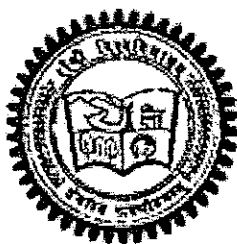


Ranchi Women's College,
(An autonomous Unit under Ranchi University)



Syllabus
for
B.Sc. Biotechnology Honours Course
(Three year degree course)
Session – 2015-2017

Year	Semester	Theory Papers			Practical Paper		
		Paper	Marks	Total Marks	Paper	Marks	Total Marks
P A R T - I	First	I	75	300	PR-01	25 + 25=50	100
		II	75				
	Second	III	75				
		IV	75				
P A R T - II	Third	V	75	300	PR-03	25 + 25=50	100
		VI	75				
	Fourth	VII	75				
		VIII	75				
P A R T - III	Fifth	IX	100	600	PR-05	100	200
		X	100				
		XI	100				
	Sixth	XII	100				
		XIII	100				
		XIV	100				

Total theory papers – 14
Total marks in theory papers – 1200

Total practical papers - 6
Total marks in practical papers – 400

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Department of Biotechnology

SUMMARY CHART of SYLLABUS for B.Sc. Biotech Hons. Course

YEAR	SEMESTER	PAPER	SUBJECTS	FULL MARKS	MID SEM	END SEM
P A R T I	FIRST	BTCH-H01	Math + Biostat & computer	75	10+5	60
		BTCH-H02	Biochemistry	75	10+5	60
		PR-01	Biochemical techniques	50		50
	SECOND	BTCH-H03	Genetics	75	10+5	60
		BTCH-H04	Microbiology	75	10+5	60
		PR-02	Microbiological techniques	50		50
P A R T II	THIRD		ON JOB TRAINING			
		BTCH-H05	Cell Biology	75	10+5	60
		BTCH-H06	Molecular biology	75	10+5	60
		PR-03	Methods in Molecular & Cellular Biology	50		50
	FOURTH	BTCH-H07	Immunology	75	10+5	60
		BTCH-H08	Genetic Engineering / RDT	75	10+5	60
P A R T III	FIFTH	BTCH-H09	Animal Biotechnology	100	15+5	80
		BTCH-H10	Plant Biotechnology	100	15+5	80
		BTCH-H11	Biophysics, Instrumentation and Bioinformatics	100	15+5	80
		PR-12	Culture techniques in plant Culture techniques in animal	100		100
	SIXTH	BTCH-H13	Environmental Biotechnology	100	15+5	80
		BTCH-H14	A. EDP B. IPR	50 50	15+5	80
		BTCH-H15	Industrial Biotechnology	100	15+5	
		PR-16	Project + Lab	1000		

FULL HONS. MARKS – 1600

Note:-

SUBSIDIARY PAPERS (For Semester-I, II, III & IV):

Compulsory – Chemistry (Full marks in Theo. – 300, Full marks in Pract. – 100)

Optional – Botany / Zoology (Full marks in Theo. – 300, Full marks in Pract. – 100)

Compulsory Paper (For Semester-I, II, III & IV) :

Alt. English or MIL Hindi (Full Marks 400)

Compulsory Paper (For Semester-V & VI) : Environmental Studies & Ethics (Full Marks - 200)

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B. Sc. Honours in Biotechnology Part – I

Semester – I

Paper – BTCH- 01, Maths, Biostatistics & Computer (20+8+12=40 lectures)

Full Marks: 15 (MSE) + 60 (ESE) = 75 Time: 2½ Hrs. Pass Marks: 34

Instructions for question setter for Maths and Biostatistics

1. The question paper will be of 35 marks and divided into three groups .

Group I :- Very short answer. (5 questions of 2 marks each) $5 \times 2 = 10$

Group II :- Short answer (4 questions of 2.5 marks each) $4 \times 2.5 = 10$

Group III :- Long answer questions .(3 questions of 5 marks each) $3 \times 5 = 15$

2. For group I , II & III , it is the right of paper setter , whether to give any choice or not.

3. All questions must cover the entire syllabus i.e. all units with equal distribution of marks as far as practicable.

Maths

Unit 1 : The set theory, properties of subsets

Unit 2 : Linear and geometric functions

Limits of functions , derivatives of functions

Unit 3 : The binomial theorem ,Logarithm

Unit 4 : a). Differentiation

Differentiation by first principle, Derivative of the product of function, Chain rule, implicit differentiation, differentiation by trigonometrical transformations, Logarithmic differentiation, Differentiation of infinite series , Higher order derivatives, Parametric differentiations, Differentiation of one function with respect to another function.

b). Integration :

Indefinite integral: simple integration , Integration by substitution, Integration using trigonometric identities, Integration by parts, Special integration, Integration using partial functions.

Definite integral: Definite integral by substitution.

Unit 5 : Probability calculations

Reference:

1. Aggarwal R.S. (2013). Senior Secondary School Mathematics. Bharati Bhawan. 13th Ed.

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Biostatistics

Unit 6 : Methods of sampling, confidence level

Measurement of central tendencies :- Mean, Median, Mode and their properties.

Measurement of deviations :- Mean deviation and standard deviation.

Presentation of Biological data in tables, graphs, histogram and pie chart

Hypothesis testing :- t-test , chi-square test and F-test, Correlation coefficient and calculation of regression equation.

Reference :

1. Bliss , C.J.K. (1967) Statistics in biology, Vol. I Mc Graw Hill, New York.
2. Campbell R.C.(1974) Statistics for Biologists, Cambridge Univ. Press, Cambridge.
3. Daniel (1999) Biostatistics (3rd edition) Panima Publications Corporation.
4. Swardlaw, A.C. (1985) Practical statistics for Experimental Biogists, John Wiley and sons, Inc, NY
5. Khan (1999) Fundamentals of Biostatistics Publishing Corporation.

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Computer

Instructions for question setter for

The question paper will be of 25 marks and divided into four groups .

Group I :- Multiple choice questions / fill in the blanks / true or false type.

(8 questions of 1 marks each) $8 \times 1 = 8$

Group II :- Number system. $2 \times 2 = 4$

Group III :- Short answer (4 questions of 2 marks each) $4 \times 2 = 8$

Group IV :- Long answer questions .(1questions of 5 marks each) $1 \times 5 = 5$

For group I , II & III , it is the right of paper setter , weather to give any choice or not.

All questions must cover the entire syllabus with equal distribution of marks as for as practicable.

Unit 7 : Digital and Analogue computers, Number System , Signed / Unsigned Numbers , Conversion between Number Bases , 1's complement and 2's complement arithmetic ,

Unit 8 :

Hardware : Architecture of computer- Input Device, Output Device , CPU , ALU

Memory: Primary and secondary, Memory Hierarchy, RAM and its type , ROM and its type Cache memory.

Software : Types, Application and system software. Program,Algorithm,languages,automation

Operating system:- Types of operating systems. Features of Unix and Windows. Introduction to some common Application Softwares, DBMS : Introduction to Word processor .

Reference:

1. Introduction to Computer science (2015). Pearson Publication. 10th Ed.
2. Sinha P. K. Computer Fundamentals. Bpb Publications. 6th Ed.
3. Thareja Reena, (2015) Fundamentals of Computers, Oxford University Press.

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B. Sc. Honours in Biotechnology Part – I

Semester – I

Paper – II, BTCH-02, Biochemistry (40 lectures)

Full Marks: 15 (MSE) + 60 (ESE) = 75 Time: 2½ Hrs. Pass Marks: 34

Instructions to question setter and examinee

1. The question paper will be of 60 marks and divided into three groups .

Group I :- Multiple choice questions / fill in the blanks / true or false type.

(10 questions of 1 marks each) 10x1 = 10

Group II :- Definition or concept based questions (7 questions of 2 marks each). 7x2 = 14

Group III :- Brief answer questions. (4 questions of 9 marks each) 4x9 = 36

2. For group II & III, it is the right of paper setter, whether to give any choice or not.

3. All questions must cover the entire syllabus i.e. all units with equal distribution of marks as far as practicable.

Unit 1 : Water : Its structure & properties

Unit 2 : Structural Biochemistry

Composition, Structure, Function & Properties of the following biomolecules.

Carbohydrate, Protein, Lipid, Nucleic Acid

Unit 3 : Metabolism – I Glycolysis, Gluconeogenesis, Glycogenesis, Glycogenolysis, TCA cycle, Oxidative phosphorylation, ETC, Pentose Phosphate Pathway

Unit 4 : Lipid metabolism : β -Oxidation of fatty acids.

Unit 5 : Metabolisms – II Protein metabolism : Transamination, Deamination, Urea cycle

Unit 6 : Introduction to Enzymes, Nomenclature & Classification, Properties of enzymes and enzyme Kinetics, Mechanism of enzymatic action, Principle of catalysis (Acid base catalysis, Covalent bond catalysis, Metal ion catalysis), Factors affecting Enzyme Catalyzed reactions, Non protein enzymes, (Ribozymes), Co-factors, Co-enzymes and Vitamins

Unit 7 : Enzyme Regulation & Applications, Regulation (Allosteric Modulation), Inhibition (Competitive, non-Competitive & Feed Back), In-vitro application of purified Enzymes in following areas:

Food Industry & Beverages, Leather Industry, paper industries & textile industries, Medicines, Enzymes as diagnostic tool : ELISA.

Unit 8 : Protein Engineering: Introduction, objectives, examples (Improvement in stability of enzyme, protein engineering application of subtilisin & Insulin).

Reference:

1. Lehninger Albert L. (2012). Principles of Biochemistry. CBS Publishers & Distributers. 6th Edition
2. Lubert Stryer (2011). Biochemistry. Freeman International. 7th Edition.
3. Jain J.L. (2013). Fundamentals of Biochemistry. S.Chand and Company. 7th Edition
4. Deb A.C. (2001). Fundamental of Biochemistry. NCBA. 7th Edition

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5. Voet and Voet (2011). Biochemistry. John Wiley & Sons. 4th Edition
6. Satyanarayan U. (2013). Biochemistry. Elsevier India. 4th Edition
7. Harvey R.A. (2010). Lippincott's Illustrated Review: Biochemistry. Lippincott Williams & Wilkins. 5th Edition

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B. Sc. Honours in Biotechnology Part – I

Semester – I

Paper – PR-01, Biochemical Techniques(50Periods)
Full Marks: 25 (E) + 25 (I) = 50 Time: 4 Hrs. Pass Marks: 23

Pattern of practical Examination

One major experiment .	(1x12 = 12)
Spotting Five spots of 1 marks each	(1x5 = 5).
Viva voce	(5)
Record / Chart	(3)

- 1.Preparation of buffer – Acetate and phosphate
- 2.Estimation of sugar in given solution.
- 3.Estimation of sugar in biological sample
- 4.Estimation of proteins .
- 5.Estimation of DNA.
- 6.Estimation of RNA
- 7.Effect of temperature on enzymatic activity.
- 8.Chromatographic methods for separation of Amino acid/ pigment molecule of green leaf

Reference:

- Biochemical Techniques
1. Bhatnagar S.K. (2010). Lab manual in Biotechnology. Vishal Publishing Co.
 2. Jayaraman K. (2011). Lab manual in Biochemistry. New Age International Pvt. Ltd.

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B. Sc. Honours in Biotechnology Part – I

Semester – II

Paper – IV, Genetics, BTCH-03, (40 lectures)

Full Marks: 15 (MSE) + 60 (ESE) = 75 Time: 2½ Hrs. Pass Marks: 34

Instructions for question setter

1. The question paper will be of 60 marks and divided into three groups.

Group I :- Multiple choice questions / fill in the blanks / true or false type.

(10 questions of 1 marks each) $10 \times 1 = 10$

Group II :- Definition or concept based questions (7 questions of 2 marks each). $7 \times 2 = 14$

Group III :- Brief answer questions. (4 questions of 9 marks each) $4 \times 9 = 36$

2. For group II & III, it is the right of paper setter, whether to give any choice or not.

3. All questions must cover the entire syllabus with equal distribution of marks as far as practicable

Unit 1 : Mendelism & Mendelian Deviations. (Mendel's work, Laws of Heredity, Test cross & back cross, incomplete dominance & Codominance & simple problems.)

Unit 2 : Interaction of Genes. Supplementary gene – glume colour in Chulam (*Sorghum caudatum*) Modifier Supplementary gene- Comb pattern in fowl

Complimentary gene – Flower colours in sweet pea. Multiple factors (quantitative or polygenic inheritance) – Skin colour in human being. Epistasis (Different types)

Multiple allelism – Blood groups in human beings (ABO and MN system).

Duplicate gene – Seed shape in Shepherd's purse.

Unit 3 : Sex determination in plants (eg- *Coccinia Melandrium* & some exceptions)

Sex determination in animals (chromosomal theory)

Concepts of auto & crossing over XX-XY, XX-XO, ZY-ZZ, ZO-ZZ types.

Unit 4 : Linkage & Crossing Over, Coupling & repulsion Hypothesis, Linkage in Maize & *Drosophila* Mechanism of crossing over & its Importance

Unit 5 : Chromosomal aberration.

General account of structural aberration. (Duplication, Deletion, Translocation, Inversion).

Numerical aberrations & Polyploidy.

Unit 6 : Cytoplasmic inheritance.

Endosymbiotic Theory, Mitochondrial and Chloroplast Genome

Plastid inheritance in *Mirabilis*, petite characters in Yeast.

Unit 7 :

Mutations, Types – spontaneous & induced mutation, Mutagens - Physical & chemical

Mutation at molecular level, Mutations for economic benefit of man

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Unit 8 : Human Genetics –Karyo -type in man , Evolution of Sex-chromosome in man ,Inherited Disorder allosomal- Klinefilter's syndrome & Turner's syndrome , Autosomal - Down's syndrome (non disjunction) & Cri du chat syndrome ,

Unit 9 : Population Genetics – Hardy Weinberg Law ,Calculating gene frequency.

Reference :

Genetics

1. Gardener, Simmons, Snustad. (2006). Principles of Genetics. John Wiley & Sons. 8th Ed.
2. Tamarin R. H. (2004). Principles of Genetics. McGraw Hill Companies. 7th Ed.
3. Griffith A.J.F. (2008). An Introduction to Genetic Analysis. W.H. Freeman. 9th Ed.
4. Gupta P.K.(2014-15). Genetics. Rastogi Publication. 4th Ed.

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B. Sc. Honours in Biotechnology Part – I

Semester – II

Paper – V, BTCH-04 , Microbiology (40 lectures)
Full Marks: 15 (MSE) + 60 (ESE) = 75 Time: 2½ Hrs. Pass Marks: 34

Instructions for question setter

1. The question paper will be of 60 marks and divided into three groups .

Group I :- Multiple choice questions / fill in the blanks / true or false type.

(10 questions of 1 marks each) 10x1 = 10

Group II :- Definition or concept based questions (7 questions of 2 marks each). 7x2 = 14

Group III :- Brief answer questions. (4 questions of 9 marks each) 4x9 = 36

2. For group II & III , it is the right of paper setter , whether to give any choice or not.

3. All questions must cover the entire syllabus i.e. all units with equal distribution of marks as far as practicable.

Unit 1 : Introduction and Scope of Microbiology

Definition and history of microbiology, contributions of Antony van Leeuwenhoek, Louis Pasteur, Robert Koch. Importance and scope of Microbiology as a modern Science

Unit 2 : Microscopy, Construction and working principles of different types of microscopes – Compound, Dark field, Phase contrast, Fluorescence and Electron (Scanning and Transmission) Confocal Microscopy, 3-D imaging

Unit 3 : Microbial Techniques

A) Sterilization: Principles and Applications of

a. Physical Methods. Autoclave, Hot air oven, Seitz filter, Sintered glass filter, and membrane filter.

b. Chemical Methods: Alcohol, Aldehydes, Phenols, Halogens and Gaseous agents

c. Radiation Methods: UV rays and Gamma rays.

B) Media preparation : Nutrient agar / Broth , Mc Conkey agar, PDA

Laminar airflow and Plating techniques.

C) Stains and Staining Techniques: Principles of staining, Types of stains – simple stains structural stains and Differential stains, acid fast stain , Negative stain

Unit 4 : Microbial Taxonomy

Concept of microbial species and strains, classification of bacteria based on – morphology (shape and flagella), respiration , nutrition & replica plating technique.

Unit 5 : A. Bacteria – Ultrastructure of bacterial cell (both Gram positive and Gram negative) including endospore and capsule , Microbial growth , growth Curve , Condition effecting growth

B. Bacterial Reproduction : (Gene transfer in Bacteria) Transformation, Conjugation & Transduction.

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Unit 6 : General Account of Viruses and Bacteria

A. Viruses – Structure of λ phage , M13 , Plant Viruses – CauMV (Cauliflower mosaic viruses)
Animal viruses – Hepatitis B , Mycoplasma (PPLO)

**Unit 7 : Eukaryotic microorganisms - General characteristics of fungi, algae and protozoa ,
Microbes in extreme environment:- Mesophile , alkalophile , thermophile.**

Unit 8 : Pathogenic Microorganisms (causative agents and symptoms only)

A. Bacterial diseases of man – Tetanus, Tuberculosis, Pneumonia and Cholera

B. Viral diseases: Hapatitis, Polio, SARS, AIDS (HIV)

C. Antimicrobial Compounds (Antibiotics and antiviral compounds)

REFERENCE:

1. Pelczar, Chan, Reid , (1998) Text Book of Microbiology ,Tata McGraw Hill Publications.
2. Ketchum A. (2012) Microbiology – concepts and application Wiley Publications
3. Bisen P.S. (2012) Frontiers in Microbial technology CBS Publishers
4. Powar. C.B .Daginawala, H.F. General Microbiology fifth Ed. Himalayan Publishing House.
5. Prescott. Harly, Klein Microbiology , fifth Ed, Tata McGraw Hill Publications.
6. Sharma P.D. (2009) Microbiology Rastogi Publication.
7. Tortora G.J. ,Microbiology- An Introduction Fifth Ed. Benjaming Cummings.

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B. Sc. Honours in Biotechnology Part – I

Semester – II

Paper – PR-02, Microbiology Techniques(50Periods)
Full Marks: 25 (E) + 25 (I) = 50 Time: 4 Hrs. Pass Marks: 23

Pattern of practical Examination

One major Experiment .	(1x12 = 12)
Spotting : Five spots of 1marks each	(1x5 = 5)
Viva voce	(5)
Record / Chart	(3)

- 1.Safety measures in microbiology Laboratory .
2. Cleaning and sterilization of glass ware.
3. Study of instruments : Autoclave , Hot air oven , pH meter Laminar air flow cabinet , Incubator .
4. Media preparation : Nutrient agar , Nutrient broth , Mc Conkey's agar, Potato Dextrose agar
5. Plating techniques
- 6.Isolation of Microorganism from air , water and soil samples.
- 7.Staining Techniques :- Simple, Gram Staining
8. Antibiotic Sensitivity.
- 9.Growth curve of Microorganism.
- 10.Isolation of microorganisms by serial dilution method.

Reference:

1. Cappucino J.C & Sherman. N.(2013) Microbiology – A Laboratory Manual by. 10th.Ed.
2. Arora . R. (2005) Modern techniques in Microbiology, IBD ,Anmol Publication. Deharadun

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B. Sc. Honours in Biotechnology Part – II

Semester – III

Paper –BTCH-05 , Cell biology (40 lectures)

Full Marks: 15 (MSE) + 60 (ESE) = 75 Time: 2½ Hrs. Pass Marks: 34

Instructions for question setter

1. The question paper will be of 60 marks and divided into three groups .

Group I :- Multiple choice questions / fill in the blanks / true or false type.

(10 questions of 1 marks each) $10 \times 1 = 10$

Group II :- Definition or concept based questions (7 questions of 2 marks each). $7 \times 2 = 14$

Group III :- Brief answer questions. (4 questions of 9 marks each) $4 \times 9 = 36$

2. For group II & III , it is the right of paper setter , whether to give any choice or not.

3. All questions must cover the entire syllabus i.e. all units with equal distribution of marks as far as practicable.

Unit 1 : Cell as a basic unit of living systems

Precellular evolution : artificial creation of “cells” , Discovery of cell , The cell theory

Difference between Plant Cell and Animal Cell

Ultra Structure of Prokaryotic and Eukaryotic cell.

Unit 2 : Membrane structure and function

Structure of model membrane, Lipid bilayer & membrane protein ,

Diffusion, Osmosis, cell wall.

Unit 3 : Structure and Function of cell organelles – Endoplasmic reticulum , Golgi complex , Ribosomes , Lysosomes , Peroxisomes , Nucleus , Vacuole , Cytoskeletal structures

Unit 4 : Energy conversion organelles:- Chloroplast and Mitochondria.

Unit 5 : Chromosomes –Discovery , Ultra structure – folded fiber and nucleosome models Morphology and structural organization – Centromere , Euchromatin and Hetrochromatin , Karyotyping.

Unit 6 : Special types of chromosomes - Salivary gland and Lamp brush Chromosomes , B-chromosomes

Unit 7 : Cell cycle , mitosis and meiosis

Unit 8 : Communication :- Cell junctions, Cell adhesion molecules, Substrate Adhesion molecules . Signal molecule and Signal Transduction

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Reference:

Cell Biology

1. Sharp W (2011). Fundamentals of Cytology. Nabu Press.
2. De Roberits E.D.P. (2010). Cell Biology & Molecular Biology. Lippincot Williams & Wilkins. 8th Ed.
3. Gupta P.K. (2015). Cell and Molecular Biology. Rastogi Publications. 4th Ed.
4. Karp G (2013). Cell Biology. Wiley. 7th Ed.
5. Cooper G.M. & Hausman R.E. (2013). The Cell : A Molecular Approach. Sinauer Associates. 6th Ed.

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B. Sc. Honours in Biotechnology Part – II

Semester – III

Paper – BTCH-06 , Molecular Biology (40 lectures)
Full Marks: 15 (MSE) + 60 (ESE) = 75 Time: 2½ Hrs. Pass Marks: 34

Instructions for question setter

1. The question paper will be of 60 marks and divided into three groups.
Group I :- Multiple choice questions / fill in the blanks / true or false type.
(10 questions of 1 marks each) $10 \times 1 = 10$
Group II :- Definition or concept based questions (7 questions of 2 marks each). $7 \times 2 = 14$
Group III :- Brief answer questions. (4 questions of 9 marks each) $4 \times 9 = 36$

2. For group II & III, it is the right of paper setter, whether to give any choice or not.

3. All questions must cover the entire syllabus i.e. all units with equal distribution of marks as far as practicable.

Unit 1 : Structure & functions of DNA and RNA
Watson and Crick model of DNA, other forms of DNA (A&Z)
Structure of Prokaryotic & Eukaryotic genes

Unit 2 : DNA replication – Prokaryotic & Eukaryotic
Enzymes and proteins involved in replication
Theta model and rolling circle model
DNA repair – Causes and mechanism (Photo reactivation, excision repair, mismatch repair, SOS repair)

Unit 3 : Recombination in prokaryotes & eukaryotes –
Transformation, Conjugation & Transduction.
Site specific recombination
Models for homologous recombination
Insertion elements and Transposons

Unit 4 : Transcription in Prokaryotes & Eukaryotes – Mechanism, promoters and
RNA polymerase, transcription factors, Messenger RNA processing and Editing, Splicing
Post transcriptional modification of eukaryotic mRNA.

Unit 5 : Translation, Genetic code, Mechanism of translation in Prokaryotes & Eukaryotes

Unit 6 : Gene expression – Regulation of gene expression
Gene expression in protozoan parasite
Gene expression in yeast
Gene expression in mitochondria and chloroplast
Regulation of gene expression in prokaryotes (Operon concept – Lac and Trp)
Regulation of gene expression in eukaryotes – transcriptional activation
Environment and gene expression- penetrance and expressivity. Expression of genes in twins
Effect of temperature and light.

Unit 7 : Oncology : Oncogenes, Tumor suppressor gene, Metastasis & Apoptosis.

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Unit 8 Brief introduction & History of Human Genome Project.

Reference

1. Glick, B.T and Pasternak J.J (1998) Molecular biotechnology, Principles and application of recombinant DNA, Washington D.C. ASM press.
2. Howe.C. (1995) Gene Cloning and manipulation, Cambridge University Press, USA
3. Lewin, B., Gene IX New York, Oxford University Press.
4. Rigby, P.W.J. (1987) Genetic Engineering Academic Press Inc. Florida, USA.
5. Sambrook et al (2000) Molecular cloning Volumes I, II, & III Cold spring Harbor Laboratory Press, New York, USA
6. Walker J.M. and Gingold, E.B. (1983) Molecular Biology & Biotechnology (Indian Edition) Royal Society of Chemistry U.K
7. Karp.G (2002) Cell & Molecular Biology, 3rd Edition, John Wiley & Sons; INC
10. Cooper G. M. (2013) The Cell : A Molecular approach- Sinauer Associates, Inc.; 6 edition

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B. Sc. Honours in Biotechnology Part – II

Semester – III

Paper – PR-03, Methods in Cellular and Molecular Biology
(50 Periods)

Full Marks: 25 (E) + 25 (I) = 50 Time: 4 Hrs. Pass Marks: 23

Pattern of practical examination

One major experiment .

(1x12 = 12)

Spotting : Five spots of 1marks each.

(1x5 = 5)

Viva voce

(5)

Record / Chart

(3)

1. Measurements with light microscope.
2. Calibration of ocular micrometer, finding out average cell size .
3. Cytological preparations :- Fixation , Dehydration and Staining
4. Mitotic and meiotic studies
5. Blood smear :- Differential staining.
6. Isolation of genomic DNA from bacteria , plant .
7. Separation of DNA by Gel electrophoresis
8. PCR

Reference :

1. Vyas S.P., Kohli D. V. Methods in Biotechnology and Bioengineering, First edition , Laurier Books /CBS Pub.

Ali
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Arvind
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Danu
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Supriya Shrivastava
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Poseena Kerketta

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B. Sc. Honours in Biotechnology Part – II

Semester – IV

Paper – BTCH-07 ,IMMUNOLOGY (40 lectures)

Full Marks: 15 (MSE) + 60 (ESE) = 75 Time: 2½ Hrs. Pass Marks: 34

Instructions for question setter

1. The question paper will be of 60 marks and divided into three groups .

Group I :- Multiple choice questions / fill in the blanks / true or false type.

(10 questions of 1 marks each) 10x1 = 10

Group II :- Definition or concept based questions (7questions of 2 marks each). 7x2 = 14

Group III :- Brief answer questions. (4 questions of 9 marks each) 4x9 =36

2.For group II & III , it is the right of paper setter , whether to give any choice or not.

3.All questions must cover the entire syllabus i.e. all unitswith equal distribution of marks as far as practicable.

Unit 1 : Historical perspective. , Introduction to Immunology and Immunity (Innate, Acquired, Active , Passive, Humoral, Cell mediated Immunity. Immune system in plants.

Unit 2 : Organs of Immune system and their function. , Haematoposis , Cells of Immune system and their Function.

Unit 3 : Antigens: Types, properties, haptens, adjuvants, epitops and factor influencing antigenicity,antigen processing and presentation.

Unit 4 : Antibodies (Immunoglobulins): Types, structure, properties and functions of immunoglobulins.MHC molecules: Structure and mechanism of action, Plantibodies.

Unit 5 : Complement system: Classical, lectin and alternative pathway.Opsonization, ADCC.

Unit 6 : Antigen- Antibody Interaction: Precipitin reaction, Agglutination reaction, Cross reactivity, Avidity. In-vitro test: Precipitation, Immunodiffusion,Immuno electrophoresis, Coomb's Test, ELISA, RIA .

Unit 7 : Hypersensitivity reaction, Effector mechanism.

Unit 8 : Immunity to infectious diseases (Bacterial, Viral) Vaccines.

Reference:

1. William, E. Paul (1989) fundamental immunology, 2nd Edition Raven Press, New York.

2. William, R. Clark (1991) the Experimental Foundations of Modern Immunology (4th Edition) John Wiley and Sons, New York.

3. Ivan, M, Roitt (1994) Clackwell Scientific Publications, London.

4. Kuby J. (2010) Immunology, Freeman and Company, New York

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B. Sc. Honours in Biotechnology Part – II

Semester – IV

Paper – BTCH-08 ,Genetic engineering / RDT(40 lectures)
Full Marks: 15 (MSE) + 60 (ESE) = 75 Time: 2½ Hrs. Pass Marks: 34

Instructions for question setter

1. The question paper will be of 60 marks and divided into three groups .

Group I :- Multiple choice questions / fill in the blanks / true or false type.

(10 questions of 1 marks each) $10 \times 1 = 10$

Group II :- Definition or concept based questions (7 questions of 2 marks each). $7 \times 2 = 14$

Group III :- Brief answer questions. (4 questions of 9 marks each) $4 \times 9 = 36$

2. For group II & III , it is the right of paper setter , whether to give any choice or not.

3. All questions must cover the entire syllabus i.e. all units with equal distribution of marks as far as practicable.

Unit 1 : What is gene cloning and importance of genetic engineering

Restriction endonucleases - Types , source and nomenclature

Plasmids and, Genomic DNA , handling of DNA , RNA , cDNA and gene library

Unit 2 : Cloning vectors - E.coli vector:- pBR322, PUC8 , λ Phage , cosmids.

Yeast vector :- YIP , YRP , YEP , YAC

Animal vector :- SV40 , Vaccinia

Plant vector : Ti Plasmid

Insect vector: Baculovirus

Unit 3 : Purification of DNA from bacterial , plant and animal cells.

Unit 4 : Manipulation of purified DNA –

The range of DNA manipulative enzymes – Nucleases , Ligases , Polymerses , Linker and adaptor. DNA modifying enzymes, Topoisomerases.

Unit 5 : Introduction of DNA into living cells – Transformation and Transfection techniques .

Biolistics , Microprojectiles , Electroporation , Microinjection .

Unit 6 :

Application of gene cloning and DNA analysis in research – Studying gene location and function

DNA sequencing – Enzymatic and chemical method , Introduction to Genomics , proteomics , Transcriptome , proteome, Metagenomics, Reverse genomics, Metabolomics.

Unit 7 : Application of gene cloning and DNA analysis in Biotechnology –

Production of heterologous proteins:- Insulin , HGH , tPA

Unit 8 : RDT / Molecular biology techniques – Electrophoretic techniques , Polymerase chain reaction , site directed mutagenesis , Blotting techniques – Southern , Western and Northern blot.

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31.7.15
Amit
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Prasad
30.7.15

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Poojita Parthasarathy

30.7.15
Shruti
29/7/2015

Reference:

1. Glick, B.R & Padernak J.J (1994) Molecular Biotechnology, Principles and Applications of Recombinant DNA, American Society for Microbiology, Washington D.C
2. Christopher H. (1995) Gene cloning and Manipulating, Cambridge University Press
3. Nicholl, D.S.T (1994) An Introduction of Genetic Engineering, Cambridge University Press.
4. Old. R.W. and Primrose, S.B. (1986) Principles of Gene manipulation, An introduction to genetic engineering (3rd Edition) Black well Scientific Publications
5. Brown T.A. (2006) Gene Cloning and DNA Analysis, An Introduction Wiley Publishers.

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B. Sc. Honours in Biotechnology Part – II

Semester – IV

Paper – PR-04, Immunological Technique (50 Periods)
Full Marks: 25 (E) + 25 (I) = 50 Time: 4 Hrs. Pass Marks: 23

Pattern of practical Examination

Marks – 25

One major experiment .

(1x12 = 12)

Spotting : Five spots of 1 marks each.

(1x5 = 5)

Viva voce (5)

Record / Chart (3)

1. Single radial immunodiffusion.
2. Double immunodiffusion (Ouchterlony)
3. Preparation of antigen from blood
4. Separation of serum and plasma from blood.
5. Enzyme linked immunoassay (Demonstration).
6. WIDAL test.

Reference :

1. Talwar and Gupta ,(2006) Handbook of Practical Immunology, CBS publishers.

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B. Sc. Honours in Biotechnology Part – III

Semester – V

Paper – BTCH-09 ,Animal Biotechnology(40 lectures)
Full Marks: 20 (MSE) + 80 (ESE) = 100 Time: 3 Hrs. Pass Marks: 45

Instructions for question setter

1.The question paper will be of 80 marks and divided into three groups

Group I :- Multiple choice questions / fill in the blanks / true or false type.

(20 questions of 1 marks each) $20 \times 1 = 20$

Group II :- Definition or concept based questions (10 questions of 2 marks each). $10 \times 2 = 20$

Group III :- Brief answer questions. (4 questions of 10 marks each) $4 \times 10 = 40$

2.For group II & III , it is the right of paper setter , whether to give any choice or not.

3.All questions must cover the entire syllabus i.e. all units with equal distribution of marks as for as practicable.

Unit 1: Scope of animal tissue culture.History of development of cell cultures.

Basic Equipment in Cell culture: CO₂ Incubator, Laminar Flow Cabinets, Liquid Nitrogen Storage

Unit 2: Culture media , - Natural media: plasma clot, biological fluids extract

Importance of serum in media .Chemically defined media.

Growth and Cell metabolism during Culture.

Unit3 : Primary culture, disaggregation of tissue, isolation of tissue, enzymatic disaggregation and mechanical disaggregation.Anchorage dependence of growth.Non anchorage dependent cells.Secondary culture: Transformed animal cells and Cell lines.

Unit 4 : Transfection of animal cell lines, Selectable markers- Methotrexate, PALA, HAT selection , antibiotic resistance.

Unit 5 : Growth factors promoting proliferation of animal cells (EGF, FGF, PDGF, IL-1, IL-2 HGF, erythropoietin.)

Unit 6 : Application of animal cell culture for studies on gene expression. Production of vaccines in animal cells. Production and application of monoclonal antibodies.

Unit 7 : Special Secondary metabolite / Products- Insulin & Interferon.

Unit 8 : Transgenic animals : Techniques and application of transgenic mice and sheep.

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References:

1. Freshney I. R . Culture of Animal Cells, Fifth Edition, Wiley-Liss.
2. Butler M. (2004) Animal cell culture and Technology, Bios Scientific Publishers.
3. Sinha Km. Basant (2010) Principles of Animal Cell Culture, by International book Distributing Co.

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B. Sc. Honours in Biotechnology Part – III

Semester – V

Paper – BTCH-10, Plant Biotechnology(40 lectures)
Full Marks: 20 (MSE) + 80 (ESE) = 100 Time: 3 Hrs. Pass Marks: 45

Instructions for question setter

1. The question paper will be of 80 marks and divided into three groups

Group I :- Multiple choice questions / fill in the blanks / true or false type.

(20 questions of 1 marks each) $20 \times 1 = 20$

Group II :- Definition or concept based questions (10 questions of 2 marks each). $10 \times 2 = 20$

Group III :- Brief answer questions. (4 questions of 10 marks each) $4 \times 10 = 40$

2. For group II & III, it is the right of paper setter, whether to give any choice or not.

3. All questions must cover the entire syllabus i.e. all units with equal distribution of marks as far as practicable.

Unit 1 : A. Introduction to *in vitro* methods. Terms and definitions. Basic requirements for *in vitro* methods. Types of culture media. Role of plant growth regulators, Historical development of Plant tissue culture.

B. Role of plant tissue culture in agriculture and pharmaceutical companies.

Unit 2: Clonal Multiplication (micropropagation) of elite species – Axillary bud, shoot tip and meristem culture, Organogenesis and Somatic Embryogenesis and their practical applications

Unit 3 : Ovary and ovule culture, *in vitro* pollination and fertilization, Embryo Culture and its applications, Endosperm culture and production of triploids.

Unit 4 : Production of haploids and their applications.

Unit 5 : Single cell suspension cultures and their applications in selection of variants, Secondary metabolites.

Unit 6 : Somaclonal variations and characterization of Somaclonal variants and its applications.

Unit 7 : Introduction to protoplast isolation – principle and applications

Various steps in the regeneration of protoplast.

Various methods for fusing protoplasts.

Somatic hybridization - an introduction, Uses of markers for selection of hybrid cells, cybrids.

Unit 8: Transgenic plants

Techniques of transformation – agrobacterium mediated transformation

A. tumefaciens, *A. rhizogenes*

Transformation by other methods (physical) – microprojectile and electroporation etc.

Bt Cotton, Golden rice.

Supriya

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Roshini Kulkarni

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30.7.15

Reference:

1. Sharma.H.P, (2012) , Plant Tissue Culture : Totipotency to Transgenic Agrobios(India)
2. Ravishankar G.A and Venkataraman L.V(1997) Biotechnology applications of Plant Tissue & cell culture (Oxford & IBH Publishing Co., Pvt Ltd.
3. Islan A.C (1996) Plant Tissue Culture, Oxford & IBH Publishing Co., Pvt. Ltd.
4. Lydiane Kyte & John Kleyn (1996) Plants from test tubes. An introduction to
5. Micropropogation (3rd Edition) timber Press, Partland.
6. Kumar H.D (1991) A test Book on Biotechnology (2nd Edition). Affiliated East West Press Private Ltd, New Delhi.
7. Chrispeel M.J. and Sdava D.E. (1994) Plants, Genes and agriculture, Jones and Barlett Publishers, Boston.
8. Reinert J. and Bajaj Y.P.S (1997) Applied and fundamental Aspects of Plant Cell, Tissue, and Organ Culture, Narosa Publishing House.
9. Chawala H.S. (2009) Introduction to Plant Biotechnology. CRC Press.
10. Dey K.K . (2008) Plant Tissue Culture, NCBA publishers.

Approved - 30.7.15
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B. Sc. Honours in Biotechnology Part – III Semester – V

Paper – BTCH-11,
BIOPHYSICS ,INSTRUMENTATION AND BIOINFORMATICS
(40lectures) Full

Marks: 20 (MSE) + 80 (ESE) = 100 Time: 3 Hrs. Pass Marks: 45

Instructions for question setter

1.The question paper will be of 80 marks and divided into three groups

Group I :- Multiple choice questions / fill in the blanks / true or false type.

(20 questions of 1 marks each) $20 \times 1 = 20$

Group II :- Definition or concept based questions (10 questions of 2 marks each). $10 \times 2 = 20$

Group III :- Brief answer questions. (4 questions of 10 marks each) $4 \times 10 = 40$

2.For group II & III , it is the right of paper setter , whether to give any choice or not.

3.All questions must cover the entire syllabus i.e. all units with equal distribution of marks as far as practicable.

Unit 1 : Concept of thermodynamics :- comparison of 1st and 2nd Law of Thermodynamics .
Comparison of living and non living system as a thermodynamics

Unit 2 : Primary events of Photosynthesis. Strategies of light reception in microbes, plants and animals.

Unit 3 : Spectrophotometry and Colorimetry- Lambert-Beer's law.

Unit 4 : Weak interactions in Biological system .Biophysics of neuron.

Unit 5 : Physical and Radioactive techniques applied to find out molecular structure:
X-ray crystallography , UV-vis, fluorescence ,measure of radio activity GM counters ,
scintillation counting .

Unit 6 : Separation methods :- Electrophoresis and Chromatography

Unit 7 : Introduction to Nanotechnology .

BIOINFORMATICS

Unit 8 : Introduction to Bioinformatics - primary , secondary and Genome data base. Sequence alignment – Global Alignment, Local Alignment and BLAST and FASTA pairwise.

Supriya Shrivastava
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Jane
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Aditya
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Reference :

1. Narayanan, P. (2000) Essentials of Biophysics, New Age Int. Pub. New Delhi.
2. Roy R.N. (1999) A Text Book of Biophysics, New Central Book Agency.
3. Des Higgins (2009) Bioinformatics: Sequence, Structure and databanks, Oxford publications.
4. D.R. Westhead, (2009) Instant notes on Bioinformatics –Viva pub
5. Murthy C. S. V. Bioinformatics Himalaya Publishing House.
6. Banerjee P K Introduction to biophysics (2010) S Chand

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B. Sc. Honours in Biotechnology Part – III

Semester – V

Paper – PR-5, Culture Method-I & II (50Periods)
Full Marks: 50 (E) + 50 (I) = 100 Time: 6 Hrs. Pass Marks: 45

Pattern of practical Examination

One Plant experiment .	1x12 = 12
One Animal experiment .	1x12 = 12
Spotting (4 spots of 2 marks each)	4x2 = 8
Viva voce	10
Practical record	8

4 marks Animal & 4marks Plant Biotechnology.

(Animal Biotech)

1. Isolation of Lymphocytes from blood sample.
2. Preparation of media , filter sterilization.
3. Microbial contamination (Bacterial , fungal etc.)
4. Human genomic DNA isolation from fresh blood.

(Plant Biotech)

1. Preparation of culture media.
2. Initiating plant tissue culture
3. Growth of plant cells into undifferentiated mass (Dedifferentiation of explants)
4. Induction of differentiation by modulating the hormonal balance

Reference :

1. U.Satynarayana , B.N.& DaliaB.Varghese (2012) ,Plant Tissue Culture Practicals and New Experimental Protocol Books and Allied.2
2. Sharma Balram.(2010) Plant tissue culture and transformation techniques NAM S & T centre
3. Ian Freshney Manual of Animal cell culture Techniques. Fifth Ed. Wiley-Liss.

Supriya Shrivastava
31.7.15

Praveen
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Pooja
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Roshini Kerketta

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B. Sc. Honours in Biotechnology Part – III

Semester – VI

Paper – BTCH-13, Environmental Biotechnology (40 lectures)

Full Marks: 20 (MSE) + 80 (ESE) = 100 Time: 3 Hrs. Pass Marks: 45

Instructions for question setter

1. The question paper will be of 80 marks and divided into three groups

Group I :- Multiple choice questions / fill in the blanks / true or false type.

(20 questions of 1 marks each) $20 \times 1 = 20$

Group II :- Definition or concept based questions (10 questions of 2 marks each). $10 \times 2 = 20$

Group III :- Brief answer questions. (4 questions of 10 marks each) $4 \times 10 = 40$

2. For group II & III, it is the right of paper setter, whether to give any choice or not.

3. All questions must cover the entire syllabus i.e. all units with equal distribution of marks as far as practicable.

Unit 1 : Scope of Environmental Biotechnology
Renewable and Non Renewable resources of energy

Unit 2 : Conventional fuels and their environmental impact, Firewood, Plant and Animal Waste, Coal and Gas

Unit 3 : Modern Fuels and their environmental impact, Methanogenic bacteria and Biogas, Beneficial role of Biogas. Microbial Hydrogen Production.

Unit 4 : Petroplants & Biodiesel – Introduction, History, Advantages & Limitations

Unit 5 : Biotechnology in waste management-Solid waste management and industrial effluents in Food, petroleum and pesticide industry.

Unit 6 : Biofertilizers, : Role of symbiotic and asymbiotic nitrogen fixing bacteria in the enrichment of soil VAM, BGA and Azolla, Vermicomposting.

Unit 7 : Biopesticides : Biological control of Insects swarming agricultural fields.

A. Environmental monitoring: Bio indicators, Biosensors, Ames Test

Unit 8 : Biobleaching: Enrichment of ores by micro-organisms (gold, copper and Uranium)

Reference :

1. Prof. S.V.S.Rana, (2014) Environmental Biotechnology (Rastogi Publication)
2. Bimal C. Bhattacharya, Rintu Banerjee, (2014) Environmental Biotechnology, Oxford University press.
3. Alen Scragg (2006) Environmental Biotechnology, OUP oxford Publications.
4. S.K. Agarwal (2005) Environmental Biotechnology, APH Publications.

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B. Sc. Honours in Biotechnology Part – III

Semester – VI

Paper – BTCH-14, EDP & IPR (20 + 20 = 40 lectures)
Full Marks: 20 (MSE) + 80 (ESE) = 100 Time: 3 Hrs. Pass Marks: 45

Instructions for question setter

1. The question paper will be of 80 marks and divided into three groups

Group I :- Multiple choice questions / fill in the blanks / true or false type.
(20 questions of 1 marks each) 20x1 = 20

Group II :- Definition or concept based questions (10 questions of 2 marks each). 10x2 = 20

Group III :- Brief answer questions. (4 questions of 10 marks each) 4x10 = 40

2. For group II & III, it is the right of paper setter, whether to give any choice or not.

3. All questions must cover the entire syllabus i.e. all units with equal distribution of marks as far as practicable.

Group – A EDP (20 Lectures)

Unit 1: Introduction to Entrepreneurship; Identification of Business opportunity.

Unit 2 : Project formulation and Project report.

Unit 3 : Market survey and research .

Unit 4 : Financial Institution in the development of industrial units and Financial incentives

Group B IPR (20 Lectures)

Unit 5 : Biotechnology and intellectual property rights. Patents, Trade secret, Copyright, Trademark, Plant Breeder's Right and farmer's Right (PPVFR)

Unit 6 : Choice of Intellectual property & plant genetic resources (PGR)

Unit 7 : Biosafety- Levels of Biosafety, Application of biosafety, Release of Genetically Modified Organisms

Unit 8 : Bioethics- Need of Bioethics, Human genome project and ethical issues.

Reference :

1. S.C.Poornima, (2013) Entrepreneurship development, New Age International Publishers.
2. S.V.S.Rana, (2010) Environmental Biotechnology by Rastogi publications.
3. Deeca goel and shomini parashar (2014) IPR, Bioethics and Biosafety by Pearson Publications.
4. M.K.Sateesh, (2015) Bioethics and Biosafety I.K. International

Supriya Shrivastava
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Pranav
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Paulin Kankhla
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B. Sc. Honours in Biotechnology Part – III

Semester – VI

Paper – BTCH-15, Industrial Biotechnology

Full Marks: 20 (MSE) + 80 (ESE) = 100 Time: 3 Hrs. Pass Marks: 45

Instructions for question setter

1. The question paper will be of 80 marks and divided into three groups

Group I :- Multiple choice questions / fill in the blanks / true or false type.

(20 questions of 1 marks each) $20 \times 1 = 20$

Group II :- Definition or concept based questions (10 questions of 2 marks each). $10 \times 2 = 20$

Group III :- Brief answer questions. (4 questions of 10 marks each) $4 \times 10 = 40$

2. For group II & III, it is the right of paper setter, whether to give any choice or not.

3. All questions must cover the entire syllabus i.e. all units with equal distribution of marks as far as practicable.

Unit 1 : Introduction & Scope of Industrial Biotechnology.

Unit 2 : Food Biotechnology : Microbial production of food –
Fermented food (Cheese , Yogurt, Sauerkraut), Sweetener, & Food additives
SCP & Production of edible Mushroom.

Unit 3 : Bioreactors. (Different types) –STR, Air- Lift Fermenters, Packed Bead and Fluidized bed Reactors.

Unit 4 : Conversion of Sugar to Ethanol. Gasohol Experiment.

Unit 5 : Bioremediation: Type – In Situ & Ex Situ Bioremediation, Advantages & Limitations.

Unit 6 : Biodegradation of Pesticides & Role of genetically engineered organisms in degradation of Petroleum products.

Unit 7 : Phytoremediation : Degradation of heavy metals by phytoremediation(Biosorption).

Unit 8 : Ecofriendly textile through application of Biotechnology.

Approved -
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(Signature)
Supriya Shrivastava
31.7.15
Positive feedback
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References:

1. Sullia S. B& Shantharam S: (2001) General Microbiology Oxford & IBH Publishing Co. Pvt.Ltd.
2. Bisen P.S . Frontiers in Microbial Technology, CBS Publishers.
3. Glaser A.N & Nilaido.H (2006), Microbial Biotechnology W.H Freeman & Co.
4. Prescott & Dunn Industrial Microbiology, 4th Edition, CBS Publishers & Distributors.
5. Prescott & Dunn . (2005) Industrial Microbiology, Agrobios (India) Publishers.
6. Crueger W. & Crueger A. A text of Industrial Microbiology, 2nd Edition, Panima Publishing Corp.
7. Stanbury P.F, Ehitaker H, Hall S.J (2001) Principles of Fermentation Technology., Aditya Books (P) Ltd.

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B. Sc. Honours in Biotechnology Part – III Semester – VI

Paper – PR-06, Project + Lab (Internal)

Full Marks: 50 (E) + 50 (I) = 100 Time: 6 Hrs. Pass Marks: 45

In any Immunology / Veterinary / Virology / Microbiology Institute / Plant tissue culture / RDT Lab.

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Alvina 30.07.15
Alvina 31.8.15
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