and reaction intermediates
- 2.1.1. Carbocation,
- 2.1.2. Carbonion
- 2.1.3. Carbon free radicals.

UNIT – III

3.1. Alkanes: - Sources methods of formation,
3.2. Physical properties and chemical properties of alkanes.

Group- PHYSICAL

UNIT-I

Gaseous state

1.1. Ideal and real gases, Causes of deviation of an real gas from ideal behavior.
1.2. Equation of state of ideal gases, correction of pressure and volume terms for real gases in equation of state.
1.3. Units and significance of van der walls constant.
1.4. Applications of van der walls equation.

UNIT- II

Dilute Solutions

2.1. Ideal and non- ideal solute, ions, methods of expressing concentrations of solutions,
2.2. Colligative properties- Relative lowering of vapour pressure, osmosis and osmotic pressure.

UNIT-III

Chemical Kinetics and catalysis

3.1. Chemical kinetics and its scope, rate of reaction, factors influencing the rate of reaction-

concentration, temperature, pressure, light and catalyst.

3.2. Order and molecularity,

3.3. Derivation of expression for the 1st order reaction.

3.4. Units of specific rate constants for various orders of reactions, half life and mean life.

3.5. Effect of temperature on the rate of reaction: - Arrhenius Equation experimental

3.6. Determination of order of reaction.

3.7. Radioactive decays as the 1st order phenomenon.

BIO-H-C-307-P **CHEMISTRY PRACTICAL**

ORNANIC PRACTICAL

1. Hydrolysis of ester: Ethyl benzoate to benzoic acid.
2. Nitration: Nitrobenzene to m- dinitrobenzene
3. Oxidation: Oxidation of Benzeldehyde to benzoic acid.
4. Detection of elements (Nitrogen, sulphur and Halogen) and functional groups (Phenolic, carboxylic acid, aromatic nitro, aromatic amino, aldehydes and ketone)

INORGANIC PRACTICAL

1. Acidimetry- alkalimentry: preparation of 250cc (N/10) oxalic acid solution. Determination of acetic acid in vinegar using standard NaOH solution.
2. Permangnatometry: Determination of Fe++ iron in Hohr's salt by standard permanganate.
3. Complexometric: Estimation of calcium ion in water using EDTA.

BIO-H-C-307-P **CHEMISTRY-1 PRACTICAL EXAMINATION**

Credit - 02 **Lectures - 30** **F.M - 20** **Time - 03 Hrs.**

All question are compulsary

01. To prepare Ethyl benzoate to benzoic acid. **10**

OR

To prepare Benzeldehyde to benzoic acid.

OR

To prepare 250cc (N/10) oxalic acid solution.

OR

To Determine Fe++ iron in Hohr's salt by standard permanganate.

03. Practical Record **05**

04. Viva-Voce **05**

CBCS SYLLABUS FOR ENVIRONMENT AND PUBLIC HEALTH

SEC (Skill Enhancement Course)

B.A./ B.Sc./ B. Com. Semester III

BIO-H-SEC-301-T **THIRD SEMESTER**

CREDIT – 02	**LECTURES – 30**
Duration of Exam-90 Minutes	**F.M: 60** **40 marks external**, will be held on OMR sheet; 40 objective questions will be asked each of one mark. **Internal: 10 Marks.**

- **Syllabus will be made available from the Institution.**

BIO-H-GE-303-T (BOTANY/ ZOOLOGY)*

- **Syllabus will be made available in the respective Department**

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-C-408-T **FOURTH SEMESTER**

CREDIT – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

MOLECULAR BIOLOGY

UNIT I

1.1. DNA structure and replication

DNA as the genetic material – experiments proving DNA as genetic material.

1.1.1 Replication of DNA in prokaryotes

1.1.2 Semi conservative replication of DNA, Bi-directional replication and DNA polymerases and other enzymes involved in replication

1.1.3Replication complex, theta model and rolling circle replication

1.2. DNA damage and repair:

1.2.1. DNA Damage & Repairs - causes of DNA damage

1.2.3 DNA Repair mechanisms- photoreactivation, base excision repair, nucleotide excision repair and mismatch repair,

SOS repair.

1.2.4. Homologus recombination: models and mechanism.

UNIT III

3.1. Transcription in prokaryotes

3.1.1. **RNA structure and types of RNA**

3.1.2. Prokaryotic RNA polymerase, role of sigma fctor

3.1.3. Promoter, Initiation, Elongation and termination of RNA chains

3.2. Inhibitors of transcription.

UNIT IV

4.1. Regulation of Gene Expression in prokaryotes

4.1.1. Operon concept- Inducible and repressible system
4.1.2. Positive and negative regulation.
4.1.3. Operon model- lac, trp.
4.1.4 Genetic code and its characteristics, Wobble hypothesis

4.2.Regulation of Gene Expression and Translation/Protein synthesis in prokaryotes:

4.2.1.Ribosome structure and assembly
4.2.2 Activation of t- RNA, aminoacyl tRNA synthetases
4.2.3 Mechanism of initiation, elongation and termination of protein synthesis in Prokaryotes and Inhibitors of translation.
4.2.4 Post-translational modifications.

SUGGESTED READINGS

1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
3. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
4. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., (2008) Molecular Biology of the Gene (VI Edition.). Cold Spring Harbour Lab. Press, Pearson Pub.

PRACTICALS

1. Preparation of solutions for Molecular Biology experiments.
2. Isolation of chromosomal DNA from bacterial cells.
3. Isolation of Plasmid DNA by alkaline lysis method
4. Agarose gel electrophoresis of genomic DNA & plasmid DNA
5. Preparation of restriction enzyme digests of DNA samples
6. Demonstration of AMES test or reverse mutation for carcinogenicity

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-C-409-T **FOURTH SEMESTER**

CREDIT – 04	LECTURES – 60
TIME – 03 HRS	F.M: 60

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

IMMUNOLOGY

UNIT I

1.1. Immunology:

1.1.1. Immunity: Definition,

1.1.2. Types of Immunity- Innate, Adaptive/acquired (active, passive, natural/artificial, Humoral and Cell mediated immunity).

1.1.3 T-lymphocyte and immune response (cytotoxic cells T-cells, Helper T-cells nd Suppressor T-cells)

1.1.4 T-cell receptors

1.1.5. Features of Immune Response – memory, cell specificity/diversity, recognition of self and non-self.

1.2 Cells of the Immune System – Myeloid progenitor and lymphoid progenitor.

1.3. Organs of the Immune System: Primary and Secondary Lymphoid organs- Thymus, Spleen, Lymph nodes.

UNIT II

3.1. Antigens

3.1.1. Types of Antigens,

3.1.2. Antigenic determinants/epitopes, Hapten, Antigen, Immunogen and Superantigen.

3.1.4. Antigenecity and Immunogenecity.

3.1.5. Factors affecting antigenicity.

3.2. Antibodies

3.2.1. Structure, Types/Classes.

3.2.2. Properties and functions of immunoglobulins

3.2.4. Antibody diversity (a brief account only).

3.3. Immune Response:

3.3.1. Types of Immune responses:
3.3.2. Humoral Immunity – Primary and Secondary immune response
3.3.3. B cells in antibody formation (differentiation, maturation and activation of B cells).
3.3.4. T cell (differentiation, maturation and activation of T cells).

UNIT IV

4.1. Antigen – Antibody Interactions

4.1.1. Binding sites,
4.1.2. Affinity, Avidity and cross reactions
4.1.3. Precipitation and Agglutination reactions
.

4.2. Major Histocompatibility complexes

4.2.1. Antigen processing- endocytosis and exocytosis.
4.2.2. Antigen presentation-– MHC class I & class II
4.2.3 Complement system- Structure, components, properties and functions.
4.2.4. Hypersensitivity,
4.2.5. Auto immune diseases, Immunodeficiency- AIDS

4.3. Vaccines & Vaccination

4.3.1. Adjuvants, cytokines.
4.3.2. DNA vaccines, recombinant vaccines, bacterial vaccines, viral vaccines, vaccines to other infectious agents, passive & active immunization.
4.3.3 Introduction to Immunodiagnostics- RIA and ELISA

SUGGESTED READINGS

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6 th edition Saunders Publication, Philadelphia.
2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.
3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
4. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.
6. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

BIO-H-C-408&409-P **MOLECULAR BIOLOGY & IMMUNOLOGY PRACTICALS**

Credit - 04 **Lectures - 60** **F.M - 40** **Time - 03 Hrs.**

1. Preparation of solutions for Molecular Biology experiments.
2. Isolation of chromosomal DNA from bacterial cells.
3. Isolation of Plasmid DNA by alkaline lysis method
4. Agarose gel electrophoresis of genomic DNA & plasmid DNA
5. Preparation of restriction enzyme digests of DNA samples
6. Demonstration of AMES test or reverse mutation for carcinogenicity
7. Differential leucocytes count
8. Total leucocytes count
9. Haemagglutination assay
10. Haemagglutination inhibition assay
11. Separation of serum from blood
12. Double immunodiffusion test using specific antibody and antigen. ELISA.

BIO-H-C-408&409-P **MOLECULAR BIOLOGY & IMMUNOLOGY PRACTICAL EXAMINATION.**

F.M - 40 **Time - 03 Hrs.**

All questions compulsory.

1.One practical from C-408 **7**

2.One practical from C-409 **7**

3. Spotting (C-408 & C-409) **2x5 = 10** **4.**

Model , Chart Display **06**

5.Practical Record **05** **6.**

Viva-Voce **05**

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-C-410-T **FOURTH SEMESTER**

CREDIT – 04	LECTURES – 60
TIME – 03 HRS	F.M: 60

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

CHEMISTRY

Group – A (INORGANIC)

UNIT I

1.1. Chemistry of elements of first transition series: - Characteristics properties of d-block elements.
1.2. Properties of the elements of the first transition series their binary compounds and complexes illustration relative stability of their oxidation states,
1.3. Coordination number and geometry.

UNIT II

2.1. Coordination compounds: - Werner's coordination theory and its experimental verification,
2.2. Effective atomic number concept,
2.3. Chelates,
2.4. Nomenclature of coordination compounds,
2.5. Isomerism in coordination compounds,
2.6. Valence bond theory of transition metal complexes.

Group- B (ORGANIC)

UNIT I

(Alkenes)

1.1. Nomenclature of alkenes,
1.2. Methods of formation,
1.3. Mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides; the Saytzeff rule, Hoffmann elimination;
1.4. Physical properties and relative stabilities of alkenes,
1.5. Chemical reaction of alkenes; Mechanism involving in electrophilic and free radical additions, Markovnikov's rule Kharasch effect,

1.6. Hyroboration- oxidation, oxymercuration- reduction, Epoxidation, Ozonolysis, Hydroxylation and oxidation with KMnO4,
1.7. Plymerization of alkenes, Substitution at allylic and vinylic position of alkenes.

UNIT II

(Alkynes)

2.1. Nomenclature, structure and Bonding in alkynes
2.2. Methods of formation, chemical reactions of alkynes, acidity of alkynes,
2.3. Mechanism of electrophilic and nucleophilic addition reaction,
2.4. Hydroboration- oxidation, metal ammonia reduction, oxidation and polymerization.

UNIT III

(Alkyl and aryl halides)

1.1. Preparation of alkyl halides Nucleophilic substitution- SN1 and SN-2 and elimination reaction –E1, E2 and E1CB,
1.2. Reactions with metals.
1.3. Methods of formation of aryl halides, Nuclear and side chain reactions,
1.4. comparison of reactivity and dipole moment with alkyl halides, vinyl halides and allyl halides.

UNIT IV

(Alcohol)

4.1. Classification and nomenclature,
4.2. Methods of formation,
4.3. Physical and chemical properties of monohydric alcohols,
4.4. Comparison of alcohols and phenols.

Group-C (PHYSICAL)

UNIT I

1.1. Definition: - System, surrounding, intensives and extensive properties,
1.2. Reversible and irreversible process isothermal,
1.3. Adiabatic and isochoric process,
1.4. Heat works, internal energy, Heat capacity,
1.5. 1st law of thermodynamic, Expression for work done in various processes; Enthalpy;
1.6. Second law of thermodynamic; concept of entropy, Gibbs free energy and Heimhitz
1.7. Work function; criteria of equilibrium and spontanelty – Gibbs –Helmholtz equation,
1.8. Maxwells's four relation- derivation on the basis of the properties of exact differential

UNIT II

Chemical Equilibium

2.1. Law of mass action,
2.2. Derivation of expressing for equilibrium constant (Kp and Kc) for the following reactions.
CH3 COOH + C2H5OH CH3COOC2H5 + H2O
N2(g) + 3H2(g) 2NH3(g)
2SO2(g) + O2(g) 2SO3(g)
2NO(g) + O2(g) 2NO2(g)
PCl5(g) Pcl3(g) + Cl2(g)

$CaCo_3(s) \rightleftharpoons CaO(s) + CO_2(g)$

2.3. Application of Le-Chatelier's Principle to the above equillibria.

2.4. Relationship between temperature and pressure on equilibrium between two phases.

(a) Ice Water

(b) Water Steam

(c) C (Diamond) C (Graphite)

(d) Clausius Clapeyron equation.

BIO-H-C-410-P **CHEMISTRY PRACTICAL**

Credit - 02 **Lectures - 30** **F.M - 20** **Time - 03 Hrs.**

1. Qualitative inorganic analysis of salt mixture containing four radicals including one interfering radical.
2. Preparation of sodium trioxalato ferrate (III)
3. Preparation of copper tetraamminne complex.
4. Gravimetric analysis of sulphate of barium.

BIO-H-C-410-P **CHEMISTRY-2 PRACTICAL EXAMINATION**

F.M - 20 **Time - 03 Hrs.**

All questions are compulsory.

01. To Prepare trioxalato ferrate (III) **10**

OR

To prepare copper tetra-ammine complex.

03. practical Record **05**

04. Viva-Voce **05**

BIO-H-SEC-402-T **ENTERPRENEURSHIP DEVELOPMENT**

UNIT I

1.1. Need, Scope & Characteristics of Entrepreneurship.
1.2. Identification of opportunities.
1.3. Exposure to Demand based, Resource based, Service based, Import Substitute and Export Promotion Industries.
1.4. Market Survey Techniques.

UNIT II

2.1. Need, Scope and Approached for Project Formulation.
2.2. Structure of Project Report.
2.3. Books of Accounts
2.4. Resource Management – Men, Machine and Materials.
(a) Creativity and Innovation
(b) Problem Solving Approach.
(c) Strength Weakness Opportunity and Threat (SWOT) Techniques.
2.5. Techno-Economic Feasibility of the project.
2.6. Quality Control / Quality Assurance and Testing of Product.

UNIT III

3.1. Business Plan
3.2. Elements of Marketing and Sales Management.
(a) Nature of Product and Market Strategy.
(b) Packaging and Advertising After sales Service

UNIT IV

4.1. Management of self and understanding human behavior.
4.2. Sickness in Small Scale Industries and their Remedial measures.

Project Report on a selected product should be prepared and submitted.

Recommended Books:

1. Couger, Creativity & Innovation
2. Dollinger M.J.-Entrepreneurship Development (Prentice Hall 1994)
3. Holt Entrepreneurship; New Venture Creation (Prentice Hall 1999)
4. Entrepreneurship: New Venture Creation : David H. Holt
5. Patterns of Entrepreneurship : Jack M. Kaplan
6. Entrepreneurship and Small Business Management: C.B. Gupta, S.S. Khanka, Sultan Chand & Sons.

BIO-H-GE-404-T

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-C-511-T **FIFTH SEMESTER**

CREDIT – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

INDUSTRIAL FERMENTATION

UNIT I

1.1. Principles of Microbial growth

1.1.1. Introduction, the ways of growing microorganisms, ways to increase yield of microbes,

1.2.2 Batch, fed-batch and continuous cultures.

1.2. Products from Microorganisms – Metabolites, Enzymes, Antibiotics, Single-cell Protein. .

UNIT II

2.1. Bioreactor / Fermenter

2.1.1. Types & operation of Bioreactors(Stirred tank, bubble columns, airlift. Bioreactors, Static, Submerged Agitated fermentation)

2.1.2. physico-chemical standards used in bioreactors,

2.1.3. Limitations of bioreactors,

2.1.4. Stages of fermentation processes,

2.1.5. Media design for fermentation processes,

2.1.6. Solid substrate fermentation,

2.1.7. Advantages & disadvantages of solid substrate and Liquid fermentations.

UNIT III

3.1. Technology of Microbial cell maintenance

3.1.1. Methods for inoculation, maintenance and preservation of microbial culture in an aseptic & sterile environment

3.1.2. Strain preservation and Maintenance

3.1.3. Strain improvement by mutation of gene transfer processes

UNIT IV

4.1. Downstream processing

4.1.1. Extraction, separation, concentration, recovery & purification, operations,

4.1.2. Industrial production of Ethyl alcohol, Acetic Acid (Vinegar), α-amylase, protease penicillin, vitamin B12, with reference to easily available raw materials.

4.2. Enzyme technology

4.2.1. Nature of enzymes and its application
4.2.2. Limitations of microbial cells used as catalysts in fermentation,
4.2.3 Genetic engineering & cloning strategy for enzymes, technology of enzyme production,
4.2.4. Use of immobilized cells and enzymes,
4.2.5. Industrial applications of immobilized enzymes.

SUGGESTED READINGS

1. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.

2. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.

3. Patel AH. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.

4. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd. edition, Elsevier Science Ltd

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-C-512-T **FIFTH SEMESTER**

CREDIT – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

RECOMBINANT DNA TECHNOLOGY

UNIT I
Molecular tools and applications

1.1. Enzymes involved in RDT-Restriction enzymes, ligases, polymerases,alkaline phosphatase.
1.2. Gene recombination and gene transfer – Transformation , Episomes ,Plasmids and other cloning vectors(Bacteriophage derived vectors , artificial chromosomes) Recognition
1.3. Methods for Gene cloning- Microinjection ,Electroporation, Ultrasonication.
1.4. Principle and applications of Polymerase chain reaction (PCR) , Primer design and RT-(Reverse transcription) PCR.
1.5. Selection and screening of recombinant clones.

UNIT II

2.1. Restriction and Modification systems , restriction mapping .
2.2 Hybridization techniques (Northern, Southern, Western blotting),
2.3 Preparation and comparison of Genomic and cDNA library , screening of recombinants , reverse transcription.
2.4 Genome mapping – DNA fingerprinting

UNIT III

3.1. Cloning vectors in prokaryotes; -
- 3.1.1. pBR322,
- 3.1.2. Bacteriophage vectors,
- 3.1.3. Cosmids,
- 3.1.4. Phasmid.

3.2. Cloning vectors in eukaryotes;-
- 3.2.1. Yeast vectors,

3.2.2. *Agrobacterium* – Ti plasmid , Ri-plasmid.

UNIT IV

4.1. **Genetic engineering in animals:**

4.1.1 Production and applications of transgenic mice ,role of ES cells in gene targeting in animals.

4.1.2 Therapeutic products produced by genetic engineering-blood proteins, human hormones, immune modulators and vaccines.(one example each)

4.2. **Genetic engineering in plants:**

4.2.1 Use of *Agrobacterium tumefaciens* and *A. rhizogenes*, Ti plasmids.

4.2.2 Strategies for gene transfer to plant cells

4.2.3 Direct DNA transfer to plants , Gene targeting in plants.

SUGGESTED READINGS

1. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.
2. Clark DP and Pazdernik NJ. (2009). Biotechnology-Applying the Genetic Revolution. Elsevier Academic Press, USA.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington
4. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
5. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press.

BIO-H-C-511&512-P INDUSTRIAL BIOTECHNOLOGY & RECOMBINANT DNA TECHNOLOGY PRACTICAL

Credit - 04 **Lectures - 60** **F.M - 40** **Time - 03 Hrs.**

1. Comparative analysis of design of a batch and continuous fermenter.
2. Calculation of Mathematical derivation of growth kinetics.
3. Solvent extraction & analysis of a metabolite from a bacterial culture.
4. Perform an enzyme assay demonstrating its hydrolytic activity (protease/peptidase/glucosidase etc.)
5. Isolation of chromosomal DNA from plant cells
6. Isolation of chromosomal DNA from *E.coli*
7. Qualitative and quantitative analysis of DNA using spectrophotometer
8. Plasmid DNA isolation

9. Restriction digestion of DNA
10. Making competent cells
11. Transformation of competent cells.
12. Demonstration of PCR

BIO-H-C-511&512-P INDUSTRIAL BIOTECHNOLOGY & RECOMBINANT DNA TECHNOLOGY PRACTICAL EXAMINATION

F.M - 40 **Time - 03 Hrs.**

All questions compulsory.

1.One practical from C-511	**7**
2.One practical from C-512	**7**
3. Spotting (C-511 & C-512)	**2x5 = 10**
4. Model , Chart Display	**06**
5.Practical Record	**05**
6. Viva-Voce	**05**

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-DSE-501A-T **FIFTH SEMESTER**

CREDIT – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

PLANT BIOTECHNOLOGY

UNIT I

1.1 Introduction, Cryo- and organogenic differentiation.

1.2 Types of culture: Seed , Embryo, Callus,Organs, Cell and Protoplast culture.

1.3 Micropopagation Axillary bud proliferation, advantages and disadvantages of micropropagation.

1.4 Meristem and shoot tip culture, cud culture, organogenesis, embryogenesis,

UNIT- II

2.1 In vitro haploid production Androgenic methods: Anther culture, Microspore culture andogenesis Sgnificance and use of haploids,

2.2 Ploidy level and chromosome doubling, diplodization, Gynogenic haploids, factors effecting gynogenesis,

2.3 chromosome elimination techniques for production of haploids in cereals.

UNIT - III

3.1 Protoplast Isolation and fusion Methods of protoplast isolation, Protoplast development, Somatic hybridization,

3.2 Identifiation and selection of hybrid cells, Cybrids, Potential of somatic hybridization limitations.

3.3 Somaclonal variation Nomenclautre, methods, applications basis and disadvantages.

UNIT - IV

4.1 Plant Growth Promoting bacteria.

4.2 Nitrogen fixation, Nitrogenase, Hydrogenase, Nodulation,

4.3Biocontrol of pathogens, Growth promotion by free-living bacteria.

4.4 **Somatic hybridization** – Protoplast fusion techniques, selection of hybrids, production of symmetric & asymmetric hybrids cybrid production.

PRACTICALS

1. Preparation of simple growth nutrient (knop's medium), full strength, half strength, solid and liquid.
2. Preparation of complex nutrient medium (Murashige & Skoog's medium)
3. To selection, Prune, sterilize and prepare an explant for culture.
4. Significance of growth hormones in culture medium.
5. To demonstrate various steps of Micropropagation

SUGGESTED READINGS

1. Bhojwani, S.S. and Razdan 2004 Plant Tissue Culture and Practice.
2. Brown, T. A. Gene cloning and DNA analysis: An Introduction. Blackwell Publication.
3. Gardner, E.J. Simmonns, M.J. Snustad, D.P. 2008 8th edition Principles of Genetics. Wiley India.
4. Raven, P.H., Johnson, GB., Losos, J.B. and Singer, S.R. 2005 Biology. Tata MC Graw Hill.
5. Reinert, J. and Bajaj, Y.P.S. 1997 Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture. Narosa Publishing House.
6. Russell, P.J. 2009 Genetics – A Molecular Approach. 3rdedition. Benjamin Co.
7. Sambrook & Russel. Molecular Cloning: A laboratory manual. (3rd edition)
8. Slater, A., Scott, N.W. & Fowler, M.R. 2008 Plant Biotechnology: The Genetic Manipulation of Plants, Oxford University Press.

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-DSE-501B-T **FIFTH SEMESTER**

CREDIT – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

DEVELOPMENTAL BIOLOGY

UNIT I

1.1. Gametogenesis and Fertilization

1.1.1. Definition, scope & historical perspective of development Biology,

1.1.2. Gametogenesis – Spermatogenesis, Oogenesis

1.1.3. Fertilization - Definition, mechanism, types of fertilization.

1.1.4. Different types of eggs on the basis of yolk.

UNIT II

1.2. Early embryonic development

1.2.1. Cleavage: Definition, types, patterns & mechanism Blastulation:

1.2.2. Process, types & mechanism Gastrulation:

1.2.3. Morphogenetic movements– epiboly, emboly, extension, invagination, convergence, de-lamination.

1.2.3. Formation & differentiation of primary germ layers, Fate Maps in early embryos.

UNIT III

3.1**. Embryonic Differentiation**

3.2. Differentiation: Cell commitment and determination

3.3. Epigenetic landscape: a model of determination and differentiation

3.4. Control of differentiation at the level of genome, transcription and

3.5. Post-translation level Concept of embryonic induction: Primary, secondary & tertiary embryonic induction, Neural induction and induction of vertebrate lens.

UNIT IV

4.1. Organogenesis

4.2. Neurulation,

4.3. Notogenesis,

4.4. Development of vertebrate eye.

4.5. Fate of different primary germ layers

4.6. Development of behavior: constancy & plasticity,

4.7. Extra embryonic membranes,

4.8. Placenta in Mammals.

SUGGESTED READINGS

1. Gilbert, S. F. (2006). Developmental Biology, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
2. Balinsky, B.I. (2008). An introduction to Embryology, International Thomson Computer Press.
3. Kalthoff, (2000). Analysis of Biological Development, II Edition, McGraw-Hill Professional

BIO-H-DSE-501B-P DEVELOPMENTAL BIOLOGY PRACTICAL

1. Identification of developmental stages of chick and frog embryo using permanent mounts
2. Preparation of a temporary stained mount of chick embryo
3. Study of developmental stages of Anopheles.
4. Study of the developmental stages of Drosophila from stock culture/ photographs..
5. Study of different types of placenta.

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-DSE-501C-T **FIFTH SEMESTER**

CREDIT – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

ANIMAL DIVERSITY-I

UNIT I: Proto-chordates, Pisces and Ambhibia

1.1. Proto-chordates: Outline of classification, General features and important characters of *Herdmania, Branchiostoma*

1.2. Origin of Chordates Pisces: Migration in Pisces,

1.3. Outline of classification Amphibia: Classification, Origin, Parental care, Paedogenesis

UNIT II: Reptilia, Aves and Mammalia

2.1. Reptelia: Classification, Origin

2.2. Aves: Classification, Origin, flight- adaptations, migration

2.3. Mammalia: Classification, Origin, dentition

UNIT III: Comparative anatomy of vertebrates I

3.1. Comparative anatomy of various systems of vertebrates: Integumentary, digestive respiratory systems.

UNIT IV: Comparative anatomy of vertebrates II

1.1. Comparative Anatomy of vertebrates – Heart, Aortic arches, Kidney & urinogenital system, Brain, Eye, Ear. Autonomic Nervous system in Mammals

SUGGESTED READING

1. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. & J.I., Spicer (2002) The Invertebrates: A New Synthesis. III Edition. Blackwell Science.
2. Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. E.L.B.S. and Nelson.
3. Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students. Asia Publishing Home.
4. Bushbaum, R. (1964) Animals without Backbones. University of Chicago Press.
5. Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-HillCompanies.

BIO-H-DSE-501C-P **ANIMAL DIVERSITY-I PRACTICALS**

Credit - 02 **Lectures - 30** **F.M - 20** **Time - 03 Hrs.**

1. Identification and Classification of Any these of the following –
   Porifera*: Scypha, , Leucosolenia, Euspongia, Hylonema, Euplectella Cnidaria: Medrepora, Millepora, Physalia, Porpita, Valella, Aurelia, Metridium*
   Platyhelminthes: *Taenia, Fasciola*, Aschelminthes*: Ascaris, Ancylostoma, Enterobius*
   Annelida: *Pheretima, Hirudinaria, Chaetopterus, Nereis, Aphrodite* Arthropoda: *Julus, Scolopendra, Peripatus, Carcinus, Limulus, Lepisma, Dragonfly, Musca, Acheta*
   Mollusca: *Pila, Unio, Mytilus, Loligo, Sepia, Octopus, Solen*
   Echinodermata: *Asterias, Ophiothrix, Echinus, Holothuria, Astrophyton*
   Hemichordata: *Balanoglossus*

2. Identification of slides with two points of identification.
   Amoeba, Paramoecium, Ceratium, Plasmodium, Opalina, L.S. Sponge, Spicules of sponges, L.S. *Hydra, Obelia, Bougainvillia*, Larvae of *Fasciola,* Seta of Earthworm, Radula

3. Ecological Note – On any of the specimens in Exercise No 1
   Models of dissection of Earthworm, Cockroach
   Earthworm: Digestive, Nervous System,
   Cockroach: Digestive Reproductive, Nervous System

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-DSE-502A-T **FIFTH SEMESTER**

CREDIT – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

ENVIRONMENTAL BIOTECHNOLOGY

UNIT I

1.1. Natural resources- Renewable and non-renewable resources of Energy.

1.2. Conventional fuels and their environmental impacts:

1.2.1. Coal
1.2.2 Gas
1.2.3 Petroleum

UNIT II

2.1. Modern fuels and their environmental impacts:

2.1.1. Methanogenic bacteria and biogas
2.1.2. Microbial hydrogen production
2.1.3. Conversion of sugars to alcohol Gasohol

UNIT III

3.1. Microbiological quality of food and water.
3.2. Environmental monitoring (Physical and Chemical)
3.3. Biological analysis, Biosensors.
3.4. Treatment of municipal waste and industrial effluents (Solid & Liquid)., Biofertilizers
1.5. Bioremediation of soil & water contaminated with oil spills, heavy metals and

detergents. Degradation of lignin and cellulose using microbes. Phyto-remediation.

UNIT IV

4.3. Environmental significance of genetically modified microbes ,plants and animals. *Thuringiensis* toxin as a natural pesticide,

4.4. Bioleaching, Enrichment of ores by microorganisms (Gold, Copper and Uranium),

4.5. Role of symbiotic and asymbiotic nitrogen fixing bacteria in enrichment of soil. Algal and fungal biofertilizers (VAM). Vermiculture.

SUGGESTED READINGS

1. Environmental Science, S.C. Santra
2. Environmental Biotechnology, Pradipta Kumar Mohapatra
3. Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
4. Waste Water Engineering, Metcalf and Eddy, Tata McGraw hill
5. Agricultural Biotechnology, S.S. Purohit
6. Environmental Microbiology : Methods and Protocols, Alicia L. Ragout De Spencer, John F.T. Spencer
7. Introduction to Environmental Biotechnology, Milton Wainwright
8. Principles of Environmental Engineering, Gilbert Masters
9. Wastewater Engineering – Metcalf & Eddy

BIO-H-DSE-501A&502-P PLANT BIOTECHNOLOGY & ENVIRONMENTAL BIOTECHNOLOGY PRACTICAL

Credit - 04 **Lectures - 60** **F.M - 40** **Time - 03 Hrs.**

1. Preparation of simple growth nutrient (knop's medium), full strength, half strength, solid and liquid.
2. Preparation of complex nutrient medium (Murashige & Skoog's medium)
3. To selection, sterilize and prepare an explant for culture.
4. Significance of growth hormones in culture medium.
5. To demonstrate various steps of Micropropagation.
6. Calculation of Total Dissolved Solids (TDS) of water sample.
7. Calculation of BOD of water sample.
8. Calculation of COD of water sample.
9. Bacterial Examination of Water by MPN Method.

BIO-H-DSE-501A&502A-P **PLANT BIOTECHNOLOGY & ENVIRONMENTAL BIOTECHNOLOGY PRACTICAL EXAMINATION**

F.M - 40 **Time - 03 Hrs.**

All questions are compulsory.

01. To prepare complex nutrient medium (Murashige & Skoog's medium) **10**

OR

To sterilize and prepare an explant for plant tissue culture

02. To calculate Total Dissolved Solids (TDS) of water sample. **08**

OR

To Bacterial examine the presence of bacteria in Water by MPN Method.

03. Spotting **2x5 = 10**

04. Model & Practical Record **06**

05. Viva-Voce **06**

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-DSE-502B-T **FIFTH SEMESTER**

CREDIT – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

INTELLECTUAL PROPERTY RIGHTS (IPR), BIOETHICS AND BIOSAFETY

UNIT I

1. 1 Introduction to Indian Patent Law.
1.2 World Trade Organization and its related intellectual property provisions.
1.3 Intellectual/Industrial property and its legal protection in research, design and development.
1.4 Patenting in Biotechnology, economic, ethical and depository considerations.
1.5 Patents- objectives, rights, procedure of obtaining and working of patents, infringement.

1.6. Copyrights - works protected under copyright law, rights, transfer of copyright.

UNIT II

2.1 Entrepreneurship: Selection of a product, line, design and development processes, economics on material and energy requirement, stock the product and release the same for making etc.
2.2 The basic regulations of excise: Demand for a given product, feasibility of its production under given constraints of raw material, energy input, financial situations export potential etc.

UNIT III (BIOETHICS AND BIOSAFETY)

3.1 Bioethics – Necessity of Bioethics,

3.2 Different paradigms of Bioethics – National & International.
3.3 Ethical issues against the molecular technologies.
3.4 Biosafety– Introduction to biosafety and health hazards concerning biotechnology.
3.5 Introduction to the concept of containment level and Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).

UNIT IV

Biotechnology and Intellectual Property Rights

4.1. Plant varieties protection- Rights of farmers, breeders and researchers, National gene International union for the protection of new varieties of plants (UPOV), protection of plant bank, varieties and farmers' rights act, 2001
4.2. Animal breeder's rights, patenting animal breeds: Example of Animal patents (Dolly the cloned sheep, Super-salmon, Sex-selection in Animals, genetically manipulated dairy cows)
4.3. Patenting microbes and organisms - Novelty, International Depository Authorities (IDAs), submitting details of the deposit.
4.4 Patenting genes - Pros and cons, ethics, examples
4.5. Patenting markers and variants - examples

PRACTICALS

1. Proxy filing of Indian Product patent
2. Proxy filing of Indian Process patent
3. Planning of establishing a hypothetical biotechnology industry in India
4. A case study on clinical trials of drugs in India with emphasis on ethical issues.
5. Case study on women health ethics.
6. Case study on medical errors and negligence.
7. Case study on handling and disposal of radioactive waste.

SUGGESTED READINGS

1. An Introduction to Ethical, Safety and Intellectual Property Rights Issues in Biotechnology" by Padma Nambisan
2. IPR, Biosafety and Bioethics" by Goel and Parashar
3. enetically Modified Crops and Agricultural Development (Palgrave Studies in Agricultural Economics and Food Policy)" by MatinQaim
4. Biosafety and Bioethics" by Rajmohan Joshi

PRACTICALS

1. Proxy filing of Indian Product patent
2. Proxy filing of Indian Process patent

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-DSE-502C-T **FIFTH SEMESTER**

CREDIT – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

MEDICAL MICROBIOLOGY

UNIT I

1.1. Introduction: Normal microflora of human body, nosocomial infections, carriers, septic shock, septicemia, pathogenicity, virulence factors, toxins, biosafety levels.

1.2. Morphology, pathogenesis, symptoms, laboratory diagnosis, preventive measures and Chemotherapy of gram positive bacteria: *S. aureus, C. tetani, C. botulinum, C. diphtheria, M. tuberculosis.*

UNIT II

2.1. Morphology, pathogeneis, symptoms, laboratory diagnosis, preventive measures and Chemotherapy caused by gram negative bacteria: *E.coli, S. typhi, S. dysenteriae, H. influenzae, V. cholerae, M. pneumoniae, Rickettsiaceae.*

UNIT III

3.1. Diseases caused by viruses-Picornavirus, Orthomyxoviruses, Paramyxoviruses,

Rhabdoviruses, Reoviruses, Pox virus, Herpes virus,

3.2. Retro viruses (including HIV/AIDS) and Hepatitis viruses.

UNIT IV

4.1. Fungal and Protozoan infections.
4.2. Dermatophytoses (Trichophyton, Microsporun and Epidermophyton)
4.3. Subcutaneous infection (Sporothrix, Cryptococcus),
4.4 Gastrointestinal infections (Amoebiasis, Giardiasis),
4.5. Blood-borne infections (Leishmaniasis, Malaria)

SUGGESTED READINGS

1. Brooks GF, Carroll KC, Butel JS and Morse SA. (2007). Jawetz, Melnick and Adelberg's Medical Microbiology. 24th edition. McGraw Hill Publication.
2. Goering R, Dockrell H, Zuckerman M and Wakelin D. (2007). Mims' Medical Microbiology. 4th edition. Elsevier. .
3. Willey JM, Sherwood LM, and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. 7th edition. McGraw Hill Higher Education.

PRACTICALS

Credit - 02 **Lectures - 30** **F.M - 20** **Time - 03 Hrs**

1. Identification of pathogenic bacteria (any two) based on cultural, morphological and biochemical characteristics.
2. Growth curve of a bacterium.
3. To perform antibacterial testing by Kirby-Bauer method.
4. To prepare temporary mounts of Aspergillus and Candida by apprpriate staining.
5. Staining methods: Gram's staining permanent slides showing Acid fast staining, Capsule staining and spore staining.

BIO-H-DSE-502C-P MEDICAL MICROBIOLOGY PRACTICAL EXAMINATION

F.M - 20 **Time - 03 Hrs**

All question are compulsory

To perform antibacterial testing by Kirby-Bauer method.

OR

To prepare temporary mounts of *Aspergillus* and *Candida* by appropriate staining.

Spotting
Model & Practical Record
Viva-Voce

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-C-613-T **SIXTH SEMESTER**

CREDIT – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

MICROBIAL AND PLANT PHYSIOLOGY

UNIT I

1.1. Nutritional classification of microorganisms based on carbon, energy and electron sources

1.2. Metabolite Transport

1.2.1. Diffusion: Passive and facilitated
1.2.2. Primary active and secondary active transport
1.2.3. Group translocation (phosphotransferase system), symport, antiport and uniport, electrogenic and electro neutral transport, transport of Iron.

UNIT II

2.1. Effect of the environment on microbial growth

2.1.1. Temperature- temperature ranges for microbial growth, Classification based on temperature ranges and adaptations
2.1.2. pH-classification based on pH ranges and adaptations
2.1.3. Solutes and water activity
2.1.4. Oxygen concentration
2.1.5. Radiation
2.1.6. Pressure

2.2. Chemolithotrophic metabolism, Physiological groups of aerobic and anaerobic

chemolithotrophs.
2.3. Hydrogen oxidizing bacteria
2.4. Methanogens

UNIT III

3.1. Photosynthesis
- 3.1.1. Photosynthetic pigments,
- 3.1.2. Anoxygenic and oxygenic photosynthesis,
- 3.1.3. Concept of two photo systems.

3.2. Light reactions
- 3.2.1. Cyclic and non-cyclic photophosphorylation
- 3.2.2. Physiology of bacterial photosynthesis

3.3. Dark reaction
- 3.3.1. Calvin cycle
- 3.3.2. C_4 cycle
- 3.3.3. Photorespiration
- 3.3.4. CAM pathway
- 3.3.5. Compensation point

UNIT IV

4.1. Nitrogen metabolism-
- 4.1.1. Inorganic & molecular nitrogen fixation
- 4.1.2. Nitrate reduction
- 4.1.3. Ammonium assimilation in plants

4.2. Growth and development:
- 4.2.1. Definitions, phases of growth and growth curve
- 4.2.2. Growth hormones (auxins, gibberellins, cytokinins, abscisic acid, ethylene), Physiological role and mode of action.
- 4.2.3. Seed dormancy
- 4.2.4. Seed germination,
- 4.2.5. Concept of photoperiodism
- 4.2.6. Vernalization

Practicals:

Credit - 04 **Lectures - 60** **F.M - 40** **Time - 03 Hrs.**

1. Native gel electrophoresis of proteins
2. SDS-polyacrylamide slab gel electrophoresis of proteins under reducing conditions.
3. Preparation of the sub-cellular fractions of rat liver cells.
4. Preparation of protoplasts from leaves.
5. Separation of amino acids by paper chromatography.
6. To identify lipids in a given sample by TLC.
7. To verify the validity of Beer's law and determine the molar extinction coefficient of NADH
8. Separation of photosynthetic pigments by paper chromatography.

9. Demonstration of aerobic respiration.
10. Preparation of root nodules from a leguminous plant.
11. To study and plot the growth curve of *E coli* using turbidometric method and to calculate specific growth rate and generation time.
12. To study and plot the growth curve of *Aspergillus niger* by radial growth measurements.
13. To study the effect of pH on the growth of *E. coli.*

SUGGESTED READINGS

1. Alexopoulos CJ, Mims CW, and Blackwell M. (1996). Introductory Mycology. 4 th edition. John and Sons, Inc.
2. Jay JM, Loessner MJ and Golden DA. (2005). *Modern Food Microbiology*. 7thedition, CBS Publishers and Distributors, Delhi, India.
3. Kumar HD. (1990). Introductory Phycology. 2nd edition. Affiliated East Western Press.
4. Hopkins, W.G. and Huner, P.A. 2008 Introduction to Plant Physiology. John Wiley and Sons.
5. Mauseth, J.D. 1988 Plant Anatomy. The Benjammin/Cummings Publisher, USA.
6. Nelson, D.L., Cox, M.M. 2004 Lehninger Principles of Biochemistry, 4^{TH} edition, W.H. Freeman and Company, New York, USA.
7. Salisbury, F.B. and Ross, C.W. 1991 Plant Physiology, Wadsworth Publishing Co. Ltd.
8. Taiz, L. and Zeiger, E. 2006 Plant Physiology, 4^{TH} edition, Sinauer Associates Inc .MA, US

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-C-614-T **SIXTH SEMESTER**

CREDIT – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

BIOSTATISTICS AND BIOINFORMATICS

UNIT I

1.1**. Biostatistics**: An introduction.

1.2. **Collection and Representation of data:**

1.2.1 Collection of data and sampling methods.
1.2.3. Types of Data- Primary & Secondary data.
1.2.4.Graphical representation of Statistical data.
1.2.5. Measures of central tendency- Mean, Median and Mode.
1.2.6. Measures of central Dispersion- Mead Deviation and Standard Deviation
1.2.7. Measures of Skewness and Kurtosis.

1.3 Probability

1.3.1 Probability classical & axiomatic definition of probability,
1.3.2 Theorems on total and compound probability),
1.3.3 Elementary ideas of Binomial, Poisson and Normal distributions.

UNIT II

2.1 testing of hypothesis

2.1.1 confidence level, critical region,
2.1.2 large sample(Z test)and small sample(t- test).
2.1.3 Problems on test of significance, t-test, chi-square test for goodness of fit and
2.1.4 Analysis of variance (ANOVA)

2.2 Correlation

2.3 Regression lines and Equation
2.4 Emphasis on examples from Biological Sciences.

UNIT III

3.1 History of Bioinformatics.
3.2 Sequence Information Sources(databases)- EMBL,GENBANK, NCBI and OMIM.
3.3 Searching Databases: SRS, Entrez, Sequence Similarity Searches-BLAST, FASTA, Data Submission.
3.4Sequence similarity- Global/ local , Pairwise Alignments, Multiple Sequence Alignment(CLustal W)

UNIT IV

4.1 Protein Information Sources, PDB, SWISSPROT, TREMBL,
4.2 Literature databases – PubMed
4.3 Understanding the structure of each source and using it on the web.
4.4 Sequence and Phylogeny analysis,

PRACTICALS

1. Sequence information resource NCBI
2. Understanding and use of various web resources: EMBL, Genbank, Entrez,Protein information resource (PIR)
3. Understanding and using: PDB, Swissprot, TREMBL
4. Using various BLAST and interpretation of results.
5. Retrieval of information from nucleotide databases.
6. Sequence alignment using BLAST.
7. Multiple sequence alignment using Clustal W.

SUGGESTED READINGS

1. Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications. Oxford University Press.
2. Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley-Blackwell.
3. Campbell A. M., Heyer L. J. (2006) Discovering Genomics, Proteomics and Bioinformatics. II Edition. Benjamin Cummings.

BIO-H-C-613-P & 614-P MICROBIAL PHYSIOLOGY/ BIOSTATISTICS AND BIOINFORMATICS PRACTICAL

1. Based on graphical Representation
2. Based on measures of Central Tendency & Dispersion
3. Based on Distributions Binomial Poisson Normal
4. Based on t, f, z and Chi-square
5. Sequence information resource
6. Understanding and use of various web resources: EMBL, Genbank, Entrez, Unigene, Protein
7. Understanding and using: PDB, Swissprot, TREMBL

8. Using various BLAST and interpretation of results.
9. Sequence alignment using BLAST.
10. Multiple sequence alignment using Clustal W

BIO-H-C-613&614-P **MICROBIAL PHYSIOLOGY & BIOSTATISTICS AND BIOINFORMATICS PRACTICAL EXAMINATION**

F.M - 40 **Time - 03 Hrs.**

All questions are compulsory.

01. To Determine blood groups in given sample . **10**

OR

To Determine Haemoglobin in given sample.

02. To Understand and use of web resources: EMBL, or Genbank. **08**

OR

To prepare graphical Representation based on given data.

03. Spotting **2x5 = 10**
04. Model & Practical Record **06**
06. Viva-Voce **06**

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-DSE-603A-T **SIXTH SEMESTER**

CREDIT – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

ANIMAL BIOTECHNOLOGY

UNIT I

1.1 Gene transfer methods in Animals
- 1.1.1– Microinjection,
- 1.1.2 Embryonic Stem cell,
- 1.1.3 gene transfer,Retrovirus & Gene transfer.

UNIT II

2.1 Introduction to transgenesis.
2.1.1 Transgenic Animals – Mice, Cow, Sheep .
2.1.2 Animal diseases need help of Biotechnology –
- Foot-and mouth disease,
- Coccidiosis,
- Trypanosomiasis.

UNIT III

3.1Cloning and expression of foreign genes in animal cells:
- 3.1.1. Expression vectors.
- 3.1.2. Over production and preparation of the final product i.e. expressed proteins.
- 3.1.3. Production of vaccines in animal cells.
- 3.1.4. Hybridoma Technology: Production of monoclonal antibodies and their applications.

UNIT IV

4.1 Animal propagation
- 4.1.1– Artificial insemination,
- 4.1.2 Animal Clones.

4.2 Conservation Biology –
- 4.2.1Embryo transfer techniques.
- 4.2.2 Introduction to Stem Cell Technology and its applications.

4.3 Genetic modification in Medicine –
- 4.3.1 gene therapy, types of gene therapy,
- 4.3.2 vectors in gene therapy,

4.4 Molecular engineering- human genetic engineering, problems & ethics.

PRACTICALS

1. Sterilization techniques: Theory and Practical: Glass ware sterilization, Media sterilization, Laboratory sterilization
2. Sources of contamination and decontamination measures.
3. Preparation of Hanks Balanced salt solution
4. Preparation of Minimal Essential Growth medium
5. Isolation of lymphocytes for culturing
6. DNA isolation from animal tissue
7. Quantification of isolated DNA.
8. Resolving DNA on Agarose Gel.

SUGGESTED READINGS

1. Brown, T.A. (1998). Molecular biology Labfax II: Gene analysis. II Edition. Academic Press, California,USA.
2. Butler, M. (2004). Animal cell culture and technology: The basics. II Edition. Bios scientific publishers.
3. Glick, B.R. and Pasternak, J.J. (2009). Molecular biotechnology- Principles and applications of recombinant DNA. IV Edition. ASM press, Washington, USA.
4. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An introduction to genetic analysis. IX Edition. Freeman & Co., N.Y., USA.
5. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNAgenes and genomes- A short course. III Edition. Freeman and Co., N.Y., USA.

BIO-H-DSE-603A-P ANIMAL BIOTECHNOLOGY PRACTICAL

Credit - 02 Lectures - 30 F.M - 20 Time - 03 Hrs.

1. Sterilization techniques: Theory and Practical: Glass ware sterilization, Media Sterilization, Laboratory sterilization
2. Sources of contamination and decontamination measures.
3. Preparation of Hanks Balanced salt solution
4. Preparation of Minimal Essential Growth medium
5. DNA isolation from animal tissue
6. Quantification of isolated DNA.
8. Resolving DNA on Agarose Gel.

BIO-H-DSE-603A-P ANIMAL BIOTECHNOLOGY PRACTICAL EXAMINATION

F.M - 20 **Time - 03 Hrs.**

All question are compulsory.

01. To Prepare Hanks Balanced salt solution. **10**

OR

To Prepare Minimal Essential Growth medium.

02. Spotting **04**

03. Model & Practical Record **03**

04. Viva-Voce **03**

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-DSE-603B-T **SIXTH SEMESTER**

CREDIT – 04	LECTURES – 60
TIME – 03 HRS	F.M: 60

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

MOLECULAR DIAGNOSTICS

UNIT I

1.1. **Enzyme Immunoassays:**

1.1.1. Comparison of enzymes available for enzyme immunoassays, conjugation of enzymes.

1.1.2. Solid phases used in enzyme immunoassays.

1.1.3. Homogeneous and heterogeneous enzyme immunoassays.

1.1.4. Enzyme immunoassays after immuno blotting.

1.1.5. Enzyme immuno histochemical techniques.

1.1.5. Use of polyclonal or monoclonal antibodies in enzymes immuno assays.

1.1.6. Applications of enzyme immunoassays in diagnostic microbiology

UNIT II

2.1**. Molecular methods in clinical microbiology**

2.1.1. Applications of PCR, RFLP, Nuclear hybridization methods, Single nucleotide polymorphism and plasmid finger printing in clinical microbiology

2.1.2. Laboratory tests in chemotherapy:

2.1.3. Susceptibility tests: Micro-dilution and macro-dilution broth procedures.

2.1.4. Susceptibility tests: Diffusion test procedures.

2.1.5. Susceptibility tests: Tests for bactericidal activity.

2.1.6. Automated procedures for antimicrobial susceptibility tests.

UNIT III

3.1. Automation in microbial diagnosis, rapid diagnostic approach including technical purification and standardization of antigen and specific antibodies.

3.1.1. Concepts and methods in idiotypes.

3.1.2 .Antiidiotypes and molecular mimicry and receptors.

3.1.3. Epitope design and applications.

3.1.4. Immunodiagnostic tests.

3.1.5. Immune florescence

3.1.6. Radioimmunoassay.

UNIT IV

4.1. GLC

4.2. HPLC

4.3. Electron microscopy

4.4. Flowcytometry

4.5 Cell sorting

SUGGESTED READINGS

1. Practical Biochemistry, Principles and Techniques, Keith Wilson and John Walker
2. Bioinstrumentation, Webster
3. Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes, J.F. Van Impe, Kluwer Academic
4. Ananthanarayan R and Paniker CKJ. (2005). Textbook of Microbiology. 7th edition (edited by Paniker CKJ). University Press Publication.
5. Brooks GF, Carroll KC, Butel JS and Morse SA. (2007). Jawetz, Melnick and Adelberg's Medical Microbiology. 24th edition. McGraw Hill Publication.
6. Goering R, Dockrell H, Zuckerman M and Wakelin D. (2007). Mims' Medical Microbiology. 4th edition. Elsevier.
7. Joklik WK, Willett HP and Amos DB (1995). Zinsser Microbiology. 19th edition. Appleton-Centuary-Crofts publication.
8. Willey JM, Sherwood LM, and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. 7th edition. McGraw Hill Higher Education.
9. Microscopic Techniques in Biotechnology, Michael Hoppert.

BIO-H-DSE-603B-P **PRACTICAL**

Credit - 02 **Lectures - 30** **F.M - 20** **Time - 03 Hrs**

(Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.)

1. Perform/demonstrate RFLP and its analysis
2. Kirby-Bauyer method (disc-diffusion method) to study antibiotic sensitivity of a bacterial culture
3. A kit-basd detection of a microbial infection (Widal test)
4. Study of Electron micrographs (any four).
5. Perform any one immuno diagnostic test (Typhoid, Malaria, Dengue)

BIO-H-DSE-603B-P MOLECULAR DIAGNOSTICS PRACTICAL EXAMINATION

F.M - 20 **Time - 03 Hrs**

All questions are compulsory.

01. To study antibiotic sensitivity of a bacterial culture by Kirby-Bauyer method (disc-diffusion method) **10**

OR

To Perform any one immuno diagnostic test (Typhoid, Malaria, Dengue)

02. Spotting **04**

03. Model & Practical Record **03**

04. Viva-Voce **03**

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-DSE-603C-T **SIXTH SEMESTER**

CREDIT – 04	**LECTURES – 60**
TIME – 03 HRS	**F.M: 60**

Instructions to Question setter- There will be two group of questions . Five questions to be answered out of nine questions. Group A is compulsory and will contain two questions. Question no. 1 (A) will be MCQ of 1 mark each (six questions). Question No.1 (B) will be short answer type to be answered in about 50 words of 3 marks (2 questions). Group B will contain descriptive type eight questions of twelve marks each, out of which any four questions are to answer. Each question carries 12 marks.

ANIMAL DIERSITY II

UNIT I

1. Proto-chordates, Pisces and Ambhibia

1.1. Proto-chordates:

1.1.1. Outline of classification, General features and important characters of *Herdmania, Branchiostoma*

1.1.2. Origin of Chordates Pisces: Migration in Pisces,

1.1.3. Outline of classification Amphibia: Classification,

1.1.4. Origin, Parental care, Paedogenesis

UNIT II

2. Reptilia, Aves and Mammalia

2.1. Reptelia: Classification, Origin

2.2. Aves: Classification, Origin, flight- adaptations, migration

2.3. Mammalia: Classification, Origin, dentition

UNIT III

3. Comparative anatomy of vertebrates I

3.1. Comparative anatomy of various systems of vertebrates:

3.2. Integumentary,

3.3. Digestive respiratory systems.

UNIT IV

4. Comparative anatomy of vertebrates II

4.1. Comparative Anatomy of vertebrates – Heart, Aortic arches, Kidney & urinogenital System, Brain, Eye, Ear. Autonomic Nervous system in Mammals

SUGGESTED READING

1. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.
2. Kardong, K.V. (2005) Vertebrates Comparative Anatomy, Function and evolution. IV Edition. McGraw-Hill Higher Education.
3. Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-HillCompanies.
4. Weichert, C.K. (1970). Anatomy of Chordate. McGraw Hill.
5. Young, J.Z. (2004). The life of vertebrates. III Edition. Oxford university press.

BIO-H-DSE-603C-P ANIMAL DIERSITY II PRACTICAL

Credit - 02 **Lectures - 30** **F.M - 20** **Time - 03 Hrs**

1. Identification & Classification upto order of the following:
   Proto-chordata: *Salpa, Doliolum, Herdmania, Branchiostoma*
   Cyclostomata*: Myxine, Petromyzon*
   Chondrichthyes: *Scoliodon, Zygnea, Pristis, Trygon, Raja, Chimaera*
   Ostiechthyes: *Labeo, Mystus, Catla, Hippocampus, Anabas, Echeneis, Lophius, Polypeterus*
   Amphibia: *Rana, Hyla, Amblystoma, Necturus, Proteus*.
   Reptiles: *Hemidactylus, Calotes, Draco, Phrynosoma, Naja Vipera, Bungarus*
   Aves*: Columba, Alcedo, Passer*
   Mammalia: *Ornithorhynchus, Macropus, Didelphes, Dasypus*

2. An Ecological Note on any one of the specimens in Experiment 1
3. Identification of the following slides
   Mammalian Histology: Liver, Lung, Intestine, Kidney, Ovary, Testes
   Slides of *Salpa, Doliolum,* Spicules of *Herdmania*, Tadpole of Frog
4. Preparation of a permanent mount of *Salpa*, Placoid scales, spicules of *Herdmania,* Pharynax of *Amphioxus*, Tadpole Larva of frog

5. Identification of endoskeletons of frog and rabbit.

BIO-H-DSE-603C-P ANIMAL DIERSITY II PRACTICAL EXAMINATION

F.M - 20 **Time - 03 Hrs**

All question are compulsory

0.1. To Identify the following slides of *Salpa, Doliolum,* Spicules of *Herdmania*, Tadpole of Frog. **10**

OR

To identify endoskeletons of frog and rabbit.

02. Spotting **04**

03. Model & Practical Record **03**

04. Viva-Voce **03**

B.Sc. (HONS.) BIOTECHNOLOGY

BIO-H-DSE-604- DISSERTATION **SIXTH SEMESTER**

BIO-H-DSE-604- DISSERTATION	DISSERTATION	PERSENTATION
	70	30

(DISSERTATION / PROJECT /ON THE JOB TRANING)

Dissertation of the project work to be carried out by the candidates either in the departmental laboratory or other suitable industries/ institutions/ laboratories to have real on the spot knowledge by technological applications of biotechnological skills.

The dissertation / project /on the job training should be submitted in bound form for evaluation

Presentation and defense of project works: Students will be judged on the basis of

1. Quality of work
2. Preparation of dissertation
3. Delivery and quality of talk
4. Defense in response to audience queries