

VIVEKANANDHA
COLLEGE OF ARTS AND SCIENCES FOR WOMEN
[AUTONOMOUS]

An ISO 9001:2008 Certified Institution
Affiliated to Periyar University
(Approved by AICTE and Re-accredited with „A“ Grade by NAAC)
Recognized Under 2(f) and 12 (b) of UGC Act, 1956.
Elayampalayam, Tiruchengode-637 205, Namakkal Dt., Tamil Nadu, India

DEPARTMENT OF BIOTECHNOLOGY
Bachelor of Science

B. Sc SYLLABUS

[For the Candidates admitted on 2018-2019 onwards under Autonomous, CBCS & OBE pattern]
(I to VI SEMESTERS)



SPONSORED BY
ANGAMMAL EDUCATIONAL TUST
ELAYAMPALAYAM – 637 205, TIRUCHENGODE Tk., Namakkal Dt., Tamil Nadu
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B.Sc BIOTECHNOLOGY

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

GRADE	OBJECTIVE
PEO: 1	Biotechnology graduate students shall attain professional/industrial expertise by developing competent, creative and ever ready personality to accept recent, innovative and challenging roles in Industry and Academic and Research sectors
PEO: 2	Students shall inculcate in the development of entrepreneurial traits in order to cuddle innovative opportunities by adapting emerging biotechnological concepts in terms of techniques with subsequent development of leadership in the course of start-up of small-medium scale biotech based industry
PEO: 3	Students shall progressively adapt, follow and learn the concepts of biotechnology continuously by aiding modern teaching tools
PEO: 4	Imparting the basic and outstanding knowledge in all terms of biotechnology
PEO: 5	Students shall acquire the concepts to disseminate the advanced biotechnological aspects and its cutting edge developments in specific and developing area in the field of Biotechnology

PROGRAMME OUTCOMES (POs)

GRADE	OUTCOME
PO: 1	To train and develop students with the much needed biotechnological education, so that they develop added competitive skill metrics (CSM) for industrial employment higher education and employment upon graduation
PO: 2	To comprehend the assorted knowledge of biotechnical concepts domains and their applicability in the development of value added products for the welfare of the society
PO: 3	To develop a broad range of biotechnological skills and knowledge, development of general and specific competences to meet-out current expectations and requirements of medical, pharmaceutical, bio-molecular and agricultural sectors
PO: 4	To understand and merge the knowledge and concepts of biochemical, biophysical and bio statistical domains
PO: 5	To clarify various challenges in health care by integrating different biological domains including clinical, immunological, pharmaceutical and cancer genomics

PROGRAMME SPECIFIC OUTCOMES (PSOs)

GRADE	SPECIFIC OUTCOME
PSO: 1	To provide solutions for the challenges faced by pharmaceutical and molecular diagnostic Sectors
PSO: 2	To provide technical products with high frequency of reproducibility to the society
PSO: 3	To gain vertical mobility in career that will make students more competent to face national/international qualifying exams with practical knowledge acquaintance and in modern biotechnology field
PSO: 4	To solve complex problems in the field of Biotechnology with an understanding of social, ethical, legal and cultural aspects of the society
PSO: 5	To understand the over-all theme/concepts of each specialization in biotechnology and analysing the frequency of its applicability in industry, research and for the goodness of Society

CBCS SYLLABUS – UG (OBE PATTERN)
(For candidates admitted from 2018-2019 onwards)

I year

Subject code	Part	Course	Title	Hrs/ week	Credit	Internal	External	Total
SEMESTER I								
18U1LT01 18U1LM01 18U1LH01 18U1LF01	I	Language I	Tamil I Malayalam I Hindi I French I	6	3	25	75	100
18U1LE01	II	Language II	Foundation English I	6	3	25	75	100
18U1BTC01	III	Core I	Cell Biology and Evolution	5	5	25	75	100
18U1BTCP01	III	Core I Practical	Lab in Cell Biology	4	3	40	60	100
18U1BTA01	III	Allied I	Plant Science	4	4	25	75	100
18U1BTAP01	III	Allied Practical I	Lab in Plant science	3	3	40	60	100
18U1VE01	IV	Value Education I	Yoga	2	2	25	75	100
Total				30	23	205	495	700
SEMESTER II								
18U2LT02 18U2LM02 18U2LH02 18U2LF02	I	Language II	Tamil II Malayalam II Hindi II French II	6	3	25	75	100
18U1LE02	II	Language II	Foundation English II	6	3	25	75	100
18U2BTC02	III	Core II	Genetics and Molecular Biology	4	4	25	75	100
18U2BTCP02	III	Core Practical II	Lab in Genetics and Molecular Biology	3	3	40	60	100
18U2BTA02	III	Allied II	Animal science	4	4	25	75	100
18U2BTAP02	III	Allied Practical II	Lab in Animal Science	3	3	40	60	100
18U2VE02	IV	Value Education II	Environmental Studies	4	2	25	75	100
Total				30	23	205	495	700
Grand Total of First Year					46	410	990	1400

YEAR II

Subject code	Part	Course	Title	Hrs/ Week	Credit	Internal	External	Total
SEMESTER III								
18U3LT03 18U3LM03 18U3LH03 18U3LF03	I	Language III	Tamil III Malayalam III Hindi III French III	6	3	25	75	100
18U3LE03	II	Language III	Foundation English III	6	3	25	75	100
18U3BTC03	III	Core III	Microbiology	5	5	25	75	100
18U3BTCP03	III	Core Practical III	Lab in Microbiology	4	3	40	60	100
18U3BCA03	III	Allied III	Biochemistry I	4	3	25	75	100
18U3BCAP03	III	Allied Practical III	Lab in Biochemistry I	3	3	40	60	100
	IV	NMEC I	Optional	2	2	25	75	100
Total				30	22	205	495	700
SEMESTER IV								
18U4LT04 18U4LM04 18U4LH04 18U4LF04	I	Language IV	Tamil IV Malayalam IV Hindi IV French IV	6	3	25	75	100
18U4LE04	II	Language IV	Foundation English IV	6	3	25	75	100
18U4BTC04	III	Core IV	Genetic Engineering	5	5	25	75	100
18U4BTCP04	III	Core Practical IV	Lab in Genetic Engineering	4	3	40	60	100
18U4BCA04	III	Allied IV	Biochemistry II	4	3	25	75	100
18U4BCAP04	III	Allied practical II	Lab in Biochemistry II	3	3	40	60	100
	IV	NMEC II	Optional	2	2	25	75	100
Total				30	22	205	495	700
Grand Total of Second Year				60	44	410	990	1400

YEAR III

Subject code	Part	Course	Title	Hrs/ week	Credit	Internal	External	Total
SEMESTER V								
18U5BTC05	III	Core V	Immunology	5	5	25	75	100
18U5BTC06	III	Core VI	Plant Biotechnology	5	5	25	75	100
18U5BTCP05	III	Core practical V	Lab in Immunology	5	3	40	60	100
18U5BTCP06	III	Core practical VI	Lab in Plant Biotechnology	5	3	40	60	100
	III	Elective I	Optional	4	3	25	75	100
	IV	SBEC I	Optional	2	2	25	75	100
	IV	SBEC II	Optional	2	2	25	75	100
18U5BTEX01	IV	Internship		1	1	40	60	100
		Library/Sports	Reference/Health Management	1	-	-	-	-
Total				30	23	245	555	800
SEMESTER VI								
18U6BTC07	III	Core VII	Bioprocess technology	5	5	25	75	100
18U6BTC08	III	Core VIII	Animal Biotechnology	5	5	25	75	100
18U6BTCP07	III	Core practical VII	Lab in Bioprocess technology and Animal Biotechnology	5	5	40	60	100
	III	Elective II	Optional	5	4	25	75	100
	IV	SBEC III	Optional	2	2	25	75	100
	IV	SBEC IV	Optional	2	2	25	75	100
18U6BTMP01	IV	Research Activity	Mini project	5	5	40	60	100
		Extension activity		-	1	-	-	-
		Library/Sports	Reference/Health Management	1	-	-	-	-
Total				30	29	205	495	700
Total of Third Year					140	1270	3030	4300

LIST OF ELECTIVE PAPERS		
GRADE	SUBJECT	SUBJECT CODE
Elective I	Pharmaceutical Biotechnology	18U5BTE01
	Enzymology and Enzyme Technology	18U5BTE02
	Tissue Engineering	18U5BTE03
Elective II	Genomics and Proteomics	18U6BTE04
	Biophysics and Bioinstrumentation	18U6BTE05
	Environmental Biotechnology	18U6BTE06
LIST OF SKILLED BASED ELECTIVE PAPERS		
SBEC I	Lab in food processing and technology	18U5BTS01
	Developmental Biology	18U5BTS02
	Food biotechnology	18U5BTS03
SBEC II	Lab in poultry science	17U5BTS04
	Marine Biotechnology	18U5BTS05
	Forensic science and technology	18U5BTS06
SBEC III	Lab in Bioinformatics	17U6BTS07
	Biosafety, Bioethics and IPR	18U6BTS08
	Cancer Biology	18U6BTS09
SBEC IV	Lab in Entrepreneurship in Biotechnology	18U6BTS10
	Nano Biotechnology	18U6BTS11
	Biofarming	18U6BTS12
LIST OF NON-MAJOR ELECTIVE PAPERS		
NMEC I	Concepts of Biotechnology	18U3BTN01
	Biotechnology for Society	18U3BTN02
NMEC II	Biosafety, Bioethics and IPR	18U4BTN03
	Bioinformatics	18U4BTN04

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN		
KL	CPD	DESCRIPTION
K1	Remember	Retrieving, recognizing and recalling knowledge from long-term memory
K2	Understand	Constructing meaning from oral, written and graphic messages through interpreting
K3	Apply	Carrying out or using a procedure through executing or implementing
K4	Analyse	Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing and attributing
K5	Evaluate	Making judgments based on criteria and standards through checking and critiquing
K6	Create	Putting elements to form a coherent or functional whole, reorganizing elements into a new pattern or structure through generating, planning or producing

Note: **KL: Knowledge Level; CPD: Cognitive Process Dimension**

**BLOOM'S TAXONOMY BASED INTERNAL ASSESSMENT PATTERN
FOR MODEL AND SEMESTER EXAMINATION**

SECTION	CPD/GRADE	MARKS	CONTENT	CUMULATIVE
A: 20 X 1	K1 & K2	20	Multiple choice questions	75
B: 1 out of 2 (5 X 5) Either or choice	K2, K3, K5 & K6	25	Short notes	
C: 3 out of 5 X 10	K3, K4, K6	30	Essay type descriptive	

**BLOOM'S TAXONOMY BASED INTERNAL ASSESSMENT PATTERN
FOR CIA I & II EXAMINATIONS**

SECTION	CPD/GRADE	MARKS	CONTENT	CUMULATIVE
A: 10 X 1	K1 & K2	10	Multiple choice questions	25
B: 1 out of 2 (1 X 5)	K2, K3, K5 & K6	5	Short notes	
C: 1 out of 2 (1 X 10)	K3, K4, K6	10	Essay type descriptive	

YEAR I – SEMESTER I
CELL BIOLOGY AND EVOLUTION

Paper	: Core I	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 18U1BTC01	External	: 75

Aim:

To understand the the structural behavior of a cell with respect to its organization and function. The paper also gives introduction to basic concepts of evolution.

Objective:

The objective of the paper is to make the students to understand the cell structure and physiological functions, structure and function of sub cellular organelles, chromosomal organization and biological evolution.

OUTCOME:

- CO1 Familiarize about cell theory and classification and cell division.
- CO2 understand the cellular architecture and its physiological functions.
- CO3 Get knowledge about sub cellular organelles.
- CO4 Exposure on chromosomal organization and special type of chromosomes.
- CO5 Get an idea about evolutionary biology and molecular evolution.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4
CO1	S	S	S	M
CO2	S	M	M	S
CO3	S	S	S	S
CO4	S	S	S	S
CO5	M	S	S	M

S- Strong; M-Medium; L-Low

CONTENT:

Unit I – (10 Hrs.): Discovery of cell and its history: Cell theory. Classification of cell types (prokaryotic & eukaryotic). Organization of plant and animal cell. Cell cycle: Mitosis and Meiosis.

Unit II – (20 Hrs.): Cellular architecture and its physiological functions: Cell wall and cell membrane. Cell membrane components. Cell membrane model. Cytoskeletal structures - (Micro tubules, Micro filaments and intermediary filaments). Cytoskeleton movement (Gliding mechanism and Contraction). Nutrient transport through cell (Active transport, passive transport and facilitated diffusion).

Unit III – (15 Hrs.): Sub cellular organelles: Discovery, structure and functions of Endoplasmic reticulum, Golgi apparatus, Chloroplast, Ribosomes, Mitochondria, Vacuoles, Lysosomes, Glyoxysomes and Peroxisomes.

Unit IV – (15 Hrs.): Chromosomal organization: Nucleus (Nuclear membrane, nuclear pore, Nuclear sap). Chromosome: Morphology, Structure (Chromatid, centromere, telomere, Chromatin, Histone - types). Special chromosomes (Lambrush, Polytene and Giant chromosome).

Unit V – (15 Hrs.): Introduction to evolutionary biology: Lamarck; Darwin-Concepts of variation (Adaptation, struggle, fitness and natural selection). The evolutionary time scale, Eras, periods & Epoch. Molecular evolution – Concepts and tools in phylogeny. Neutral evolution and molecular divergence.

Text Book:

- Verma, P. S. and Agarwal, V. S. 2005. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S Chand and Company Ltd., New Delhi 110 055, pp-294.
- Arumugam, N. 2014. Organic Evolution, Saras Publication, Kanyakumari, p-500.

Reference Books:

- Paul, A. 2007. Text Book of Cell and Molecular Biology, Books and Allied (P) Ltd. 2nd edition, Kolkata 700 009, pp-1310.
- Malacinski, G. M. 2008. Freifelder's Essentials of Molecular Biology. 4th edition, Narosa Publishing House Private Ltd., Chennai 600 006, pp-491.
- Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., and Walter, P. 2002. Molecular biology of the cell (4th ed.): Garland Publishing, New York, pp-1462.
- Lodish, H., Berk, A., Zipursky, S. L., Matsudaira, P., Baltimore, D. Darnell, J. 2000. Molecular Cell Biology, 4th ed. W. H. Freeman and Company, New York 10010, pp-1084.

Karp G. 2002. Cell and Molecular Biology, 3rd Edition. John Wiley and Sons Inc., United States, pp-785.

PEDOGOGY: CHALK and Talk , PPT, Seminar, Models

B.Sc., BIOTECHNOLGY
QUESTION PAPER PATTERN
MAXIMUM MARKS – 75 marks
DURATION – 3 hours

PART – A (20 marks)

1. Multiple choice questions

PART – B (5 X 5 = 25 marks)

2. Either or Type
3. From each unit two questions

PART – C (3 X 10 = 30 marks)

4. Any three out of five (open choice)
5. From each unit one question

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)

MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER I (2018-19)
CELL BIOLOGY AND EVOLUTION

Paper	: Core Practical I	Section - A (20X1)	: 20
Examination	: External	Section – B (5X5)	: 25
Time	: Six Hours	Section – C (3X10)	: 30
Paper Code	: 18U1BTCPO1	Maximum Marks	: 75

Section A (Answer all the questions)

- The cell theory is one of the unifying themes of biology. Which of the following statements would be part of the cell theory?**
 - All life is made of cells.
 - Cells come from preexisting cells.
 - Cells are the smallest units of life.
 - All of the above**
- The type of cell division that occurs in body cells is known as.**
 - Cytosis
 - Meiosis
 - Osmosis
 - Mitosis**
- You look at them through a microscope and see cell walls and membrane-bound organelles. You conclude that the cells.**
 - are plant cells.
 - could be either plant or bacterial.
 - are animal cells.
 - could be plant, animal, or bacterial.
- The diameter of most animal and plant cells ranges from.**
 - 1.0 to 10 microns.
 - 0.01 to 0.1 microns
 - 10 to 100 microns.**
 - 100 to 1000 microns.
- Cells without a membrane-bound nucleus and membrane systems in the cytoplasm are ____ cells.**
 - Prokaryotic**
 - Eukaryotic
 - Fungal
 - Protest
- The cytoskeleton is a system of ____ in ____ cells.**
 - Proteins – prokaryotic
 - Proteins – eukaryotic**
 - DNA – prokaryotic
 - DNA – eukaryotic
- The cytoskeleton is a system of ____ in ____ cells.**
 - Proteins – prokaryotic
 - Proteins – eukaryotic**
 - DNA – prokaryotic
 - DNA – eukaryotic
- DNA is stored in the cell nucleus as.**
 - Ribosomes
 - Chromosomes**
 - Chlorophyll
 - Lysosomes
- What is the immediate source of energy for active transport?**
 - carbohydrates
 - lipids
 - ATP**
 - A & B
- Microtubules, microfilaments and intermediate filaments are components of the.**
 - cell wall in plants
 - plasma membrane in prokaryotes
 - chromosome in eukaryotes
 - chromosome in prokaryotes
- Most organelles in a eukaryotic cell are found in the.**
 - Cell wall
 - Cytoplasm
 - Nucleus**
 - Capsule
- The nucleus of a cell.**
 - Is the region of the cell where ribosomes are degraded
 - contains DNA and controls cell activities**
 - is contained inside the nucleolus.
 - is surrounded by a single layer of membrane.
- The function of mitochondria is.**

- a. intracellular transport of proteins.
b. photosynthesis.
- 14. Lysosomes.**
a. Destroy harmful bacteria engulfed by white blood cells.
b. Help to digest worn-out or damaged organelles
- 15. The function of chloroplasts is.**
a. Intracellular transport of proteins.
b. Intracellular digestion.
- 16. Darwin began to formulate his concept of evolution by natural selection after.**
a. experimentation with animals
b. observations of many species and their geographical locations.
- 18 Lamarck proposed that organisms.**
a. **have an innate tendency toward complexity and perfection.**
b. have an innate tendency to become more simple as time passes
- 18 Organelles found outside a eukaryotic cell and usually involved in movement of the cell or movement of substances past the cell are called.**
a. cilia and flagella
b. Cell walls and plasmodesmata
- 19. Unlike animal cells, plant cells have _____ and _____ and _____.**
a. chloroplasts . cell walls . mitochondria
b. centrioles . cell walls . glycocalyx
- 20. _____ located within the Nucleus, it is responsible for producing ribosomes.**
a. Centrosome
b. Nucleolus
- c. intracellular digestion.
d. cellular respiration (ATP synthesis)
- c. Recycle materials within the cell.
d. All of the choices are correct
- c. Lipid synthesis.
d. Photosynthesis.
- c. reading the writings of Wallace.
d. agreeing with Lamarck about the driving force behind evolution
- B. inherit all of the adaptations they display**
d. belong to species that never change.
- c. Nucleus and nucleolus
d. cytoplasm and endoplasm
- c. chloroplasts . cell walls . vacuoles
d. centrioles . chloroplasts . vacuoles
- c. Lysosome
d. Endoplasmic reticulum

Section-B (Answer All The Questions)

- a) Write about the history of cell biology. **(or)**
b) Differentiate mitosis and meiosis.
- a) Elucidate the Cell Membrane Model. **(or)**
b) Write short notes on Passive transport.
- a) Draw a neat diagram of chloroplast and explain its structure. **(or)**
b) Write short note on structure and function of Endoplasmic reticulum.
- a) Write a brief account on the structure of DNA. **(or)**
b) Discuss about the types of chromosome.
- a) Explain in detail about the concepts of variation. **(or)**
b) Explain in detail about concepts & tools in concepts and tools in phylogeny.

Section-C (Answer Any Three Questions)

- Explain the ultra structure of plant cell with neat labeled diagram
- Discuss structure and function of cytoskeletons (microtubules, microfilaments and intermediate filaments).
- Explain the structure and function of mitochondria.
- Give an account on structure of chromosomes.
- Briefly explain about the Lamarck and Darwin concepts of variation.

**YEAR I – SEMESTER I
LAB IN CELL BIOLOGY AND EVOLUTION**

Paper	: Core Practical I	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 3	Internal	: 40
Paper Code	: 18U1BTCPO1	External	: 60

- CO1 Learn and understand the handling of microscopy and staining techniques.
- CO2 Demonstrate the mitosis and cell counting and chromatin electrophoresis.
- CO3 Analyze the specialized cells like nerve cell, sperm cell and muscle cell.

Major Practical:

Lab 1 – (10 hrs.): The Microscope: The Bright Field Microscope, Use of Oil Immersion (100x), Measurements: Ocular and Stage Micrometers, Measuring Depth, Measuring Area and Measuring Volume.

Lab 2 – (10 hrs.): Enumeration of cells (Cell counting by Neubauer chamber), Enumeration of blood cells.

Lab 3 – (10 hrs.): Preparation of mitotic cell stages from onion root tip squash, Preparation of meiotic cell stages from Grass hopper testis cells.

Lab 4 – (10 hrs.): Isolation of mitochondria and Respiration of Mitochondria, isolation of chloroplast from spinach leaves and Chlorophyll Content.

Lab 5 – (10 hrs.): Chromosomes: Salivary Gland Preparation (Squash tech.), Extraction of Chromatin, and Chromatin Electrophoresis.

Minor Practical:

Lab 1 – (4 hrs.): The Microscope: Measurement of Cell, Organelles, Use of Darkfield Illumination, The Phase Contrast Microscope, The Inverted Phase Microscope, The Transmission Electron Microscope.

Lab 2 – (4 hrs.): Histochemistry: Selective Staining: Prepared Slides, Basophilia, Periodic Acid Schiff (PAS) Reaction, Methyl Green-Pyronin Staining of DNA and RNA.

Lab 3 – (4 hrs.): Staining of macro molecules (Carbohydrate, Lipid and protein staining) and Buccal smear preparation.

Lab 4 – (4 hrs.): Observation of specialized cells (Nerve cell, sperm cells, muscle cell and cardiac cell).

Lab 5 – (4 hrs.): Phylogenetic analysis and construction of phylogenetic tree.

Spotters (5 hrs.):

Robert hooke, Antonie van Leeuwenhoek, Matthias Jakob Schleiden and [Theodor Schwann](#), Prophase, Metaphase, Anaphase, Telophase, Leptotene, Zygotene, Pachytene, Diplotene, Diakinesis, Nerve cell, Muscle cell, Sperm cell, Mitochondria, Chloroplast, Iodine, Methylene blue, Light Microscope, Phase contrast microscope, TEM, SEM, Microtubules, Polytene chromosomes, Lamp brush chromosome, Eosinophil, Basophil, Neutrophil, Lymphocytes, etc.

Reference Books:

- Rajan, S. R. and Christy, R. S. 2015. Experimental Procedures in Life Sciences, Anjana Book House, Chennai-600 107, p-552.
- Kalaichelvan, P. T. 2005. Microbiology and Biotechnology A laboratory Manual. MJP Publishers, Chennai 600 005, p-250.
- Cappuccino, J. G. and Sherman, N. 2004. Microbiology A Laboratory Manual, 6th Edition, Pearson Education Inc. p-491.

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)
MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER I (2018-19)**

LAB IN CELL BIOLOGY AND EVOLUTION

Paper	: Core Practical I	Major (1X20)	: 20
Examination	: External	Minor (1X10)	: 10
Time	: Six Hours	Spotters (5X4)	: 20
Paper Code	: 18U1BTCPO1	Record (1X5)	: 5
Batch	:	Viva Voce	: 5
Date	:	Maximum Marks	: 60

MAJOR (Answer All the Questions)

- a. Isolate mitochondria from the given sample. (or)
- b. Enumerate the cells from the given blood sample.

MINOR (Answer All the Questions)

- a. Perform carbohydrate staining with the given plant sample.
- b. Perform the buccal smear preparation and observe the barr bodies under the microscope.

SPOTTERS (Answer All the Questions)

Identify the given spotters and discuss (A, B, C and D.).

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YEAR I – SEMESTER I (2018-19)**

LAB IN CELL BIOLOGY AND EVOLUTION

Paper	: Core Practical I	Major (1X20)	: 20
Examination	: External	Minor (1X10)	: 10
Time	: Six Hours	Spotters (5X4)	: 20
Paper Code	: 18U1BTCPO1	Record (1X5)	: 5
Batch	:	Viva Voce	: 5
Date	:	Maximum Marks	: 60

KEY

MAJOR

Pea seedlings, Test tubes, Homogenization buffer, Potassium buffer, Ascorbic acid, Triton, and Sodium dithionate crystals.

MINOR

Glass slide, microscope, Iodine solution and necessary glassware's are to be provided.

SPOTTERS

1. Mitosis,
2. Robert hook,
3. Nucleus,
4. Diakinesis and
5. Chromosomes.

RECORD

VIVA-VOCE

**YEAR I – SEMESTER I
PLANT SCIENCE**

Paper	: Allied I	Total Hours	: 60
Hours/Week	: 4	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 18U1BTA01	External	: 75

Aim:

- To understand the Plant Kingdom, its classification, characteristics, physiology and importance.

Objective:

- The objective of the paper is to make the students to understand the life cycle of Algae and Fungi, Pteridophytes and Gymnosperms, classification of Bentham and Hooker's system and understand the physiological aspects of higher plants.

OUTCOME:

- CO1 Familiarize with characteristic and life cycle of thallophytes
- CO2 Understand the characteristic, life cycle and economic importance of thallophytes
- CO3 Acquiring indepth knowledge in differentiate bryophytes, pteridophytes and gymnosperms
- CO4 Exposure on plant taxonomy and economic importance of different families of angiosperms
- CO5 Get an detailed idea about physiological aspects of higher plants

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4
CO1	S	M	S	S
CO2	S	S	M	S
CO3	S	S	S	S
CO4	M	S	S	M
CO5	S	S	S	S

S- Strong; M-Medium; L-Low

CONTENT:

Unit I – (15 Hrs.): Thallophytes: General characteristics of algae. Study on the thallus morphology, reproduction, life cycle and economic importance of *Chlorella* and *Scenedesmus*. General characteristics of fungi – thallus morphology, reproduction, life cycle and economic importance of *Penicillium* and *Saccharomyces cerevisiae*

Unit II – (15 Hrs.): Bryophytes – Morphology, reproduction and life cycle of *Marchantia* and *Riccia*.

Pterodophytes – Morphology, reproduction and lifecycle of *Selaginella*. **Gymnosperms** – Morphology, reproduction and lifecycle of *Cycas*

Unit III – (15 Hrs.): Plant Taxonomy - Bentham and Hookers system of classification – study of the following families and their economic importance – *Annonaceae* (*Annona squamosa*), *Fabaceae* (*Clitoria ternatea*), *Rubiaceae* (*Ixora coccinea*), *Asteraceae* (*Tridax procumbens*), *Poaceae* (*Chloris barbata*).

Unit IV – (15 Hrs.): Plant anatomy – Simple, permanent tissues (Parenchyma, colenchyma and Sclerenchyma). Complex, Permanent tissues (Xylem and Phloem). Primary internal structure of Monocot (stem and root) and Dicot (stem and root) plants.

Unit V – (15 Hrs.): Plant Physiology – Transpiration (Stomatal). Plant water absorption (Osmosis, imbibition and diffusion). Photosynthesis – Light reactions (cyclic and non-cyclic photophosphorylation) and dark reactions (C3 cycle).

TEXT BOOKS:

- Sing, V., Pande, P. C. and Jain, D. K. 2018. A Text Book of Botany, 5th Edition, Rastogi Publications, Meerut, p-1250.
- Pandey, B. P. 2016. A Text Book of Botany Angiosperms, S. Chand & Company, Private, Ltd. New Delhi, p-990.
- Pandey, B. P. 2015. Economic Botany, S. Chand & Company, Private, Ltd. New Delhi, p-680.
- Ragland, R., Kumaresan, V. and Arumugam, N. 2014. Algae, Fungi, Bryophytes, and Plant Pathology, Saras Publication Nagercoil, p-668.
- Jain, V. K. 2009. Fundamentals of Plant Physiology. 12th Edition, S. Chand & Company, Private, Ltd. New Delhi, p-634.
- Pandey, S. N and Sinha, B. K. 2009. Plant Physiology. 4th Edition, Vikas Publication Housing Ltd. New Delhi, p-682.

REFERENCE BOOKS:

- Ragland, R., Kumaresan, V. and Arumugam, N. 2014. Algae, Saras Publication Nagercoil, p-719.
- Vasishta, P. C. 2003. Botany for Degree Students Gymnosperms, S. Chand & Company, Private, Ltd. New Delhi, p-500.
- Gangulee, H. C. and Kar, A. K. 2004. College Botany Volume II, New Central Book Agency, p-1198.
- Sharma, O. P. 2006. Textbook of Fungi, Tata McGraw-Hill Publishing Company Limited, New Delhi, p-365.
- Vashishta, P. C., Sinha, A. K. and Kumar, A. 2006. Botany for Degree Students Pteridophyta, S. Chand & Company, Private, Ltd. New Delhi, p-628.
- Verma, V. 2003. A textbook of Plant Physiology. 7th Edition, EMKAY Publication, New Delhi, p-664.
- Ray Noggle, G and Fritz, G. J. 2010. Introductory Plant Physiology. Asoke K. Chose, PHI Learning Private Ltd. New Delhi, p-627.
- Sinha, R.K. 2007. Modern Plant Physiology. Narosa publication Housing Limited. New Delhi, p-620.
- Srivastava, H. N. 2006. Plant Physiology. Pradeep Publications, Jalandhar, India, p-480.

PEDOGOGY: CHALK and Talk , PPT, Seminar, Models

B.Sc., BIOTECHNOLGY
QUESTION PAPER PATTERN
MAXIMUM MARKS – 75 marks
DURATION – 3 hours

PART – A (20 x 1 = 20 marks)

1. Multiple choice questions

PART – B (5 X 5 = 25 marks)

1. Either or Type
2. Two questions from each unit

PART – C (3 X 10 = 30 marks)

1. Any three out of five (open choice)
2. One question from each unit

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)
MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER I (2018-19)
PLANT SCIENCE**

Paper	: Allied Paper I	Section - A (20X1)	: 20
Examination	: External	Section - B (5X5)	: 25
Time	: Three Hours	Section - C (3X10)	: 30
Paper Code	: 18U1BTA01	Maximum Marks	: 75

Section A (Answer all the questions)

1. Phycology is the study of

a. Fungai	c. Bacteria
b. Algae	d. Protozoa
2. The term algae was coined by

a. Theophrastus	c. Fritsch
b. Engler	d. Linnaeus
3. Which of the following algae produces antibiotic?

a. Chlorella	c. Scenedesmus
b. Gracillaria	d. None of the above
4. Which of the following is a single cell fungi?

a. Yeast	c. Penicillium
b. Mucor	d. Aspergillus
5. Which of the following is an aquatic bryophyte?

a. Riccia	c. Marchentia
b. Dendroceras	d. Polytrichum
6. Who is the father of Bryophytes?

a. Linnaeus	c. Kashyap
b. Iyengar	d. Buttler
7. Which of the following is heterosporous?

a. Lycopodium	c. Selaginella
b. Isoetes	d. Equacetum
8. Which one of the following is called palm tree?

a. Cycas	c. Pinus
b. Ephidra	d. Gnetum
9. Which one of the following family possess polypetalae?

a. <i>Fabaceae</i>	c. <i>Rubiaceae</i>
b. <i>Asteraceae</i>	d. <i>Poaceae</i>
10. Which of the following plant part is used as wild edible fruits?

a. <i>Annona squamosa</i>	c. <i>Clitoria ternatia</i>
b. <i>Ixora coccinea</i>	d. <i>Helianthus annus</i>
11. Which of the following classification is a natural classification?

a. Bentham & Hooker	c. Phylogenic
b. Aims & Smith	d. Alexopolus
12. Which one of the capsule is an example for dry fruit?

a. <i>Annona squamosa</i>	c. <i>Ixora paveta</i>
b. <i>Clitoria ternatia</i>	d. <i>Mangifera indica</i>
13. In which of the cells does the sclerocytes are deposited?

a. Sceleremchyma	c. Parenchyma
b. Chlorenchyma	d. Colenchyma

14. Which of the following is a water conducting tissue?
 a. Phloem
 b. Cortex
 c. Xylem
 d. Cambium
15. Which of the following contain parallel veination?
 a. *Annona*
 b. *Oryza*
 c. *Hibiscus*
 d. *Tridax*
16. Which of the following system contain exarch xylem?
 a. Monocot root
 b. Dicot root
 c. Monocot stem
 d. Dicot stem
18. Which of the following plant contains anisocytic type stomata?
 a. *Solanum tuberosum*
 b. *Morinda tinctoria*
 c. *Solanum lycopersicum*
 d. *Hybiscus rosacinensis*
18. Osmosis can be defined as
 a. Movement of solute particles from lower to higher concentration
 b. Movement of solvent particles from lower to higher concentration
 c. Movement of solute particles from higher to lower concentration
 d. Movement of solvent particles from higher to lower concentration
19. Which of the type of chlorophyll involved in cyclic photophosphorylation?
 a. Chlorophyll-a
 b. Chlorophyll-c
 c. Chlorophyll-b
 d. Chlorophyll-d
20. Which of the following substance from the light dependant reactions of photosynthesis is a source of energy for the Calvin cycle?
 a. ATP
 b. NADPH
 c. Water
 d. Pyruvic acid

Section-B (Answer All The Questions)

21. a) Write short notes on the thallus structure of *Chlorella* (or)
 b) Explain the asexual reproduction of *Scenedesmus*
22. a) Write down the general characteristics of fungi (or)
 b) Describe the asexual reproduction of *penicillium*
23. a) Write short note on the vegetative reproduction of *Penicillium* (or)
 b) Describe the internal structure of *Cycas rachis*
24. a) Write short notes on the absorption of water (or)
 b) List out the difference between cyclic and non-cyclic photophosphorylation
25. a) Describe the types of stomata (or)
 b) Write short notes on osmosis

Section-C (Answer Any Three Questions)

26. Write an essay on the various types of reproduction of *Scenedesmus*. Add a note on its life cycle.
27. Write a detailed account on the reproduction of *Penicillium*.
28. Describe the ovule organization in *Cycas*.
29. Write a detailed account on cyclic photophosphorylation.
30. Write an essay on C3 cycle with chemical reaction mechanisms.

**YEAR I – SEMESTER I
LAB IN PLANT SCIENCE**

Paper	: Allied Practical I	Total Hours	: 75
Hours/Week	: 4	Exam Hours	: 03
Credit	: 4	Internal	: 40
Paper Code	: 18U1BTAP01	External	: 60

- CO1 To identify different angiosperms families with respect their floral biology
- CO2 Describing the anatomical section of Bryophyte, Pteredophyte, Gymnosperms and Angiosperms (root and stem)
- CO3 To familiarize the economic importance angiosperm families plant twigs with flower specimens
- CO4 To familiarize with plant physiological experiments
- CO5 To describe the economic point of algae, fungi, plant anatomy such as simple-permanent and complex-permanent

1. Identification of Angiosperms families (A) (*Asteraceae*, *Fabaceae*, *Anonaceae*, *Rubiaceae* and *Poeceae*) (1 x 5 = 5)
2. Performing and describing the anatomical view of the transverse section of the given specimen 'B' (1 x 5 = 5)

B. i. Marchentia

ii. Lycopodium

iii. Cycus

iv. Monocot plant (Stem and Root)

v. Dicot plant (Stem and Root)

3. List out the economic importance of following plant family specimens (5 x 3 = 15)

C. *Annona squamosa* (3)

D. *Clitoria ternatea* (3)

E. *Ixora coccinea* (3)

F. *Tridax procumbans* (3)

G. *Chloris barbata* (3)

4. Physiology experimental set up (H) and commenting (1 x 3 = 3)

N. Potato Osmoscope, Willmoot's bubbler and Ganong's respirometer

5. Identify the given spotters (I, J, K & L) and comment on them (4 x 3 = 12)

I. Algae (*Scenedesmus* and *Chlorella*)

J. Fungi (*Penicillium* and *Saccharomyces*)

K. Simple, permanent tissues (Parenchyma, Cholenchyma and Sclerenchyma)

L. Complex, permanent tissues (Xylem and Phloem)

Text Books:

- Pandey, B. P. 2014. Modern Practical Botany, (Volume I), S. Chand & Company Private, Ltd., New Delhi, p-512.
- Pandey, B. P. 2010. Modern Practical Botany, (Volume II), S. Chand & Company Private, Ltd., New Delhi, p-408.
- Pandey, B. P. 2015. Modern Practical Botany, (Volume III), S. Chand & Company Private, Ltd., New Delhi, p-326.

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)
MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER I (2018-19)**

LAB IN PLANT SCIENCE

Paper	: Allied Practical I	Expt 1 & 2	: 10
Examination	: External	Expt 3 & 4	: 18
Time	: Three Hours	Spotters	: 12
Paper Code	: 18U1BTAPO1	Herbarium	: 10
Batch	:	Record	: 5
Date	:	Viva-Voce	: 5
		Total	: 60

1. Identify the given plant (A) family and narrate the plant floral parts. Display the dissected parts for observation. (1 x 5 = 10 marks)
2. Perform transverse sectioning of given plant part (B) and comment on it (1 x 5 = 10 marks)
3. List out the economic importance of given plant families (C, D, E, F & G) (5 x 3 = 15 marks)
4. Identify the given plant physiological setup (H) and comment on it (1 x 3 = 3 marks)
5. Identify the given spotters (I, J, K & L) and comment on them (4 x 3 = 12 marks)

HERBARIUM (10 marks)

RECORD (5 marks)

VIVA-VOCE (5 marks)

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)
MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER I (2018-19)**

LAB IN PLANT SCIENCE

Paper	: Allied Practical I	Major (1X20)	: 20
Examination	: External	Minor (1X10)	: 10
Time	: Six Hours	Spotters (5X4)	: 20
Paper Code	: 18U1BTAPO1	Record (1X5)	: 5
Batch	:	Viva Voce	: 5
Date	:	Maximum Marks	: 60

KEY

1. Identification of Angiosperms families (*Asteraceae*, *Fabaceae*, *Anonaceae*, *Rubiaceae* and *Poaceae*)

(Materials to be provided – Plant sample, Dissection board/sheet, Dissecting needle)

Identification & Scientific name	-	1 mark
Habit & Charactersitics features	-	2 marks
Results (Floral parts display)	-	3 marks

2. Performing and describing the anatomical view of the transverse section of the given speciemen

(Materials to be provided – Plant sample, slide, cover slip, stains, microscope, petriplate with water, teasing needle, Blade and teasing brush)

Identification of plant specimen	-	1 mark
Diagram & explanation	-	2 marks
Sections	-	2 marks

3. List out the economic importance of following plant family specimens

(Materials to be provided – Plant sample)

Identification & Scientific names of the family plants	-	1 marks
Plant parts and their uses	-	2 marks

4. Physiology experimental set up and commenting

(Materials to be provided – Given physiological setup)

Identification	-	1 mark
Diagram & Explanation	-	2 marks

5. Identify the given spotters and comment on them

(Materials to be provided – Given spotters)

Identification	-	1 mark
Diagram & Explanation	-	2 marks

**YEAR I – SEMESTER II
GENETICS AND MOLECULAR BIOLOGY**

Paper	: Core II	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 18U2BTCO2	External	: 75

Aim:

- To understand the emphasizing the science of heredity and variation in living organism and ways in which the traits are passed down from generation to another and molecular structure of different constituents of a cell.

Objective:

- The objective of the paper is to make the students to understand Mendelian principles of inheritance, chromosomal changes, molecular processes of DNA replication, transcription and translation, gene regulation and cancer biology.

OUTCOME:

- CO1 Familiarize with mendalian laws, gene interaction and crossing over.
- CO2 understand the chromosomal structure, variations and aberrations and gene mutations.
- CO3 Get deep knowledge in DNA replication, transcription and gene regulation.
- CO4 Exposure on protein translation and protein folding.
- CO5 Get awareness about DNA damage, DNA repair mechanisms and types of cancer and prevention methods .

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	M
CO3	S	M	M	S
CO4	S	S	M	M
CO5	S	S	S	M

S- Strong; M-Medium; L-Low

CONTENT:

Unit I – (15 Hrs.): History of Genetics: Mendelian Laws of Segregation, Independent Assortment, Dominance relations. co-dominance of gene. Multiple alleles. Gene interaction, Epistasis, lethality and lethal genes. Linkage and crossing over.

Unit II – (15 Hrs.): Chromosomal variations: Chromosomal variations in number, Changes in Chromosomal structure, Chromosomal aberrations. Gene mutation-lethal, conditional and biochemical, loss of function, gain of function. Genetic disorders. Transposable elements in prokaryotes and eukaryotes.

Unit III – (15 Hrs.): Genetic control: DNA replication- Unit of replication, enzymes involved, replication origin and replication fork, extrachromosomal replicons, homologous and site-specific recombination. Transcription- Transcription machinery, RNA polymerase, initiation complex, activator and repressor. Gene regulation- Lac and Trp operons, House keeping genes.

Unit IV – (15 Hrs.): Translation: Translation of protein (prokaryotes and eukaryotes) - post translational modifications in eukaryotes. Protein folding, protein export (nuclear, ER and golgi-bodies).

Unit V – (15 Hrs.): DNA damage: DNA repair- Types and mechanisms - photo reactivation excision repair, post replication recombinant repair, SOS repair. Cancer- Tumour- Benign and Malignant, prevention of cancer, Tumour suppressor gene-P53.

TEXT BOOKS:

- Gardner, E. J., Simmons, M. J. and Snustad, D. P. 2006. Principles of Genetics, 8th Edition, John Wiley & Sons, Inc. p-649.
- Paul, A. 2007. Text Book of Cell and Molecular Biology, Books and Allied (P) Ltd. 2nd edition, Kolkata 700 009, pp-1310.

REFERENCE BOOKS:

- Weaver, R. F. and Hedric, P. W. 1995. Basic genetics, Wm. C. Brown Publisher, p-498.
- Friefelder, D. 2002. Microbial genetics, Narosa Publishing House. P-601.
- Watson, J. D. Hopkins, N. H., Roberts, J. W., Steitz, J. A. and Weiner, A. M. 1987. Molecular Biology of the genes 4th Edition, The Benjamin /Cummings Publishing Company, Inc., p-1163.
- Lodish, H., Berk, A., Zipursky, S. L., Matsudaira, P., Baltimore, D. Darnell, J. 2000. Molecular Cell Biology, 4th ed. W. H. Freeman and Company, New York 10010, pp-1084.

PEDOGOGY: CHALK and Talk , PPT, Seminar, Models

B.Sc., BIOTECHNOLGY
QUESTION PAPER PATTERN
MAXIMUM MARKS – 75 marks
DURATION – 3 hours

PART – A (20 marks)

1. Multiple choice questions

PART – B (5 X 5 = 25 marks)

2. Either or Type
3. From each unit two questions

PART – C (3 X 10 = 30 marks)

4. Any three out of five (open choice)
5. From each unit one question

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)
MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER II (2018-19)
GENETICS AND MOLECULAR BIOLOGY

Paper	: Core Paper II	Section - A (20X1)	: 20
Examination	: External	Section – B (5X5)	: 25
Time	: Three Hours	Section – C (3X10)	: 30
Paper Code	: 18U2BTCO2	Maximum Marks	: 75

Section A (Answer all the questions)

1. **An individual that is heterogenous for two pairs of alleles is called as**
 - a. Trihybrid.
 - b. Monohybrid
 - c. **Dihybrid.**
 - d. None of the above
2. **The alternative forms of a gene that at a given locus in a chromosome is called as**
 - a. Trait
 - b. **Allele**
 - c. Gene
 - d. locus
3. **Interaction among the products of nonalleles is known as**
 - a. **Epitasis**
 - b. Suppression.
 - c. Dominance.
 - d. Co dominance.
4. **The exchange of chromosomes materials through breakage and reunion is called as**
 - a. Covalent bond.
 - b. Transformation
 - c. Cross breedings.
 - d. **Crossing over.**
5. **A rearrangement in chromosomes that reverses the order of a linear array of genes is known as**
 - a. Deletion
 - b. Subtraction
 - c. **Inversion**
 - d. Multiplication
6. **An agent that causes the mutation is called as**
 - a. Protein
 - b. **Mutagen**
 - c. Chemical
 - d. Mutation
7. **DNA elements that can move from one position to another position is known as**
 - a. Ribosomes
 - b. **Transposons**
 - c. Chromosomes
 - d. Lysosomes
8. **The chromosome compliment of Turner syndrome is**
 - a. 44+XY
 - b. **45+X**
 - c. 46+XY
 - d. 44+XX
9. **Replicon is a**
 - a. Unit of Transcription
 - b. Unit of Translation
 - c. Unit of Repair system
 - d. **Unit of Replication**
10. **The point on chromosomes where crossing over occurs during recombination is called**
 - a. **Chiasmata**
 - b. Recombination point
 - c. Locus
 - d. Gene
11. **The process of RNA synthesis is called as**
 - a. Translation
 - b. **Transcription**
 - c. Replication
 - d. RNA production
12. **RNA polymerase enzyme synthesis**
 - a. Protein
 - b. DNA
 - c. **RNA**
 - d. Amnio acids
13. **70S ribosomes consist two subunits are**
 - a. 40S and 30S
 - b. 40S and 40S
 - c. 50S and 20S
 - d. **50S and 30S**
14. **Proteins are made up of**

- a. Proteins
b. Amnio acids
- c. Sugars
d. None of the above
- 15. DNA region to which the RNA polymerase binds is called**
- a. i Enhancer .
b. intracellular digestion
- c. Terminator.
d. photosynthesis
- 16. 16. Darwin began to formulate his concept of evolution by natural selection after**
- a. experimentation with animals
b. Promoter
- c. reading the writings of Wallace.
d. Activator
- 18 Exchange of genetic material between the chromosomes are called as**
- a. Exchange .
b. Transfer
- H. Recombination**
d. Translocation
- 18 Dimer repair mechanism include**
- a. Excision Repair
b. Recombinational Repair
- c. Photoreactivation
d. All of these
- 19. Which of the following is dark repair**
- a. Nucleotide excision repair
b. Both a and b
- c. Base excision repair
d. None of these
- 20. Cancer is caused by**
- a. Unconcontrolled mitosis**
b. Rupturing of cells
- c. Uncontrolled meiosis
d. Loss of immunity of the cells

Section-B (Answer All The Questions)

- a) Write about the Mendelian Laws of Segregation. **(or)**
b) Explain shortly about Multiple alleles.
- a) Explain the Genetic disorders. **(or)**
b) Write short notes on Chromosomal aberrations.
- a) Explain homologous recombination. **(or)**
b) Write short note on enzymes involved in DNA replication.
- a) Write a brief account on the post translational modifications. **(or)**
b) Discuss about the protein export.
- a) Explain shortly about photo reactivation repair system. **(or)**
b) write a short notes on prevention of cancer.

Section-C (Answer Any Three Questions)

- write an account on Linkage and crossing over.
- Explain in detail about Transposable elements.
- Write an elaborate note on the Lac and Trp operons.
- Give an account on Translation of protein.
- Explain in detail about the Tumour suppressor gene-P53.

YEAR I – SEMESTER II
LAB IN GENETICS AND MOLECULAR BIOLOGY

Paper	: Core Practical II	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 3	Internal	: 40
Paper Code	: 18U2BTCPO2	External	: 60

- CO1 Learn and understand the Mendel's law of genetics and karyotypic analysis.
- CO2 Demonstrate the DNA isolation, bacterial transformation and replica plating technique.
- CO3 Analyze the interpret the protein isolation and SDS PAGE.

MAJOR PRACTICAL:

Lab 1 – (10 hrs.): Mendel's law of Genetics-Monohybrid and Dihybrid Experiments.

Lab 2 – (10 hrs.): Isolation and visualization of Plasmid DNA.

Lab 3 – (10 hrs.): Isolation and visualization of Genomic DNA.

Lab 4 – (10 hrs.): Separation of proteins by SDS.

Lab 5 – (10 hrs.): Bacterial Transformation.

MINOR PRACTICAL:

Lab 1 – (4 hrs.): Isolation of proteins and purification of proteins.

Lab 2 – (4 hrs.): Replica plating technique.

Lab 3 – (4 hrs.): Karyotypic analysis.

Lab 4 – (4 hrs.): Isolation autrophic mutants by gradient plate technique.

Lab 5 – (4 hrs.): Observation of Genetic model organisms (*Arabidopsis thaliana* and *Coenorhabditis elegans*).

Spotters (5 hrs.): Monohybrid cross, Dihybrid cross, *Drosophila melanogaster*, P^{BR322} plasmid, Proteinase K, SDS, X Gal, Lac operon, IPTG, Agarose, Agarose gel electrophoresis, Karotype, Replica Plate Technique, Dialysis membrane, Acrylamide Bis acrylmide, Bacterial Transformation, Bacterial Conjugation, DNA replication, Translation, TEMED, 2-Mercaptoethanol, Bromophenol blue, Ethidium bromide, Tris Buffer, Gel Documentor, Uv-Transilluminator, Crossing over, Homologus recombination, Isoamyl alcohol and Transposons.

Manual

Swamy, P.M. 2009 Laboratory manual on Biotechnology, 1st Edition, Rastogi publications, India, p-618.

Sinha, J., Chatterjee, A. K. and Chattopadhyay, P. 2001. Advanced Practical Zoology, 2nd Edition, Books and Allied (P) Ltd., Kolkata, p-1038.

(AUTONOMOUS)
MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER II (2018-19)

GENETICS AND MOLECULAR BIOLOGY

Paper	: Core Practical II	Major (1X20)	: 20
Examination	: External	Minor (1X10)	: 10
Time	: Six Hours	Spotters (5X4)	: 20
Paper Code	: 18U1BTCPO2	Record (1X5)	: 5
Batch	:	Viva Voce	: 5
Date	:	Maximum Marks	: 60

MAJOR (Answer All the Questions)

- a. Isolate Plasmid DNA from the given sample. (or)
- b. Separate proteins from the given sample through SDS.

MINOR (Answer All the Questions)

- a. Demonstrate replica plating technique.
- b. Demonstrate Karyotypic analysis.

SPOTTERS (Answer All the Questions)

Identify the given spotters and discuss (A, B, C and D.).

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)
MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER II (2018-19)**

LAB IN GENETICS AND MOLECULAR BIOLOGY

Paper	: Core Practical II	Major (1X20)	: 20
Examination	: External	Minor (1X10)	: 10
Time	: Six Hours	Spotters (5X4)	: 20
Paper Code	: 18U1BTCPO2	Record (1X5)	: 5
Batch	:	Viva Voce	: 5
Date	:	Maximum Marks	: 60

KEY

MAJOR

Bacteria, Centrifuge, CTAB, Gel Documentation Instrumentation, etc.

MINOR

Media, Incubator, Culture, etc.

SPOTTERS

1. Monohybrid cross,
2. Karotype,
3. Bacterial Transformation,
4. Tris Buffer and
5. Transposons.

RECORD

VIVA-VOCE

**YEAR I – SEMESTER II
ANIMAL SCIENCE**

Paper	: Allied II	Total Hours	: 60
Hours/Week	: 4	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 18U2BTA02	External	: 75

Aim:

- To understand the basic animal science in which classification and animal kingdom based on their morphological, anatomical characteristics, their reproduction and development.

Objective:

- The objective of the paper is to make the students to understand the classification of animal kingdom, animal reproduction and development.

OUTCOME:

- CO1 Familiarize with animal kingdom and classification.
- CO2 understand the animal classification based on the morphology..
- CO3 Get deep knowledge in nematodes, annelid, arthropoda and mollusca.
- CO4 Exposure on echinidermata, hemichordate and chordata.
- CO5 Get an idea about animal cells and tissues, organs and reproduction.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4
CO1	S	S	M	M
CO2	S	S	M	S
CO3	S	S	S	M
CO4	M	S	S	S
CO5	S	M	S	M

S- Strong; M-Medium; L-Low

CONTENT:

Unit I – (15 Hrs.): Outline classification of Animal Kingdom: Phylum Protozoa-Amoeba Structure, Locomotion and feeding. Porifera- Leucosolonia –Structure, general topic in canal system in Sponges. Coelenterata-External Morphology of Aurelia and its life history. General topic in Protozoan and human disease.

Unit II – (15 Hrs.): Platyhelminthes: External structure of Taenia solium and Reproductive system. Annelida: Earthworm-Digestive and excretory system. General topic: Human Helminth Parasite

Unit III – (15 Hrs.): Arthropoda: External Morphology of Prawn. Mollusca: External structure of fresh water mussel and Digestive system. Star fish – External structure. General Topic: Water vascular system

Unit IV – (15 Hrs.): Chordata: Hemichordata: External Morphology of Amphioxus and Digestive system. Pisces: External morphology of ‘Shark’ – Digestive system of shark. Amphibia: Frog- External Structure and Respiratory system. General Topic: Parental care in Amphibia. Reptilia: Identification of poisonous and Non poisonous snakes.

Unit V – (15 Hrs.): Aves: Pigeon – Digestive System and Respiratory System. General Topic: Flight adaptation in birds. Mammalia: Rabbit – Digestive system and Structure of Brain.

REFERENCE BOOKS:

- Agarwal, V. K. 2000. Invertebrate Zoology – S.Chand and Company Ltd., publications, New Delhi.
- Iyer, E. 1993. Manual of Zoology –Vol. I &II Invertebrata, S. Viswanathan (Printers & Publisher) Chennai.
- Kotpal, R. L. 2003. Modern text book of Zoology – Invertebrates, Rostogi publication, Meerut
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- Wolpert, L. 2007. Principles of Development (III edition) Oxford University Press, UK.
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PEDOGOGY: CHALK and Talk , PPT, Seminar, Models

B.Sc., BIOTECHNOLGY
QUESTION PAPER PATTERN
MAXIMUM MARKS – 75 marks
DURATION – 3 hours

PART – A (20 marks)

6. Multiple choice questions

PART – B (5 X 5 = 25 marks)

7. Either or Type
8. From each unit two questions

PART – C (3 X 10 = 30 marks)

9. Any three out of five (open choice)
10. From each unit one question

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)
MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER II (2018-19)
ANIMAL SCIENCE**

Paper	: Allied Paper II	Section - A (20X1)	: 20
Examination	: External	Section – B (5X5)	: 25
Time	: Three Hours	Section – C (3X10)	: 30
Paper Code	: 18U2BTAO2	Maximum Marks	: 75

Section A (Answer all the questions)

1. Which of the following class has the largest number of animals?

a. Mammals	c. Insects
b. Fishes	d. Reptiles
2. The largest animal ever existed on earth is.

a. Woolly mammoth	c. Tyrannosaurus
b. African elephants	d. Blue whale
3. Name protozoa was given by.

a. Goldfuss	c. Hall
b. Jablot	d. None of these
4. Largest fresh water protozoa is.

a. Paramecium caudatum	c. Pelomyxa palustris
b. Vorticella minim	d. Spirostomum ambiguum.
5. A sponge can be distinguished from other animals by the presence of.

a. Hollow body	c. Choanocytes
b. Coelenteron	d. Dermal papillae
6. Nematocysts are the specialized cells found in the members of _____.

a. Cnidaria	c. Annelida
b. Porifera	d. Mollusca
7. The First invertebrate to develop a true nervous system are.

a. Flat worms	c. Coelenterates
b. Sponges	d. Annelids
8. Free living platyhelminthes forms belong to the class.

a. Cestoda	c. Turbellaria
b. Trematoda	d. Nematoda
9. Anticoagulant secreted by leech is.

a. Heparin	c. Haematin
b. Hirudin	d. Hamoglobin
10. Hemocoelic body cavity is a characteristic of

a. Ascaris	c. Cockroach
b. Leech	d. Snails
11. Most primitive arthropods belongs to the class.

a. Archnida	c. Onychophora
b. Insecta	d. Myriapoda
12. Which of the following produces a shell of great ornamental value?

a. Pila	c. Unio
b. Nautilus	d. Ostrea
13. Which of the following systems is found in echinoderms?

a. Nervous system .	c. Excretory system
b. Respiratory system	d. System of internal skeleton
14. Starfishes are

a. Herbivorous	c. Filter feeders
b. Carnivorous	d. Omnivorous

15. Which of the following structures is present in all the chordates?
 a. Cranium
b. Notochord
 c. Spinal cord.
 d. Vertebral column
16. Which of the following is a characteristic chordate character?
 a. Autotomy
 b. Myotomy
c. Pharyngotomy
 d. Dermatotomy
17. Animal cells do not contain
a. Chloroplast
 b. Cytoplasm
 c. Nucleus
 d. Cell membrane
18. The layer of actively dividing cells of skin is termed as.
 a. Stratum compactum
 b. Stratum corneum
 c. Stratum lucidum
d. Stratum malpighii
19. Genetic identity of a human male is determined by.
 a. Autosomes
 b. Nucleolus
 c. Cell organelles
d. Sex chromosomes
20. Fertilization of ova in human take place in.
 a. Ovary
 b. Vagina
c. Fallopian tube
 d. Uterus

Section-B (Answer All The Questions)

- Outline the classification of animal kingdom. **(or)**
 - Bring out the life cycle of *plasmodium*.
- Give an account of the skeleton in the sponges. **(or)**
 - Compare the digestive system of Leech and Nereis.
- Describe the classification of phylum arthropoda. **(or)**
 - Bring out the general characteristics of phylum annelida.
- Give an account of air bladder in fishes. **(or)**
 - Write an account of biology and distribution of prototheria
- Describe the types of tissues found in animals. **(or)**
 - Discuss the digestive system of animals.

Section-C (Answer Any Three Questions)

- Explain about the various methods of reproduction in *protozoa*.
- Give a detailed account of the canal system in the sponges.
- Illustrate the economic importance of *mollusca*.
- Mention the chief characters of the phylum *Echinodermata* and classify upto classes with their distinguishing characters and examples.
- Discuss in detail about the reproductive system in animals.

**YEAR I – SEMESTER II
ANIMAL SCIENCE PRACTICAL**

Paper	: Allied II Practical	Total Hours	: 60
Hours/Week	: 4	Exam Hours	: 03
Credit	: 3	Internal	: 40
Paper Code	: 18U2BTA02	External	: 60

- CO1 Learn and understand the animal kingdom and taxonomy.
- CO2 Get knowledge about identification of protozoa, echinodermata, hemochordata, ctenophore and porifera.
- CO3 Analyze the characterize the animal cells, organs and tissues.

MAJOR PRACTICAL:

Lab 1 – (8 hrs.): Animal Kingdom-Key to common taxa.

Lab 2 – (8 hrs.): Identification and characterization of Protozoa, Porifera and Coelenterata.

Lab 3 – (8 hrs.): Identification and characterization Ctenophora, Platyhelminthes and Nematoda.

Lab 4 – (8 hrs.): Identification and characterization Annelida, Arthropoda and Mollusca.

Lab 5 – (8 hrs.): Identification and characterization Echinodermata, Hemichordata and Chordata.

MINOR PRACTICAL

Lab 1 – (3 hrs.): Characterization of Animal cells and tissues.

Lab 2 – (3 hrs.): Characterization of Animal organs.

Lab 3 – (3 hrs.): Structure and function of Animal organ systems.

Lab 4 – (34 hrs.): Study on Animal reproductive systems.

Lab 5 – (3 hrs.): Study of Animal development.

Spotters (5 hrs.): Amoeba, Paramecium, Aurelia, Fasciola hepatica and Ephyra larva, Taenia scolex, Fasciola hepatica. C.S., Ascaris – Male and Female, Taenia solium, Amphioxus, Shark, Ichthyophis, Cobra and Sea Anemon on Hermit crab, Pigeon, Blastula of frog, 24 and 48 hours of chick embryo, Star fish, Redia / Cercaria, Nauplius, Mysis Larva.

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)
MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER II (2018-19)

LAB IN ANIMAL SCIENCE

Paper	: Allied Practical I	Major (1X20)	: 20
Examination	: External	Minor (1X10)	: 10
Time	: Three Hours	Spotters (5X4)	: 20
Paper Code	: 18U1BTAPO2	Record (1X5)	: 5
Batch	:	Viva Voce	: 5
Date	:	Maximum Marks	: 60

MAJOR (Answer All the Questions)

- Depict key to common taxa to Animal Kingdom and identify the given species A. (**or**)
- Depict key to common taxa to Animal Kingdom and identify the given species B.

MINOR (Answer All the Questions)

- Characterize the given animal cells and tissues.
- Identify structure and function of given animal organ .

SPOTTERS (Answer All the Questions)

Identify the given spotters and discuss (A, B, C and D.).

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)
MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER II (2018-19)**

LAB IN ANIMAL SCIENCE

Paper	: Allied Practical I	Major (1X20)	: 20
Examination	: External	Minor (1X10)	: 10
Time	: Three Hours	Spotters (5X4)	: 20
Paper Code	: 18U1BTAPO2	Record (1X5)	: 5
Batch	:	Viva Voce	: 5
Date	:	Maximum Marks	: 60

KEY

MAJOR

Microscope, Stain, Slide, etc. .

MINOR

Permanent slide, Microscope, stain.

SPOTTERS

1. Fasciola hepatica and Ephyra larva,
2. Taenia solium,
3. Sea Anemon on Hermit crab,
4. Blastula of frog, 24 and 48 hours of chick embryo and
5. Mysis Larva

RECORD

VIVA-VOCE

**YEAR I – SEMESTER II
ENVIRONMENTAL STUDIES**

Paper	: Value Education II	Total Hours	: 30
Hours/Week	: 4	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 18U2VE02	External	: 75

Aim:

- To understand the importance of environmental science and environmental studies to achieve the sustainable development.

Objective:

- The objective of the paper is to make the students to understand the environmental science, to create the awareness about pollution, waste management and global warming.

OUTCOME:

- CO1 Familiarize with multi disciplinary nature of environmental studies.
- CO2 understand the natural resources and renewable, non renewable resources.
- CO3 Get deep knowledge in concept, structure and function on ecosystem and ecological food chain.
- CO4 Exposure on biodiversity and conservation at global, national and local levels.
- CO5 Get an idea about environmental pollution and disaster management.
- CO6 Get awareness about social issue in the environment and environmental ethics.
- CO7 Exposure in human population and the environment, human rights and role of information technology in human health concern.
- CO8 To create idea through field work by visiting local, rural, industrial and agricultural sites

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4
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CO1	S	S	M	M
CO2	S	S	S	S
CO3	S	S	S	S
CO4	M	S	S	S
CO5	S	S	S	M
CO6	S	S	M	S
CO7	S	M	S	S
CO8	M	S	S	S

S- Strong; M-Medium; L-Low

CONTENT:

Unit I – (2 Hrs.): Multidisciplinary nature of environmental studies: Definition, scope and importance, Need for public awareness.

Unit II – (8 Hrs.): Natural Resources : Renewable and non-renewable resources : Natural resources and associated problems.

a) Forest resources : Use and over-exploitation, deforestation, case studies (Timber extraction, mining, dams and their effects on forest and tribal people). b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Unit III – (6 Hrs.): Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystem :- a. Forest ecosystem, b. Grassland ecosystem, c. Desert ecosystem, d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Unit IV – (8 Hrs.): Biodiversity and its conservation: Introduction – Definition : genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic, and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

Unit V – (8 Hrs.): Environmental Pollution: Definition, Cause, effects and control measures of :- a. Air pollution, b. Water pollution, c. Soil pollution, d. Marine pollution, e. Noise pollution, f. Thermal pollution, g. Nuclear hazards, Solid waste Management : Causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management : floods, earthquake, cyclone and landslides.

Unit VI – (7 Hrs.): Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Case Studies, **Environmental ethics:** Issues and possible solutions. Climate change, global warming and acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies, Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation and, Public awareness.

Unit VII – (6 Hrs): Human Population and the Environment: Population growth, variation among nations, Population explosion – Family Welfare Programme, Environment and human health, Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health and Case Studies.

Unit VIII – (8Hrs): Field work: Visit to a local area to document environmental assetsriver/forest/grassland/hill/mountain, Visit to a local polluted site-Urban/Rural/Industrial/Agricultural, Study of common plants, insects, birds, Study of simple ecosystems pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours).

TEXT BOOK:

- Bharucha, E. 2004. The text book for Environmental Studies, University Grants Commission, New Delhi. p-286.

REFERENCE

- Agarwal, K. C. 2001. Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Erach, B. The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
- Brunner, R. C. 1989. Hazardous Waste Incineration, McGraw Hill Inc. p-480p
- Clark, R. S. 2001. Marine Pollution, Clarendon Press Oxford (TB)
- Cunningham, W. P. Cooper, T. H. Gorhani, E. and Hepworth, M.T. 2001. Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
- De, A. K. 1993. Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- Gleick, H. P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins, R. E. Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
- Heywood, V. H. and Waston, R. T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi p-284.
- Mckinney, M. L. and School, R. M. 1996. Environmental Science systems & Solutions, Web enhanced edition. P-639.
- Mhaskar, A. K., Matter Hazardous, Techno-Science Publication (TB)
- Miller, T. G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E. P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, p-574.
- Rao, M. N. and Datta, A. K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. p-345.

PEDOGOGY: CHALK and Talk , PPT, Seminar, Models

B.Sc., BIOTECHNOLGY
QUESTION PAPER PATTERN
MAXIMUM MARKS – 75 marks
DURATION – 3 hours

PART – A (20 marks)

1. Multiple choice questions

PART – B (5 X 5 = 25 marks)

2. Either or Type
3. From each unit two questions

PART – C (3 X 10 = 30 marks)

4. Any three out of five (open choice)
5. From each unit one question

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)
MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER II (2018-19)
ANIMAL SCIENCE**

Paper	: VALUE EDUCATION II	Section - A (20X1)	: 20
Examination	: External	Section – B (5X5)	: 25
Time	: Three Hours	Section – C (3X10)	: 30
Paper Code	: 18U2VE2	Maximum Marks	: 75

Section A (Answer all the questions)

- 1 **Which of the following is the example of impact of development activities on hydrosphere?**
 - a. Air pollution
 - b. Noise pollution
 - c. Soil pollution
 - d. Water pollution
- 2 **The drop in air temperature at a rate of 6.50 C per 1000 m increase in altitude of troposphere is known as.**
 - a. Environmental lapse rate
 - b. Green house effect
 - c. Environmental degradation
 - d. Global warming
- 3 **Earthworms and bacteria are called.**
 - a. Producers
 - b. Decomposers
 - c. Consumers
 - e. None of these
- 4 **In India, Tropical rain forest occurs in.**
 - a. Jammu and Kashmir
 - b. Uttar Pradesh
 - c. Andaman & Nicobar
 - d. Himachal Pradesh
- 5 **Noise is measured using sound meter and the unit is.**
 - a. Hertz
 - b. Joule
 - c. Decibel
 - d. Sound
- 6 **Area of land, water and air where the life exists is called.**
 - a. Biosphere
 - b. Atmosphere
 - c. Lithosphere
 - d. Hydrosphere
- 7 **Troposphere has altitude range of**
 - a. 8 to 18 km from earth surface
 - b. 800 km from earth surface
 - c. 50 km from earth surface
 - d. 80 km from earth surface
- 8 **The layer which provides ideal site for flying of jet planes is.**
 - a. Thermosphere
 - b. Mesosphere
 - c. Stratosphere
 - d. Troposphere
- 9 **The green plants are also called.**
 - a. Producers
 - b. Reducers
 - c. Consumers
 - d. Detritivores
- 1 **Sequence of eating and being eaten in a ecosystem is called.**
 - a. Food web
 - b. Ecological Pyramid
 - c. Natural cycle
 - d. Food chain
- 1 **Biodiversity means.**
 - a. The living natural resources
 - b. Oceans and sea
 - c. Land and forest
 - d. Atmosphere
- 1 **Gaseous nitrogen can be used by plants only after the process of.**
 - a. Nitrogen cycling
 - b. Ammonification
 - c. Nitrogen fixation
 - d. Nitrifications
- 1 **Conversion of ammonia to nitrite and then nitrate is called.**
 - a. Nitrogen fixation
 - b. Nitrification
 - c. De nitrification
 - d. Ammonification
- 1 **The subsurface sources of water is.**

- a. River
- b. Stream

- c. Dug well
- d. Ocean

1 **71% of earth surface is covered with.**

- a. Land
- b. Water
- c. Air
- d. Coal

1 **Major cause of increment in population growth**

- a. Decreases in birth rate
- b. Illiteracy
- c. Decreases in mortality rate
- d. None of the above

1 **Which of the following is an air pollutant**

- a. Ozone
- b. Carbon dioxide
- c. CFC
- d. Oxygen

1 **Which of the following are major causes of land degradation?**

- a. Soil erosion
- b. Water logging
- c. Deforestation
- d. Desertification

1 **Biochemical oxygen demand means**

- a. Industrial pollution
- b. Polluting capacity of effluent
- c. Air pollution
- d. Dissolved O₂ needed for plants

2 **Eutrophication means**

- a. Thermal change in water
- b. Solid waste
- c. Filling up of water body with aquatic plants
- d. None of the above

Section-B (Answer All The Questions)

1. a) Write short notes on scope of environmental studies. (or)
b) Role of forest resources towards human welfare.
2. a) Explain different issues related to land resources. (or)
b) Describe structure and function of ecosystem.
3. a) What is ecological succession and its role. (or)
b) State Biogeographical classification of India.
4. a) Write a brief account on endangered and endemic species of India. (or)
b) Discuss about pollution with examples.
5. a) Explain in detail about Solid waste management. (or)
b) Write short notes on Wildlife Protection Act and Forest Conservation Act.

Section-C (Answer Any Three Questions)

1. Describe social issues related to environment.
2. Enumerate different types of environmental pollution and explain.
3. Give an account of different types of biodiversity conservation.
4. Classify different types of ecosystems and describe.
5. What are renewable and non-renewable resources explain.

SEMESTER III

MICROBIOLOGY

Paper	: Core II	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 18U3BTC03	External	: 75

PREAMBLE

To make students on understanding and identification of simple and polysaccharides, and to make them in understanding the knowledge on qualitative identification of amino acids. The students also gain hands on skills on basic separation of biomolecules by simple chromatographic techniques.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	To understand historical prospective on the evolution of microbiology and gaining the concepts microscopic techniques	K1 & K2
CO2	To acquire knowledge on the basic concepts on prokaryotic cellular structure	K1 & K2
CO3	To acquaintance of basic nutritional requirements of microorganism and their growth pattern and media requirements	K2, K3 & K4
CO4	To know about the anti-microbial therapy and their mode of action on controlling the growth of microorganisms	K2, K3, K4 & K5

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	M
CO2	S	S	M	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
I	INTRODUCTION: Evolution and scope of microbiology. Description of various groups of microorganisms with typical example. Cell cycle and reproduction of bacteria. Bacterial cell structure and components, bacterial growth curve in batch culture.	15

II	MICROSCOPY: Microscopy – principles of microscopy- bright-field microscopy – PCM, FM CSLM, ICM, TEM, SEM and STEM – description, principle and use.	15
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III	STERILIZATION: Sterilization – High temperature- Tyndallization, Pasteurization, inspissation, incineration, moist heat under pressure; low temperature – preservation; filtration- membrane filters, depth filters; centrifugation; radiation- principle, use and Quality control. Disinfection- Mode of action and Evaluation.	15
IV	ANTIBIOTICS: Antibiotics – Classification, Mode of Action, mechanism of resistance, Evaluation – Disc Diffusion; MIC – Broth dilution, agar dilution; MBC; E- test with Quality control for each method.	15
V	ALGAE: Structure of algal cell with example; Life-cycle patterns of Algae. Reproduction in algae. Structure of Paramecium, Amoeba, Euglena, Giardia.	15

SUGGESTED READINGS:

1. Microbiology – concepts and application by Paul A. Ketchum, Wiley Publications 2010.
2. Fundamentals of Microbiology- Frobisher, Saunders & Toppan publications 1975.
3. Microbiology - Ronald M. Atlas 1993.
4. Introductory Biotechnology – R.B. Singh C.B.D. India (1990)
5. Industrial Microbiology – Casida, E. Wiley Eastern Ltd 1962.
6. Industrial Microbiology – Casida, E. Wiley Eastern Ltd 1962.
7. Fundamentals of Bacteriology – Salley 1996.
8. Microbiology – Pelczar, Chan, Krieg, Tata McGraw Hill Publications 2005.
9. Frontiers in Microbial technology – P.S. Bisen, CBS Publishers 1994.
10. Biotechnology: International Trends of perspectives - A.T.Bull, G. Holl, M.D.Lilly, Oxford & TBH publishers 1987.
11. General Microbiology-C.B.Powar, H.F. Daginawala, Himalayan Publishing House 2011.

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

LAB IN MICROBIOLOGY

Paper	: Core practical II	Total Hours	: 60
Hours/Week	: 4	Exam Hours	: 05
Credit	: 3	Internal	: 40
Paper Code	: 18U3BTCP03	External	: 60

PREAMBLE

To make students on understanding basic microbiological techniques, aseptic practices in laboratory. The candidate also shall know how to maintain and culture the microorganisms in laboratory and their biochemical identification mechanisms.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	To understand and implement the principles of aseptic practices in laboratory	K1, K2 & K3
CO2	To gain knowledge on the media preparation and culturing the microorganism	K2, K3 & K4
CO3	To identify the microorganisms by staining techniques and biochemical tests	K3, K4 & K5
CO4	To check the growth pattern of microorganisms towards various classes antibiotics	K4, K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	M	M	S	M
CO3	S	S	S	S	S
CO4	S	S	S	S	S

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
1	General Laboratory rules to be followed in microbiological laboratory	3
2	Sterilization techniques (Dry heat, Moist heat, Filtration - membrane and HEPA filters)	4
3	Preparation of nutrient media (Solid, semi - solid and liquid)	5
4	Isolation of pure culture (Streaking methods – simple, continuous, quadrant and „T“ streaking)	2

5	Simple and negative staining	3
6	Differential staining (Gram's staining, Capsule staining, Spore	10
7	Fungal staining (LCB)	5
8	Determination of bacterial motility (Hanging drop method)	5
9	Biochemical characterization of microorganisms (IMViC), TSI test, Carbohydrate fermentation test, Urease test, Catalase test	12
10	Antibiotic sensitivity test (Kirby-Bauer method)	10

MODEL QUESTION PAPER (LAB IN MICROBIOLOGY)

NAME OF THE COURSE: LAB IN MICROBIOLOGY	COURSE CODE: 18U3BTCP03	DURATION: 6Hrs
MAX MARKS: 60		

MAJOR EXPERIMENT			
Exp: 12	Obs: 5	Res: 3	Total 20 MARKS
1. (i) Perform Gram's staining for the given sample (A). Display the results for observation. (OR)			
(ii) Perform LCB staining for the given fungal (A) and display the results for observation. (OR)			
(iii) Identify the motility of the given bacterial strain (A) and display the results for observation			
MINOR EXPERIMENT			
Exp: 6	Obs: 2	Res: 2	Total: 10 MARKS
2. (i) Determine the sensitivity pattern of the given bacterial culture (B) against the given antibiotics (OR)			
(ii) Perform quadrant streaking from the bacterial sample (B) and display the results for observation (OR)			
(iii) Perform catalase test for the given bacterial culture (B) for hydrogen peroxide production and display the results for observation			
SPOTTERS			(5 X 4 = 20 MARKS)
3. Identify the given spotters A, D, H, F & G and comment on them			
RECORD			(1 x 5 = 5 MARKS)
VIVA-VOCE			5 MARKS
TOTAL			60 MARKS

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

BIOCHEMISTRY I

Paper	: ALLIED I	Total Hours	: 60
Hours/Week	: 4	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: 18U3BCA03	External	: 75

PREAMBLE

To make the students to understand the basics biological molecules existing the living cell systems. Students also acquire knowledge on their biological functions and their importance in cell growth and development

COURSE OUTCOMES

On successful completion of the course, students will be able to,

Cos	Outcome	CPD
CO1	Acquiring knowledge on carbohydrate and its types in biological systems.	K1 & K2
CO2	Understanding the basic concepts on proteins and amino acids and their properties	K1 & K2
CO3	Under the role of biological catalysts (Enzymes) and lipids, their role in basic biochemical reactions	K2, K3 & K4
CO4	To gain over all information on vitamins, their physiological functions and deficiency symptoms and consequent diseases	K4, K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	M
CO2	S	S	S	S	M
CO3	S	S	S	S	S
CO4	M	S	S	S	S

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
I	Carbohydrates – Carbohydrate – classification, monosaccharide's (glucose, fructose, galactose & xylose)- physical and chemical properties, disaccharides (sucrose, lactose), polysaccharides (glycogen, starch, pectin, keratin sulphate & chondroitin sulphate).	12
II	Amino acids and proteins: Classification, Structure, Essential and Non-essential amino acids. Definition, Classification, Functions and Properties of protein. Proteins structure -primary, secondary, tertiary and quaternary structures.	12
III	Enzymes: Definition, holo enzyme, apo enzyme, active site, Enzyme units,	12

	classification, Lock and Key model and Induced fit hypothesis. Enzyme kinetics (MM & LB plot), factors affecting enzyme activity.	
IV	Lipids: Classification, structure, function and properties of simple, compound, Derived, Essential fatty acids and Non-essential fatty acids, cholesterol.	12
V	Vitamins: Classification, occurrence, deficiency symptoms and biochemical functions of vitamins (Fat soluble and water soluble vitamins).	12

SUGGESTED READINGS:

1. R.K. Murray, D.K. Granner, P.A. Mayes, D.W. Rodwell (2006), Harper's Biochemistry, twenty fifth edition, Prentice Hall, New Jersey.
2. D. Voet, and G.Voet (2006), Biochemistry, John Wiley and Sons, New York.
3. G.L Zubay (1999) Biochemistry, 4th Ed, WCB, McGraw-Hill, New York.
4. Ambika Shanmugam(1998)., Fundamentals of Biochemistry for Medical Students.
5. U. Satyanarayana., (2006) A textbook of Biochemistry, Books & Allied, Kolkata.
6. J.L Jain., (2005). Fundamentals of Biochemistry. S.Chand Publishing, New Delhi.
7. D.L.Nelson, and M.M. Cox (2008) Lehninger Principles of Biochemistry, 5th Ed, W.H. Freeman and Company, New York

MODEL QUESTION PAPER (BIOCHEMISTRY I)

NAME OF THE COURSE: BIOCHEMISTRY I	COURSE CODE: 18U3BCA03	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS

1. The general formula of monosaccharide is -----			
a. $C_nH_{2n}O_n$	b. $C_nH_2O_n$	c. $C_nH_2O_{2n}$	d. $C_nH_{2n}O_{2n}$
2. The aldose sugar is -----			
a. Glycerose	b. Ribulose	c. Erythrulose	d. Dihydroxyacetone
3. Polysaccharides are -----			
a. Polymers	b. Acids	c. Proteins	d. Oils
4. The most important epimer of glucose is -----			
a. Galactose	b. Fructose	c. Arabinose	d. Xylose
5. A heteropolysaccharide among the following is -----			
a. Inulin	b. Cellulose	c. Heparin	d. Dextrin
6. An example of a saturated fatty acid is -----			
a. Palmitic acid	b. Oleic acid	c. Linoleic acid	d. Erucic acid
7. Molecular formula of cholesterol is -----			
a. $C_{27}H_{45}OH$	b. $C_{29}H_{47}OH$	c. $C_{29}H_{47}OH$	d. $C_{23}H_{41}OH$
8. Sphingomyelins are -----			
a. Phospholipids	b. Nitrolipids	c. Glycolipids	d. Alcohol
9. The end product of saponification is -----			
a. Glycerol	b. Acid	c. Soap	d. Both (A) and (C)
10. All proteins contains -----			
a. Same 20 amino acids	b. Different amino acids	c. 300 Amino acids occurring in nature	d. Only a few amino acids
11. Sulphur containing amino acid is -----			
a. Methionine	b. Leucine	c. Valine	d. Asparagine
12. An essential amino acid in man is -----			
a. Aspartate	b. Tyrosine	c. Methionine	d. Serine
13. Which of the following is a dipeptide?			
a. Anserine	b. Glutathione	c. Glucagon	d. β -Lipoprotein

14. Vitamins are -----			
a. Accessory food factors	b. Generally synthesized in the body	c. Produced in endocrine glands	d. Proteins in nature
15. One manifestation of vitamin A deficiency is -----			
a. Painful joints	b. Night blindness	c. Loss of hair	d. Thickening of long bones
16. Vitamin K is found in -----			
a. Green leafy plants	b. Meat	c. Fish	d. Milk
17. In human body highest concentration of ascorbic acid is found in -----			
a. Liver	b. Adrenal cortex	c. Adrenal medulla	d. Spleen
18. A nucleoside consists of -----			
a. Nitrogenous base	b. Purine or pyrimidine base + sugar	c. Purine or pyrimidine base + phosphorous	d. Purine + pyrimidine base + sugar + phosphorous
19. RNA does not contain -----			
a. Uracil	b. Adenine	c. Thymine	d. Ribose
20. The major catabolic product of pyrimidines in human is -----			
a. Alanine	b. Urea	c. Uric acid	d. Guanine

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS

21. A) Explain Polysaccharides B) Write the structure and importance of maltose.	(OR)
22. A) Classify the fatty acids with examples. B) Write the structure of cholesterol.	(OR)
23. A) Explain the reactions of amino acid with ninhydrin B) Describe the primary structure of protein	(OR)
24. A) Write about energy rich bond B) Explain oxidative phosphorylation	(OR)
25. A) Write about Vitamin E B) Explain the structure & sources of Vitamin C	(OR)

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS

26. Classify the carbohydrate with examples
27. Classify the lipids with examples
28. Write the structural organisation of protein
29. Explain the double helical structure of DNA
30. Write the structure, physiological function & deficiency symptoms of Vitamin A

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

LAB IN BIOCHEMISTRY I

Paper	: ALLIED PRACTICAL I	Total Hours	: 60
Hours/Week	: 3	Exam Hours	: 03
Credit	: 3	Internal	: 40
Paper Code	: 18U3BCAP03	External	: 60

PREAMBLE

To make students on understanding and identification of simple and polysaccharides, and to make them in understanding the knowledge on qualitative identification of amino acids. The students also gain hands on skills on basic separation of biomolecules by simple chromatographic techniques.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	Acquiring knowledge on qualitative analysis of carbohydrates.	K3, K4 & K5
CO2	Acquiring knowledge on qualitative analysis of aminoacids.	K3, K4 & K5
CO3	Under the role of thin layer chromatography in the separation of amino acids	K3, K4 & K5
CO4	Under the role of thin layer chromatography in the separation of lipids	K3, K4 & K5

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	M
CO2	S	S	S	S	M
CO3	M	S	M	S	M
CO4	M	S	M	S	M

S: Strong; M: Medium; L: Low

Ex. No	CONTENT	HOURS
1	PREPARATION OF SOLUTION Normal, Molar, Percentage solution and calculation	3
2	Analysis of sugars a) Monosaccharides - Glucose, Fructose.	6
3	Analysis of sugars a) Monosaccharides - Galactose, Pentose.	6
4	Analysis of sugars b) Disaccharides - Sucrose, Maltose and Lactose.	6
5	Analysis of sugars c) Polysaccharide – Starch	3

6	Analysis of amino acids a) Histidine b) Tyrosine	6
7	Analysis of amino acids c) Tryptophan d) Methionine	6
8	Analysis of amino acids e) Cysteine f) Arginine	3
9	Separation of amino acids by paper chromatography	3
10	Separation of lipids by thin layer chromatography	3

MODEL QUESTION PAPER (LAB IN BIOCHEMISTRY I)

NAME OF THE COURSE: LAB IN BIOCHEMISTRY I	COURSE CODE: 18U3BCAP03	DURATION: 3 Hrs
MAX MARKS: 60		

MAJOR EXPERIMENT	
Total 25 MARKS	
1. (i) Systematically analyze the give carbohydrate sample (A) and display the results for observation (OR)	
(ii) Separate the given lipid sample (A) by thin layer chromatography.	
MINOR EXPERIMENT	
Total: 25 MARKS	
2. (i) Separate the given amino acid sample (B) by paper chromatography and display the results for observation (OR)	
(ii) Systematically analyze the give amino acid sample (B) and display the results for observation.	
RECORD	(1 x 10 = 10 MARKS)
TOTAL	60 MARKS

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

SEMESTER IV

GENETIC ENGINEERING

Paper	: Core IV	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 18U4BTC04	External	: 75

PREAMBLE

To make students on understanding basic principles of gene manipulation and its application in the development of novel pharmaceutical and drug products

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	To know about DNA manipulating enzymes and its role in rDNA Technology	K1 & K2
CO2	To gain knowledge on different types plasmid vectors and their Usage	K1 & K2
CO3	To acquire knowledge on basic gene cloning strategies	K2, K3 & K4
CO4	To evaluate the usage and applications of gene cloning for the development value added products	K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	S
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	M	S	S	S	S

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
I	SCOPE AND MILESTONES OF GENETIC ENGINEERING: Biomolecular tools and their applications in genetic engineering: Restriction endonucleases and its types, DNA polymerases, DNA Ligase, Methylase, Taq polymerase, Reverse transcriptase. DNA modifying enzymes (Alkaline phosphatase, Polynucleotide kinase, Terminal deoxy nucleotidyl transferase). S1nuclease, RNase H and DNase I.	15
II	GENE CLONING VECTORS: Plasmids (PBR322, PUC and BAC), Lambda vectors, Phagemids, Cosmids, M13 vectors, Shuttle vectors and artificial chromosomes (YAC and BAC). DNA sequencing (Maxam-Gilbert and Dideoxy) methods. DNA amplification: PCR (Principles & types - RT PCR, Real time PCR and Nested PCR). cDNA synthesis and cloning:	15

	mRNA enrichment, reverse transcription.	
III	CLONING STRATEGIES: Cloning of interacting genes - Yeast two hybrid systems. Cloning of differentially expressed genes - Nucleic acid micro arrays and Site directed mutagenesis. Methods to study gene regulation: DNA transfection, Primer extension, S1 mapping, RNase protection assay.	15
IV	INTRODUCTION TO CLONING: Detection & Screening of clones. Expression strategies for heterologous genes. Vector engineering and codon optimization. <i>In-vitro</i> transcription, expression of cloned genes in prokaryotes (bacteria – Glucose promoter) and eukaryotes (Yeast – Alcohol promoter).	15
V	APPLICATIONS OF rDNA TECHNOLOGY: Processing of recombinant proteins, Purification and refolding, characterization of recombinant proteins, stabilization of proteins. T-DNA tagging and transposon tagging: Role of gene tagging in gene analysis, Transgenic and gene knock out technologies: Targeted gene replacement and chromosome engineering.	15

SUGGESTED READINGS:

1. Molecular cloning: a laboratory manual. J. Sambrook, EF. Frisch and T. Maniatis, Cold Spring Harbor Laboratory Press, New York.2000.
2. DNA cloning: a practical approach, DM. Glover and BD Hames, IRL Press, Oxford, 1995.
3. Molecular and Cellular Methods in Biology and Medicine, PB. Kaufman, W.Wu. D, Kim and L.J Cseke, CRC Press, Florida, 1995.
4. Methods of Enzymology vol. 152, Guide to molecular cloning techniques, SL. Berger and AR. Kimmel Academic Press, Inc. An Diego, 1998.
5. Methods in Enzymology. Vol 185, gene expression technology, DV. Goeddel Academic Press, inc. San Deigo, 1990.
6. DNA science. A first Course in Recombinant Technology. DA. Mickloss and GA. Freyer; CokJ Spring Harbor Laboratory Press, New York, 1990.
7. Molecular Biotechnology. SB. Primrose, Blackwell Scientific Publishers, Oxford, 1994.
8. Milestones in Biotechnology. Classic papers on genetic Engineering. JA. Davis and WS. Reznikoff, Butterworth-Heinemann, Boston, 1992.
9. Route maps in Gene technology, MR. Walker and R. Rapley, BlackwelScience Ltd., Oxford, 1997.
10. Genetic Engineering. An Introduction to gene analysis and exploitation in eukaryotes, SM. Kingsman and AJ. Kingsman, Blackwell Scientific Publications, Oxford, 1998.
11. Molecular Biotechnology - Glick and Pasternak.
12. Principles of gene manipulations - Old & Primrose.

MODEL QUESTION PAPER (GENETIC ENGINEERING)

NAME OF THE COURSE: GENETIC ENGINEERING	COURSE CODE: 18U4BTC04	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (20 X 1 = 20 MARKS) ANSWER ALL THE QUESTIONS			
1. <i>Taq</i> polymerase is isolated from -----			
a. <i>E.coli</i>	b. <i>Thermus aquaticus</i>	c. <i>Thermus marinus</i>	d. <i>Bacillus stercophilus</i>
2. Which of the following sequence is recognized by Hind III?			
a. AA GCTT	b. A AGCTT	c. GTCGA C	d. GT CGAC
3. RNase H cleaves ----- hybrid			
a. DNA-RNA	b. DNA-DNA	c. RNA-RNA	d. RNA-Protein
4. Which of the following enzyme is used to create the sticky ends on DNA?			
a. Acid phosphatase	b. Polynucleotidyl kinase	c. Terminal deoxy nucleotidyl tranferase	d. Alkaline phosphatase
5. Which of the following vectors contains Ori „C“ sites from two different species?			
a. Cosmids	b. M13 vectors	c. Shuttle vectors	d. Phagemids
6. The insertional vector λ gt10 can able to carry up to -----of foreign DNA			
a. 4 kb	b. 5 kb	c. 7 kb	d. 8 kb
7. The size of YRp7 is -----			
a. 5.8 kb	b. 6.8 kb	c. 5.7 kb	d. 6.7 kb
8. Which of the following contains covalently closed single stranded circular DNA molecules?			
a. Phagemids	b. M13 vectors	c. Shuttle vectors	d. Cosmids
9. Which of the following DNA is used as template in chain termination method DNA sequencing?			
a. Plasmid DNA	b. Genomic DNA	c. Viral DNA	d. λ DNA
10. Denaturation of DNA during PCR is usually carried out at ----- °C			
a. 94	b. 84	c. 64	d. 74
11. The processed RNA is partially degraded by exonucleases to produce functional transcriptome. This method is called as -----			
a. cDNA library construction	b. mRNA enrichment	c. DNA sequencing	d. DNA amplification
12. In yeast two hybrid analysis, the target gene is fused with the gene for one of the pair if transcription factors and the vector construct is ligated in to a----- vector			
a. YAC	b. BAC	c. SEN	d. Lambda
13. The glucoamylase (GOX) promoter found in <i>Aspergillus nidulans</i> is induced by -----and repressed by -----			

a. Starch, Glucose	b. Starch, Fructose	c. Starch, Galactose	d. Starch, Xylose
14. The chemical method of DNA sequencing can be used to rapidly sequence DNA that are ----- kb			
a. < 0.5	b. > 0.5	c. < 1.0	d. > 1.0
15. The DNA – phosphate containing mixture is incubated with the recipient cells for -----			
a. 24 hrs	b. 48 hrs	c. 72 hrs	d. 98 hrs
16. Short pulses are generated in electroporation in higher voltage at the rate of -----			
a. 1100 V	b. 1200 V	c. 1300 V	d. 1400 V
17. Which of the following protein is first manipulated for enhancing its enzymatic activity through protein engineering?			
a. Amylase	b. Subtilisin	c. Anti-trypsin	d. Chymotrypsin
18. Which of the following assay is useful for monitoring for the purification and function of many different enzymes catalysing the synthesis of polymers like DNA, RNA, or proteins?			
a. Enrichment assay	b. Manipulating assay	c. Incorporation assay	d. Sequence specific targeting assay
19. Which of the following method comes under gene tagging technology?			
a. Selection based gene tagging	b. rDNA tagging	c. Marker assisted tagging	d. Epitope tagging
20. The given chromosome can be engineered by the principle of -----			
a. Addition	b. Point mutation	c. Inversion	d. None of the above

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS
21. A) Write short notes on DNA modifying enzymes (OR) B) Write short notes on type III restriction endonucleases
22. A) Write about PBR 322 with neat illustrations (OR) B) Explain about the principle of mRNA enrichment
23. A) Explain the process of site directed mutagenesis (OR) B) Explain the principle of S1 mapping with neat illustrations
24. A) Give a brief account on codon optimization (OR) B) Explain the expression of cloned in eukaryotes with suitable example
25. A) Write short notes on transposon tagging (OR) B) Write shortly about gene knock technology

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS
26. Give detailed account on restriction endonucleases
27. Give detailed account on M13 vectors
28. Give detailed account on cloning differentially expressed genes
29. Give detailed account on expression of heterologous genes
30. Give detailed account on processing, purification, refolding and characterization of recombinant proteins

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

LAB IN GENETIC ENGINEERING

Paper	: Core Practical IV	Total Hours	: 75
Hours/Week	: 4	Exam Hours	: 06
Credit	: 3	Internal	: 25
Paper Code	: 18U4BTCP04	External	: 75

PREAMBLE

To make students on understanding basic principles on the usage of genomic and plasmid DNA in the development of microbial recombinant clones by selection strategies

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	To isolate genomic and plasmid DNA, and to digest them restriction enzyme	K2, K3 & K4
CO2	Shall acquire practical knowledge on ligating vector and target DNA	K2, K3, & k4
CO3	Shall know about the amplification strategies of cloned vector	K3, K4 & K5
CO4	To demonstrate the selection of recombinant clones by using selectable markers	K4, K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
1	Isolation of Genomic DNA from <i>E.coli</i>	10
2	Isolation of Plasmid DNA mini prep and maxi prep from <i>E.coli</i>	10
3	Construction of restriction map of a plasmid by Hind III and BamHI	10
4	Ligation of DNA and plasmid by T4 DNA ligase	5
5	Purification of DNA fragment from gel by electro-elution	5
6	Amplification of ligated plasmid by PCR	10
7	Transformation of recombinant DNA in Host <i>E.coli</i> by CaCl method	10
8	Selection of recombinant clones by (IPTG-X-gal: Blue white selection)	15

MODEL QUESTION PAPER (LAB IN GENETIC ENGINEERING)

NAME OF THE COURSE: LAB IN GENETIC ENGINEERING	COURSE CODE: 18U4BTCP04	DURATION: 6 Hrs
MAX MARKS: 60		

MAJOR EXPERIMENT			
Exp: 12	Obs: 5	Res: 3	Total 20 MARKS
1. (i) Isolate genomic DNA from the given bacterial sample (A). Display the results for observation (OR)			
(ii) Isolate plasmid DNA from the given bacterial sample (A). Display the results for observation (OR)			
(iii) Perform restriction digestion of the given DNA sample (A) using the given enzyme/s. Display the results for observation			
MINOR EXPERIMENT			
Exp: 6	Obs: 2	Res: 2	Total: 10 MARKS
2. (i) Perform ligation of the given DNA sample (B) using DNA ligase. Display the results for observation (OR)			
(ii) Perform DNA transformation in the given host cell sample (B) using calcium chloride (OR)			
(iii) Purify the given DNA sample (B) by electro elution. Display the results for observation			
SPOTTERS			(5 X 4 = 20 MARKS)
3. Identify the given spotters C, D, E, F & G and comment on them			
RECORD			(1 x 5 = 5 MARKS)
VIVA-VOCE			5 MARKS
TOTAL			60 MARKS

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

BIOCHEMISTRY II

Paper	: ALLIED II	Total Hours	: 60
Hours/Week	: 4	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: 18U4BCA04	External	: 75

PREAMBLE

To make students on understanding basic biochemical reaction mechanisms of various biomolecules. The students also acquire knowledge on their regulation and also about the concepts of various endocrine systems and their deficiency consequences in human being.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	To under the basic concepts of thermodynamics and energy production in living systems	K1 & K2
CO2	To understand the basic concepts of carbohydrate metabolism and their energy yield	K1, K2 & K4
CO3	To understand the basic concepts of protein & lipid metabolism and their energy yield	K1, K2 & K4
CO4	To understand the basic concepts of human endocrine system	K1, K2 & K4

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	S	M
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	M	S	S	S	S

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
I	Bio energetics – Laws of thermo dynamics, Concepts of free energy and standard free energy, Exergonic and Endergonic reactions. Electron transport chain. Inhibitors of ETC. Oxidative phosphorylation, High energy compounds.	12
II	Carbohydrate metabolism: Glycolysis, Citric acid cycle with Energetics, glycogenesis, Glycogenolysis, HMP shunt.	12
III	Protein metabolism: Transamination, oxidative and non-oxidative deamination, decarboxylation- urea cycle. Interrelationship of carbohydrates, proteins and fat metabolism.	12

IV	Lipid metabolism: Basic principles of lipid metabolism. Oxidation of saturated (α , β and ω) and unsaturated fatty acids. Oxidation of odd chain fatty acids, Cholesterol biosynthesis and its importance.	12
V	Endocrinology – Definition, Classification of Hormones, secondary messenger(cAMP) Biological function and disorders of Pancreatic Hormones (Insulin and Glucagon), Thyroid hormone (thyroxin).	12

SUGGESTED READINGS:

1. R.K. Murray, D.K. Granner, P.A. Mayes, D.W. Rodwell (2006), Harper's Biochemistry, twenty fifth edition, Prentice Hall, New Jersey.
2. D. Voet, and G.Voet (2006), Biochemistry, John Wiley and Sons, New York.
3. G.L Zubay (1999) Biochemistry, 4th Ed, WCB, McGraw-Hill, New York.
4. Ambika Shanmugam(1998)., Fundamentals of Biochemistry for Medical Students.
5. U. Satyanarayana., (2006) A textbook of Biochemistry, Books & Allied, Kolkata.
6. J.L Jain., (2005). Fundamentals of Biochemistry. S.Chand Publishing, New Delhi.
7. D.L.Nelson, and M.M. Cox (2008) Lehninger Principles of Biochemistry, 5th Ed, W.H. Freeman and Company, New York

MODEL QUESTION PAPER (BIOCHEMISTRY II)

NAME OF THE COURSE: BIOCHEMISTRY II	COURSE CODE: 18U4BCA04	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS

1. In exergonic reaction heat is -----			
a. Consumed	b. Liberated	c. No change in heat transfer	d. Enthalpy in more than 1
2. Hydrogen is transferred through a series of enzyme systems to form -----			
a. Oxygen	b. Water	c. Carbohydrate	d. ATP
3. One molecule of ATP is equal to ----- molecules of NADP			
a. 1	b. 2	c. 3	d. 4
4. Oxidative phosphorylation occurs in -----			
a. Chloroplast	b. Mitochondria	c. Endoplasmic reticulum	d. Tonoplast
5. In which of the following phase in glycolysis does the ATP is consumed?			
a. Payoff phase	b. Interphase	c. Preparatory phase	d. Gap phase
6. The term glycogenolysis defines -----			
a. Break down of glucose	b. Breakdown of glycogen	c. Synthesis of glucose	d. Synthesis of glycogen
7. HMP stands for -----			
a. Hexo kinase shunt	b. Hexose mono nitrate shunt	c. Hexose mono phosphate shunt	d. Hexose mono butyrate shunt
8. Which of the following enzyme mainly involved in the process of glycogenesis?			
a. Glucagon lyase	b. Glycogen lyase	c. Glycogen synthase	d. Glucagon synthase
9. Transamination of amino acids is chiefly catalyzed by -----			
a. Deaminase	b. Transaminase	c. Transketolase	d. Trans decarboxylase
10. Which of the following amino acid involved in Urea cycle?			
a. Serine	b. Typtophan	c. Asparagine	d. Citrulline
11. SGOT is an enzyme that catalyzes----- reaction			
a. Deamination	b. Trans deamination	c. Transamination	d. Decarboxylation
12. Non-oxidative deamination reactions is accomplished by -----			
a. The conversion of alpha amino group to ammonia	b. Conversion of COOH group to CO ₂	c. Removal of amino group as nitrogen	d. None of the above
13. Lipid metabolism entails the -----			

a. Synthesis of fatty acids	b. Oxidation of fatty acids	c. Reduction of fatty acids	d. Conversion of fatty acids in to glycerol
14. Fatty acid synthase is a multi-enzyme complex composed of -----sub units			
a. 1	b. 2	c. 3	d. 4
15. Phenanthrene nucleus is found in -----			
a. Stigmesterol	b. Ergosterol	c. Cholesterol	d. Levosterol
16. The precursor for the cholesterol biosynthesis is -----			
a. Acyl Co-A	b. Acetyl Co-A	c. Aceto acetyl Co-A	d. Keto acyl Co-A
17. Ductless glands secretes -----			
a. Serum	b. Hormone	c. Plasma	d. CSF
18. Hyper insulinism leads to -----			
a. Decreased level of glycogen	b. Increased level of glucose	c. Increased level of glucagon	d. Increased rate of muscle phosphorylation
19. Which of the following is an example for secondary messenger?			
a. cGMP	b. cTMP	c. cUMP	d. cAMP
20. Thyroid hormone is highly concentrated on -----			
a. Baso lateral plasma membrane of active histiocytes	b. Baso lateral plasma membrane of active hepatocytes	c. Baso lateral plasma membrane of active thyocytes	d. Baso lateral plasma membrane of active thrombocytes

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS

21. A) Write short notes on standard free energy (OR) B) Write about the inhibitors of ETC
22. A) Explain the energetics of glycolysis (OR) B) Write shortly on the process of glycogenesis
23. A) Write short notes on transamination reactions (OR) B) Write short notes on oxidative deamination reactions
24. A) Explain the energetics of beta oxidation of fatty acids (OR) B) Explain the oxidation of odd chain fatty acids
25. A) Explain the clinical manifestations of hypo parathyroidism (OR) B) Explain the complications faced by a victim having hyperglycemia

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS

26. Give a detailed account on electron transport chain
27. Give a detailed account on TCA cycle
28. Elaborately discuss on Urea cycle with neat chemical reactions
29. Write an essay on cholesterol biosynthesis with neat chemical reactions
30. Explain the biological function thyroid hormone. Add a note on hypo and hyper thyroidism

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

ALLIED – LAB IN BIOCHEMISTRY II

Paper	: ALLIED PRACTICAL II	Total Hours	: 60
Hours/Week	: 3	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: 18U4BCAP04	External	: 75

PREAMBLE

To make students on understanding basic biochemical calculations and preparing reagents and solutions. The students also gain knowledge on estimating quantitatively the biomolecules substances.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	Become familiar in preparing different strengths of solutions for the basic requirement of executing biochemical experiments	K1, K2, K4 & K5
CO2	To know about the quantitative determination on the strength of various specific biomolecules	K1, K2, K4 & K5
CO3	Gaining knowledge on using basic instruments such as colorimeter and UV spectrophotometer for measuring the colour intensity developed in the reaction mixture	K1, K2, K4 & K5

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	M
CO2	S	S	S	S	M
CO3	S	S	S	S	M

S: Strong; **M:** Medium; **L:** Low

Ex. No	CONTENT	HOURS
1	Estimation of glucose by ortho toluidine method	3
2	Estimation of glycine by formal titration method	3
3	Estimation of ascorbic acid by 2,4 dichloro phenol indo phenol method	3
4	Estimation of urea by diacetyl monoxime method	3
5	Estimation of DNA by diphenylamine method	3
6	Estimation of RNA by orcinol method	3
7	Estimation of protein by lowry's method	3
8	Estimation of cholesterol by zak's method	3

MODEL QUESTION PAPER (LAB IN BIOCHEMISTRY II)

NAME OF THE COURSE: LAB IN BIOCHEMISTRY II	COURSE CODE: 18U4BCAP04	DURATION: 3 Hrs
MAX MARKS: 60		

MAJOR EXPERIMENT	
	Total 25 MARKS
1. (i) Estimate the amount of glycine present in the given sample (A)	(OR)
(ii) Estimate the amount of ascorbic acid present in the given sample (A)	
MINOR EXPERIMENT	
	Total: 25 MARKS
2. (i) Estimate the amount of protein present in the given sample (B)	(OR)
(ii) Estimate the amount of RNA present in the given sample (B)	
RECORD	(1 x 10 = 10 MARKS)
TOTAL	60 MARKS

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

SEMESTER V

IMMUNOLOGY

Paper	: Core V	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 18U5BTC05	External	: 75

PREAMBLE

To make students on exposing themselves to know in underlying concepts of biology of the immune system and how immunity being developed in human beings. In addition the students also know whereabouts on the mechanisms on the host pathogen interaction, principle defence mechanisms against infectious diseases and basic immune diagnostic techniques

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	Acquire knowledge on history on immunology development, and cells and their role in developing overall host immune system	K1 & K2
CO2	Knowing about the functions and properties of immunoglobulin and its expression in genetic level	K1 & K2
CO3	Acquire knowledge on antigen recognition and its processing principles by host immune system	K1, K2 & K4
CO4	Acquire basic concepts of immune regulatory molecules and their role in defence and concepts of autoimmunity	K1, K2, K4 & K5

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	M	S
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	M	S	S	S	S

S: Strong; **M:** Medium; **L:** Low

UNIT	CONTENT	HOURS
I	HISTORY AND SCOPE OF IMMUNOLOGY: Types of Immunity. Cells of Immune system. Organs of Immune response and their functions. Haematopoiesis. Antigen- properties, classes, epitopes, haptens and adjuvants. Factors influencing antigenicity. Immunoglobulin- Structure, types, properties and functions.	13

II	IMMUNOGLOBULINS AND ITS EXPRESSION: Immunoglobulin- Structure, types, properties and functions. Immunoglobulin gene re-arrangements. Generation antibody diversity. Somatic hyper mutation. Ig gene expression and its regulation.	15
III	ANTIGEN PROCESSING AND PRESENTATION: MHC – types and importance- distribution and function. Antigen processing and presentation to T- lymphocytes. Major classes of MHC genes and its regulation.	17
IV	CYTOKINES, IMMUNE CELL ACTIVATION AND ALLERGIC REACTIONS: Definition of cytokines, classification and types of cytokine, Biological functions of cytokines. Cytokine receptors. T-cell and B-cell activation and differentiation. Hypersensitivity reactions and its types.	15
V	AUTOIMMUNITY: Definition, types of autoimmune disorders. Mechanism of autoimmunity. Vaccines and its types. Immune response to bacterial, protozoal, parasitic diseases. Immuno deficiency diseases (HIV). Transplantation immunology – types of grafts. Mechanism of graft rejection. Immune suppression.	15

SUGGESTED READINGS:

1. Ivan Riot – Blackwell, 1988. Essentials of Immunology (6th Edition): Scientific Publications, Oxford,
2. Paul W.E (Eds) Ravan prss 1988.Fundamentals of Immunology:, New York,
3. Harlow and David Lane, 1988.Antibodies A laboratory Manual: cold spring harbor laboratory.
4. Janis Kuby Immunology, 1997. WH Freeman & Company, New York.
5. Tizard,1995.Immunology IV Ed Saunders college publishers, New York.
6. Robert M.Coleman., 1992. Fundamental Immunology. 2 nd edition., Wim. C.Brown Publishers.
7. Eli Benjamini et al., 1991. Immunology A short course –Wiley Publishers, NY.

MODEL QUESTION PAPER (IMMUNOLOGY)

NAME OF THE COURSE: IMMUNOLOGY	COURSE CODE: 18U5BTC05	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS			
1. The ability of an organism to resist infections by the pathogens is called?			
a. Infection	b. Hypersensitivity	c. Immunity	d. Allergy
2. Which of the following is NOT a poly morpho nuclear leukocyte?			
a. Eosinophil	b. Mast cell	c. Macrophage	d. Basophil
3. Name the first cell which recruited at the place of infection.			
a. Nk cell	b. Basophil	c. Neutrophil	d. Macrophage
4. Which of the following cell is a multipotent cell?			
a. T-cell	b. B-cell	c. HSC	d. Monocytes
5. Which of the following antibody gives a primary immune reaction?			
a. IgG	b. IgM	c. IgA	d. IgE
6. What is the origin of B-cell?			
a. Pancreas	b. Liver	c. Thymus	d. Bone marrow
7. Who discovered the structure of immunoglobulin by treating it with beta-mercaptoethanol?			
a. Nisonoff	b. Edelman	c. Porter	d. Whittekar
8. Name the heavy chain of IgG.			
a. M	b. E	c. α	d. γ
9. Which of the following is NOT the characteristic of a good antigen?			
a. Large in size	b. Foreignness	c. Highly complex	d. Reproduce only by binary fission
10. Name the molecule which constitutively expressed on the dendritic cell?			
a. Class I MHC	b. Class II MHC	c. APC	d. Antigen
11. Which of the following polypeptide is important for the expression of MHC I on the cell membrane?			
a. Interferon	b. β_2 -microglobin	c. Lymphokine	d. Interleukin
12. Name the part of processed antigen that binds to the MHC molecule and recognized by T-cells?			
a. Immunoglobulin	b. Paratope	c. Epitope	d. Chaperone
13. Name the cytokines which released in response to virus infection?			
a. Monokines	b. Interferons	c. Lymphokines	d. Interleukins
14. Name the nerve stimulator which is responsible for the pain of the inflammation.			

a. Bradykinins	b. Prostaglandin	c. Histamines	d. Kinins
15. Name the class of immunoglobulin which takes part in hypersensitivity reaction?			
a. IgG	b. IgM	c. IgA	d. IgE
16. Out of these, which transcription factor does not take part in B-cell activation?			
a. Abl	b. NF- kB	c. Jun	d. Fos
17. Which among the following is not an autoimmune disease?			
a. Myasthenia gravis	b. Systemic lupus erythematosus	c. Grave's disease	d. Sickle cell disease
18. Vaccination was invented by?			
a. Jenner	b. Pasteur	c. Koch	d. Salk
19. Heat killed vaccines are -----			
a. Dead cells of bacteria	b. Dead cells of virus	c. Dead cells of fungi	d. A & B
20. The major molecule responsible for graft rejection is -----			
a. B-cells	b. T-cells	c. MHC	d. antibodies

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS	
21. A) Explain the organs involved in immune system	(OR)
B) Write a short note on factors influencing antigenicity	
22. A) Give a short note on antibody production	(OR)
B) Explain the IgA and IgM	
23. A) Explain the process of MHC regulation	(OR)
B) Describe Apoptosis	
24. A) Explain Type II hypersensitivity	(OR)
B) Brief about the classification of Cytokines	
25. A) Explain Autoimmunity	(OR)
B) Describe AIDS and HIV types.	

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS
26. Give an detailed account on cells involved in Immune system
27. Explain Immunoglobulin's types, structure and functions
28. Give a detailed account on Antigen processing and presentation
29. Describe the types of hypersensitivity
30. Give detailed account on various types of vaccines and explain with suitable example

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

PLANT BIOTECHNOLOGY

Paper	: Core VI	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 18U5BTC06	External	: 75

PREAMBLE

To make students on exposing plants technically, so as manipulate them for the production of disease free, nutritive elite plant varieties. In addition candidates are exposed to the use of vector based engineering of plant genome for the generation of genetically modified plants and food products.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	Know about the historical development of plant tissue culture and basic tissue culture techniques and their principles	K1 & K2
CO2	Gaining knowledge on plant secondary metabolites and their role in defence mechanisms	K1 & K2
CO3	To acquire knowledge on the generation novel plant varieties by genetic manipulation strategies	K3, K4 & K5
CO4	Exposing towards the application of secondary metabolites in drug development and value added products	K4, K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S

S: Strong; **M:** Medium; **L:** Low

UNIT	CONTENT	HOURS
I	INTRODUCTION: Plant tissue culture history, Laboratory organization sterilization methods, media preparation, plant growth regulators. Applications of crop improvement in agriculture, horticulture and forestry.	12
II	PLANT TISSUE CULTURE TECHNIQUES: Micropropagation, Callus induction. Cell culture techniques, Protoplast culture and fusion. Organogenesis and somatic embryogenesis. Haploid production of plants (Anther, Pollen and embryo cultures).	12
III	PLANT SECONDARY METABOLITES: Basic biosynthesis pathway of auxins and cytokinins. Role of secondary metabolites in plant defence. Plant genome organization (Chloroplast and mitochondria), Agrobacterium mediated gene transfer (Ti plasmid and Ri plasmids) methods in plants.	18
IV	GENETIC ENGINEERING IN PLANTS: Selectable markers, Reporter genes and promoters used in plant vectors. Development of Insect resistant, Herbicide resistant and virus resistant plant varieties. Production of antibodies and viral antigens in plants. Biodegradable	18
V	APPLICATIONS OF PLANT SECONDARY METABOLITES: isolation and characterization - drug development. Production of Biopesticides and Biofertilizers. Development of value added plant products (Saline tolerance & Delayed fruit ripening). Cytoplasmic Male sterility (CMS).	15

SUGGESTED READINGS:

1. Plant Biotechnology: An introduction to genetic engineering by Adrian Slater, Nigel W. Scott, Mark R. Fowler. Oxford University, Press, 2008.
2. Biochemistry and Molecular Biology of Plants. Bod Buchananm Wilhelm Gruissem, Russell Jones. John Wiley & Sons, 2002.
3. Molecular Biotechnology by Glick, B.R. and J.J. Pasternak. Scond Edition, ASM press, Washington, 1998.
4. Plant propagation by tissue culture: volume 1 & 2. E.F George. Exegetics Limited,1999.
5. Natural products: A laboratory Guide by Raphael Ikan, Academic press, 1991.
6. Chemistry of Natural products by sujatha V. Bhat, Bhimsen A. Nagasampagi, meenakshi Sivakumar. Birkhausr, 2005.
7. An introduction to plant tissue culture by MK Razdan. M.K. 2003. Oxford & IBH Publishing Co, New Delhi, 2003.
8. Plant tissue culture by Bhojwani, S.S and Razdan, M.K. 2004.
9. Phytochemical Methods: A guide to Modern Techniques of Plant Analysis by J.B. Harborne. Springer, 1998.
10. Plant cell culture, A practical approach, 2nd Edition, Edited by R.A. Dixon and R.A. Gonzales.

MODEL QUESTION PAPER (PLANT BIOTECHNOLOGY)

NAME OF THE COURSE: PLANT BIOTECHNOLOGY	COURSE CODE: 18U5BTC06	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS

1. Who is the father of tissue culture?			
a. Bonner	b. Haberlandt	c. Laibach	d. Gautheret
2. The growth of plant tissues in artificial media is called _____			
a. Gene expression	b. Transgenesis	c. Plant tissue culture	d. Cell hybridization
3. A _____ is an excised piece of leaf or stem tissue used in micropropagation.			
a. Microshoot	b. Medium	c. Explant	d. Scion
4. Cellular totipotency is the property of -----			
a. Plant	b. Animal	c. Bacteria	d. All of these
5. In plant tissue culture, what is the term ORGANOGENESIS means?			
a. Formation of callus culture	b. Formation of root & shoot from callus culture	c. Genesis of organ	d. None of the above
6. In a cell, protoplast consists the following EXCEPT			
a. Cell wall	b. Cell membrane	c. Nucleus	d. Cytoplasm
7. In a callus culture			
a. Increasing level of cytokinin to a callus induces shoot formation and increasing level of auxin promote root formation	b. Increasing level of auxin to a callus induces shoot formation and increasing level of cytokinin promote root formation	c. Auxins and cytokinins are not required	d. Only auxin is required for root and shoot formation
8. The phenomenon of the reversion of mature cells to the meristematic state leading to the formation of callus is known as -----			
a. Redifferentiation	b. Dedifferentiation	c. either (a) or (b)	d. none of these
9. T-DNA transfer and processing into plant genome requires products of which of the following genes?			
a. <i>vir</i> A,B	b. <i>vir</i> G,C	c. <i>vir</i> D,E	d. All of these
10. Which of the following are used as selection marker for the cells transformed with <i>Agrobacterium</i> ?			
a. Neomycin phosphotransferase	b. Streptomycin phosphotransferase	c. Hygromycin phosphotransferase	d. Any of the above
11. Which technique is used to introduce genes into dicots?			

a. Electroporation	b. Particle acceleration	c. Microinjection	d. Ti plasmid infection
12. Genome is			
a. Genes on nuclear DNA	b. Nuclear DNA + mitochondrial DNA	c. Nuclear DNA + chloroplast DNA	d. Nuclear DNA + Mitochondrial DNA + Chloroplast DNA
13. The process of expression of foreign genes in a plant is called			
a. Gene expression	b. Transgenesis	c. Genetic transformation	d. Cell hybridization
14. Which of the following is considered as a visual marker?			
a. Antibiotic marker	b. Resistance marker	c. Selectable marker	d. Screenable marker
15. Name the first transgenic virus resistant plant?			
a. Rice	b. Cotton	c. Tobacco	d. Tomato
16. Which of the following is supplemented with vitamin A in order to improve its nutritional quality?			
a. Cotton	b. Potato	c. Tomato	d. rice
17. Which of the following is NOT the class of secondary metabolite?			
a. Amino acid	b. Terpenes	c. Phenolics	d. alkaloids
18. Name the class of secondary metabolites which is characterized by the presence of the hydroxyl group with an aromatic ring?			
a. Glycosides	b. Phenolics	c. Alkaloids	d. Terpenes
19. Azolla is used as biofertilizer as it has			
a. Rhizobium	b. Cyanobacteria	c. Mycorrhiza	d. Large quantity of humus
20. Which sterility is exploited in hybrid seed production?			
a. Male genetic sterility	b. Cytoplasmic genetic male sterility is found	c. Cytoplasmic sterility	d. Genetic

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS

21. A) List out the types of media. B) Mention about auxin.	(OR)
22. A) Write note on callus induction. B) Explain embryo culture.	(OR)
23. A) Briefly discuss particle bombardment. B) Biosynthesis pathway of cytokine-explain.	(OR)
24. A) What is called selectable marker? Explain with two examples. B) Write note on virus resistance.	(OR)
25. A) Explain about saline tolerance. B) Briefly explain Cytoplasmic male sterility.	(OR)

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS

26. Illustrate on the application of crop improvement in agriculture, horticulture and forestry.

27. Explain protoplast isolation, culturing and fusion.

28. Draw and explain agrobacterium mediated gene transfer.

29. Write note on genetic engineering in plants.

30. Describe about isolation and characterization of secondary metabolites.

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

LAB IN IMMUNOLOGY

Paper	: Core Practical V	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 3	Internal	: 40
Paper Code	: 18U5BTCP05	External	: 60

PREAMBLE

To make students on practical exposure towards immunological techniques in-terms of handling of laboratory animals, qualitative and quantitative estimation of antigen - antibody specificity.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	Gaining knowledge on handling of laboratory animals	K1 & K2
CO2	Knowing about the methods of immunization of bleeding and separation serum and plasma from blood	K2, K3 & K4
CO3	Analysis of qualitative and quantitative estimation of antigen and antibody interaction	K4, K5 & K6
CO4	To know about the basic principles of blotting techniques in terms of practical approach	K4, K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	M	S	S	S
CO4	S	S	S	S	S

S: Strong; **M:** Medium; **L:** Low

UNIT	CONTENT	HOURS
1	Handling of laboratory animals	5
2	Methods of bleeding and routes of immunization	10
3	Preparation of Serum and plasma	5
4	ABO Blood grouping (Rh typing) (Agglutination)	5
5	WIDAL test (Agglutination)	5
6	ASO test (Agglutination)	5
7	Pregnancy test (Agglutination inhibition)	5
8	Radial immune diffusion test (Precipitation test)	5
9	Rocket Immuno electrophoresis test (Precipitation)	5

10	Ouchterlony double immunodiffusion technique (ODD) (Precipitation)	5
11	Counter current immunoelectrophoresis (CIE) (Precipitation)	5
12	DOT ELISA test	5
13	Western Blotting- Demonstration	10

MODEL QUESTION PAPER (LAB IN IMMUNOLOGY)

NAME OF THE COURSE: LAB IN IMMUNOLOGY	COURSE CODE: 18U5BTCP05	DURATION: 6 Hrs
MAX MARKS: 60		

MAJOR EXPERIMENT			
Exp: 12	Obs: 5	Res: 3	Total: 20 MARKS
1. (i) Identify the Blood group for the given sample (A) and display the results for observation (OR)			
(ii) Perform Radial immune electrophoresis for the given serum and anti-serum sample (A) (OR)			
(iii) Perform WIDAL test for the given plant sample (A)			
MINOR EXPERIMENT			
Exp: 6	Obs: 2	Res: 2	Total: 10 MARKS
2. (i) Prepare Serum/Plasma from the given blood sample (B). Display the results for observation (OR)			
(ii) Perform DOT ELISA for the given serum sample (B). Display the results for observation (OR)			
(iii) Perform ASO test from the given blood sample (B). Display the results for observation			
SPOTTERS			(5 X 4 = 20 MARKS)
3. Identify the given spotters C, D, E, F & G and comment on them			
RECORD			(1 x 5 = 5 MARKS)
VIVA-VOCE			5 MARKS
TOTAL			60 MARKS

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

LAB IN PLANT BIOTECHNOLOGY

Paper	: Core Practical VI	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 3	Internal	: 40
Paper Code	: 18U5BTCP06	External	: 60

PREAMBLE

To make students familiar on basic plant tissue culture techniques and isolating plant pigment by chromatographic technique

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	Know about basic aseptic conditions to be followed in plant tissue culture laboratory and preparing various tissue culture media	K1, K2 & K3
CO2	Micropropagation of explant for shooting and rooting and to isolate protoplast from plant cells	K4, K5, & K6
CO3	Extraction of plant pigments by column chromatography	K4 & K5
CO4	Exposing them in preparing synthetic seeds and its preservation	K4 & K6

MAPPING WITH PROGRAMME OUTCOMES

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S

S: Strong; **M:** Medium; **L:** Low

UNIT	CONTENT	HOURS
1	Isolation of Plant genomic DNA	5
2	Sterilization of performance of aseptic condition in plant tissue culture lab	5
3	Preparation of MS media	10
4	Establishment of seed germination from carrot seeds	5
5	Establishment of shoot tip culture using MS media	10
6	Establishment and maintenance of callus culture	10

7	Micro propagation of callus culture (Shoot & Root systems)	10
8	Isolation of protoplast (Enzymatic method)	5
9	Extraction & separation of Plant pigments (Chlorophyll A & B) Column chromatography	10
10	Preparation of synthetic seeds	5

MODEL QUESTION PAPER (LAB IN PLANT BIOTECHNOLOGY)

NAME OF THE COURSE: LAB IN PLANT BIOTECHNOLOGY	COURSE CODE: 18U5BTC06	DURATION: 6 Hrs
MAX MARKS: 60		

MAJOR EXPERIMENT			
Exp: 12	Obs: 5	Res: 3	Total: 20 MARKS
1. (i) Isolate plant genomic DNA from the given plant sample (A)			(OR)
(ii) Perform shoot tip culture from the given explant sample (A)			(OR)
(iii) Perform callus induction from the given explant (A)			
MINOR EXPERIMENT			
Exp: 6	Obs: 2	Res: 2	Total: 10 MARKS
2. (i) Isolate protoplast from the given plant mesophyll tissue sample (B)			(OR)
(ii) Prepare synthetic seeds from the given plant seed sample (B)			(OR)
(iii) Separate chlorophyll pigments from the plant leaf extract sample (B) by appropriate method			
SPOTTERS			(5 X 4 = 20 MARKS)
3. Identify the given spotters C, D, E, F & G and comment on them			
RECORD			(1 x 5 = 5 MARKS)
VIVA-VOCE			5 MARKS
TOTAL			60 MARKS

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

ELECTIVE - I

PHARMACEUTICAL BIOTECHNOLOGY

Paper	: Elective I	Total Hours	: 75
Hours/Week	: 4	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: 18U5BTE01	External	: 75

PREAMBLE

This paper encodes information on pharmacology, drug designing, sources and applications of drug discovery. Students also understand the basic and applications of pharmacology and sources of drug. Also enables them to understand the concepts of rDNA technology in drug designing.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	To understand the principles of pharmacology and its development history	K1 & K2
CO2	To understand principles of action of drugs and mechanism of action to wards various diseases	K2, K3 & K4
CO3	To understand the concepts of developing therapeutic agents through genetic engineering principles	K4, K5 & K6
CO4	To explore the applications of pharmaceutical chemistry and its development	K4, K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	S	S
CO2	S	S	S	S	S
CO3	M	S	S	M	S
CO4	M	S	S	S	S

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
I	Introduction to pharmacology: History & development in pharmacology. Principles of pharmacology. – Pharmacology in the 20 th century – Drugs – Sources, dosage forms and routes of administration	15
II	Drug names & Classification systems: General Principles of Drug action	15

	Pharmacokinetics, Pharmacodynamics, measurement of drug action.	
III	Chemotherapy: Therapeutic drugs – Protein synthesis inhibitors, Antibacterial, antifungal, anti protozoal, antiviral, anti helminthic, anticancer, anti-inflammatory drugs.	15
IV	Introduction to r-DNA technology: production of biological: Human Insulin, HGH, GRF, Erythropoietins, IFN, TNF, Interleukins, Clotting factor VIII.	15
V	Production and applications: Probiotics, anticancer and anti-inflammatory agents. Biochips, biofilms and biosurfactants.	15

SUGGESTED READINGS

1. A Text Book of Biotechnology. R.C. Dubey. S.Chand& Co Ltd, New Delhi.
2. Pharmacology – H.P. Rang, M.M. Pale, J.M. Moore, and Churchill Livingston.
3. Basic Pharmacology – Foxtor Cox. Butterworth's 1980
4. Pharmacology and Pharmacotherapeutics – R.S.Satoskar, S.D. Bhandhakam and S.S. Alinapure
5. Pharmaceutical Biotechnology – S.S. Purohit, Kaknani, Saleja
6. Pharmacology – Mary J. Myuk, Richard A.Hoarey, Pamala Lippinwitt, Williams Edition.
7. Integrated pharmacology – Page, Curtis, Sulter, Walker, Halfman. Mosby Publishing Co.

MODEL QUESTION PAPER (PHARMACEUTICAL BIOTECHNOLOGY)

NAME OF THE COURSE: PHARMACEUTICAL BIOTECHNOLOGY	COURSE CODE: 18U5BTE01	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS

1. Clinical pharmacology was established by_____?			
a. Schwann	b. Robert Hooke	c. William Withering	d. William Wroth
2. The most widely used drug classification systems are?			
a. ATC	b. ADP	c. AKT	d. ATP
3. The drugs that are taken though nasal route is called -----			
a. Subcutaneous	b. Ear drops	c. Inhaler	d. Intraosseous
4. Parenteral administration can be performed by_____?			
a. Injection	b. Oral	c. Tablet	d. Powder
5. The action of drugs on the human body is called as?			
a. Pharmacodynamics	b. Pharmacokinetics	c. Drug action	d. Transporter protein
6. What the body does with the drug is called as_____?			
a. Drug action	b. Pharmacodynamics	c. Pharmacokinetics	d. Transporter protein
7. Initial consequence of drug–receptor combination is called -----			
a. Pharmacodynamics	b. Drug action	c. Drug Effect	d. Pharmacokinetics
8. Biochemical and physiological changes that occur as a consequence of drug action called ---			
a. Drug action	b. Drug Effect	c. Pharmacodynamics	d. Pharmacokinetics
9. A group of materials that fight against pathogenic bacteria?			
a. Antibacterial agents	b. Antiviral agents	c. Antifungal agents	d. Anticancer agents
10. Anti-inflammatory drugs make up about half of_____?			
a. Analgesics	b. Prostaglandins	c. Paracetamol	d. Aspirin
11. Abnormal cell growth called as_____?			
a. Cancer	b. Viral	c. Cell growth	d. Tissues
12. Fungal cell wall synthesis inhibition as_____?			
a. Nystatin	b. Caspofungin	c. Azoles	d. Naftifine
13. Insulin hormone produced by?			
a. Pancreas	b. Liver	c. Mitochondria	d. Kidney
14. Erythropoietin is a hormone produced primarily by?			
a. Liver	b. Kidney	c. Pancreas	d. Mitochondria

15. Factor VIII is an essential blood-clotting protein, also known as?			
a. Anti-hemophilic factor	b. Coagulation	c. Glycoprotein	d. Embolism
16. Erythropoietin also known as _____			
a. Hematopoietin	b. Glycoprotein cytokine	c. Erythropoiesis	d. Hypoxia
17. Probiotics are often called as _____?			
a. Helpful" Bacteria	b. Helpless" Bacteria	c. Helpful Virus	d. Helpless Virus
18. _____ is the property of a substance or treatment that reduces inflammation?			
a. Anti-cancer	b. Anti-inflammatory	c. Inflammatory	d. Cancer
19. _____ are a collective of one or more types of microorganisms that can grow on many different surfaces?			
a. Biofilms	b. Anti-inflammatory	c. Biochips	d. Anti-cancer
20. Bio surfactants are also called as _____			
a. Microbial surfactants	b. Bacterial surfactants	c. Viral surfactants	d. Biochips

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS

21. A) Explain the history and development of pharmacology. (OR) B) Explain the various routes of administration of drug.
22. A) Explain about pharmaco kinetics (OR) B) Write brief notes on the measurement of drug action
23. A) Write shortly about Anticancer drugs (OR) B) Write short notes on antibacterial drugs
24. A) Write short notes on Erythropoietins (OR) B) Write short notes on Interleukins?
25. A) What is probiotics? Explain in brief (OR) B) Write short notes on Biochips

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS

26. Write the essay on pharmacology?
27. Explain in detail on the general principle of drug action?
28. Write an essay on therapeutic drugs?
29. Write an essay on r-DNA technology?
30. Explain in detail about the production and application of drugs?

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

ELECTIVE I

ENZYMOLGY AND ENZYME TECHNOLOGY

Paper	: Elective I	Total Hours	: 75
Hours/Week	: 4	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: 18U5BTE02	External	: 75

PREAMBLE

This paper concisely presenting the fundamentals of enzymes, enzyme kinetics and industrial applications of enzymes

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	To familiarize the basics of enzyme classification, its unit measurement and extraction	K1 & K2
CO2	To explore to the usage of enzymes at molecular level such as active site, isoenzymes and their biochemical fundamentals	K3 & K4
CO3	To explore the enzyme kinetics and its mechanism of inhibitions	K4
CO4	To explore the industrial and clinical applications of commercial enzymes	K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	M	S	S	S	S
CO3	S	S	S	S	M
CO4	S	S	S	S	S

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
I	Enzymes: Introduction, Definition, History, Classification and Nomenclature of enzymes. Intracellular localization of enzymes, Extraction and purification of enzymes. Enzyme units. Substrate specificity.	15
II	Active site: Salient features, Theories of ES complex formation – Lock and Key, Induced fit and Substrate strain theory. Structure and functions of coenzymes, Isoenzymes and their separation rates. Collision and transition state theories. Factors affecting enzyme activity	15

III	Enzyme kinetics: Order of reaction, Activation energy, Kinetics of enzyme catalyzed reactions – Steady state kinetics – Michaelis Menten equation, and its transformation. Bi – substrate reaction – random, ordered and ping pong mechanisms.	15
IV	Enzyme inhibition: Reversible and irreversible inhibitors. Mechanism of catalysis – acid base, electrostatic, covalent, metal ion and enzyme catalysis, electrostatic proximity and orientation effects. Mechanism and action of chymotrypsin, lysozyme and carboxy peptidase.	15
V	Immobilization of enzymes: Methods and application. Clinical and Industrial application of enzymes, Enzyme engineering – site directed mutagenesis.	15

SUGGESTED READINGS

1. Enzymes: Biochemistry, Biotechnology, Clinical chemistry – Trevor Palmer, East West Press Edition, New Delhi, 2004.
2. Fundamentals of Enzymology - Nicholas C. Price Lewis Stevens, 2nd edition, Oxford University Press, Newyork, 1998.
3. Biochemistry – U.Satyanarayana & U.Chakrapani, Books and Allied (P) Ltd, Kolkata, 2008.
4. Lehninger Principles of Biochemistry – David L. Nelson and Michael M.Cox, W.H Freeman and Company, New York, 2007.
5. Biochemistry – Lubert Stryer, Jeremy M. Berg, John L.Tymoczko, V edition, W.H.Freeman & Company, Newyork, 2001.
6. Enzyme Technology – Ashok Pandey, Colin Webb, Calos Ricardo Soccl, Christian Larroche, Asiatech publishers Inc, New Delhi, 2005.

MODEL QUESTION PAPER (ENZYMOLGY AND ENZYME TECHNOLOGY)

NAME OF THE COURSE: ENZYMOLGY AND ENZYME TECHNOLOGY	COURSE CODE: 18U5BTE02	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS			
1. Enzymes are broadly classified into----- types			
a. 4	b. 5	c. 6	d. 7
2. The function of isomerases is -----			
a. Geometrical changes	b. Isomeric changes	c. Steric changes	d. Super numeric changes
3. Enzyme activity depends on -----			
a. Substrate conc.	b. Substrate availability	c. Substrate binding site	d. All the above
4. Which of the following method is used in separating specific enzymes from its crude sample?			
a. Dialysis	b. Native PAGE	c. 2D PAGE	d. Isoelectric focusing
5. Which of the following concept model describes the conformational changes occurring at the active site of enzyme?			
a. Lock & Key model	b. Induced fit hypothesis	c. Substrate strain concept	d. None of the above
6. Michealis – Menton equation describes -----			
a. Rate of enzyme activity	b. Rate of substrate activity	c. ES formation	d. All the above
7. Bi substrate reactions indirectly describes the concept of -----			
a. Lock & Key concept	b. Induced fit hypothesis	c. Substrate binding theory	d. None of the above
8. Which of the following physical factor affects the enzyme activity?			
a. Enzyme conc.	b. Substrate Conc.	c. Binding site	d. pH
9. Which of the following is an example for isoenzyme?			
a. ACTH	b. GH	c. LDH	d. FSH
10. Activation energy is the energy required for -----			
a. Activating enzyme	b. Activating substrate	c. Activating co factors	d. Activating physical factors
11. The kinetics of enzyme – catalysed reactions can be analysed in terms of steady state models if the substrate concentrations are -----			
a. More than an order of magnitude higher than the enzyme level	b. Less than an order of magnitude lower than the enzyme level	c. More than the rate of magnitude higher than the enzyme level	d. Less than the rate of magnitude lower than the enzyme level
12. The reaction between ADP and phosphocreatine works under the principle of -----			

a. Random mechanism	b. Double displacement mechanism	c. Ping pong mechanism	d. B & C
13. Which of the following type of enzyme inhibition shows an increase in K_M value with constant V_{max} ?			
a. Competitive	b. Non – Competitive	c. Un – Competitive	d. None of the above
14. Allosteric enzymes displays a sigmoidal curve in contrast to the ----- displayed by Michealis – Menton enzymes			
a. Hyperbolic curve	b. Parabolic curve	c. Quadratic curve	d. Transcendental curve
15. Chymotrypsin is an -----			
a. Cysteine protease	b. Serine protease	c. Proline protease	d. Leucine protease
16. Carboxypeptidase A3 (CPA3) involved in the protein digestion by -----			
a. Pancreatic cells	b. Liver cells	c. Mast cells	d. Tumour cells
17. Which of the following method is commonly used in maintaining enzyme activity			
a. Entrapment method	b. Encapsulation	c. Immobilization	d. All the above
18. Which of the following enzyme is used in leather industries?			
a. Amylase	b. Lipase	c. Protease	d. DNase
19. Which of the following technology is followed for enriching the enzyme activity?			
a. Yeast hybrid analysis	b. Site directed mutagenesis	c. Feed back inhibition	d. None of the above
20. Which of following enzyme is used as deworming agent?			
a. Trypsin	b. Papain	c. Amylase	d. Protease

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS	
21. A) Explain about enzyme units	(OR)
B) Explain about substrate specificity	
22. A) Explain about isoenzymes	(OR)
B) Explain the factors affecting the enzyme activity	
23. A) Explain the steady state kinetics of enzymes	(OR)
B) Write short notes on the order of the enzyme reaction	
24. A) Explain the mechanism of action of chymotrypsin	(OR)
B) Write short notes on mechanism of enzyme catalysis	
25. A) Explain the process of site directed mutagenesis	(OR)
B) Explain about enzyme engineering	

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS	
26. Give detailed account on the classification of enzymes	
27. Give detailed account on iso-enzymes	
28. Give detailed account on MM and LB plot	
29. Give detailed account on enzyme inhibition and its types	
30. Give detailed account on industrial applications of enzymes	

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

ELECTIVE I
TISSUE ENGINEERING

Paper	: Elective I	Total Hours	: 75
Hours/Week	: 4	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: 18U5BTE03	External	: 75

PREAMBLE

This paper deals with the use of combination of cells, engineering and materials methods, and suitable biochemical and physicochemical factors to improve or replace biological tissues. Tissue engineering involves the use of tissue scaffold for the formation of new viable tissue for a medical purpose.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	To understand the key topics in tissue engineering	K1, K2 & K3
CO2	To understand the stem cells and animal cells, processes, and strategies to regenerate or repair damaged tissues	K3 & K4
CO3	To develop students ability to identify, formulate and adapt engineering solutions to unmet biological needs	K4 & K5
CO4	To give students a knowledge of how the biomedical industry is regulated and the route to market of for tissue engineered products	K4 & K5

MAPPING WITH PROGRAMME OUTCOMES

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S

S: Strong; **M:** Medium; **L:** Low

UNIT	CONTENT	HOURS
I	Introduction to tissue engineering: Basic definition; current scope of development; use in therapeutics, cells as therapeutic agents. Measurement of tissue characteristics, appearance, cellular component, ECM component, and physical properties.	15
II	Tissue types and Tissue components, Tissue repair, Engineering wound healing and sequence of events. Basic wound healing Applications of growth factors: VEGF/angiogenesis, Basic properties, Cell-Matrix & Cell-Cell Interactions, telomeres and Self renewal, Control of cell migration in tissue	15

	engineering.	
III	Biomaterials: Properties of biomaterials, Surface, bulk, mechanical and biological properties. Scaffolds & tissue engineering, Types of biomaterials, biological and synthetic materials, Biopolymers, Applications of biomaterials, Modifications of Biomaterials, Role of Nanotechnology.	15
IV	Stem Cells : Introduction, hematopoietic differentiation pathway Potency and plasticity of stem cells, sources, embryonic stem cells, hematopoietic and mesenchymal stem cells, Stem Cell markers. Stem cell systems - Liver, neuronal stem cells with characteristics: embryonic, adult, haematopoietic, fetal, cord blood, placenta, bone marrow, primordial germ cells, cancer stem cells and induced pluripotent stem cells.	15
V	Stem cell therapy, Molecular therapy, <i>in-vitro</i> organogenesis, Neurodegenerative diseases, spinal cord injury, heart disease and muscular dystrophy. Stem cells and Gene therapy: Physiological models, tissue engineered therapies, product characterization. Preservation of stem cells: freezing and drying. Patent protection and regulation of tissue engineered products and ethical issues.	15

SUGGESTED READINGS

1. Bernhard O.Palsson,Sangeeta N.Bhatia, "Tissue Engineering", Pearson Publishers 2009.
2. Raphael Gorodetsky, Richard Schäfer. "Stem cell based tissue repair", Cambridge: RSC Publishing, c2011.
3. John P. Fischer, Antonios G. Mikos, Joseph D. Bronzino. "Tissue Engineering", CRC Press, 2012.
4. Larry L. Hench, Julian R. Jones. "Biomaterials, Artificial Organs and Tissue Engineering", CRC Press, 2005.
5. C. S. Potten, "Stem Cells", Academic Press, 1997.

MODEL QUESTION PAPER (TISSUE ENGINEERING)

NAME OF THE COURSE: TISSUE ENGINEERING	COURSE CODE: 18U5BTE03	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS			
1. The formation of blood vessel from the pre-existing blood vessel is known as -----			
a. Angiogenesis	b. Vascularization	c. Osteogenesis	d. Phagocytosis
2. The Major Histocompatibility Complexes (MHCs) are -----			
a. Signaling molecules	b. Growth factors	c. Cell surface markers	d. Cell adhesion molecules
3. Bone Morphogenic Protein (BMP) is a -----			
a. Cell surface marker	b. Growth factors	c. Hormone	d. Neurotransmitter
4. Polyglycolic Acid (PGA) scaffold is -----			
a. Biotolerant	b. Bioactive	c. Bioinert	d. Biodegradable
5. In tissue engineering, harvested cells are frozen away and stored in -----			
a. Liquid hydrogen	b. Liquid nitrogen	c. Liquid helium	d. Autoclave
6. Cell signaling compounds cytokines are a group of -----			
a. Proteins and peptides	b. Fats and triglycerides	c. Carbohydrates	d. Hormones and steroids
7. c-AMP and c-GMP functions as -----			
a. Hormone	b. Receptor	c. Second messenger	d. Ligand
8. The signals which affect only cells of the same cell type as the emitting cell are -----			
a. Endocrine	b. Autocrine	c. Paracrine	d. none of these
9. Carbon nanotubes are used for tissue engineering scaffolds as they are -----			
a. Biocompatible	b. Biodegradable	c. Biopolymers	d. none of these
10. PLA degrades within the body to form -----			
a. Amino acid	b. Glycolic acid	c. Lactic acid	d. Phosphoric acid.
11. An example of CAM is -----			
a. Cadherin	b. Protease	c. Growth hormone	d. Serine
12. For skin grafting the scaffold used should be -----			
a. Biodegradable	b. Bioactive	c. Biocompatible	d. Both (a) and (c)
13. Endocrine signaling is performed by -----			
a. Enzymes	b. Hormones	c. Cytokines	d. Carbohydrates
14. Programmed Cell death is also known as -----			
a. Apoptois	b. Lysis	c. Degeneration	d. Deformation
15. The protein of cell that binds to a specific molecules is known as -----			
a. Ligand	b. Receptor	c. Hormone	d. Cytokine
16. Notch is a cell surface protein that functions as a -----			

a. Receptor	b. Hormone	c. Protein-A	d. Cytokine.
17. Solid Free Forming is a fabrication technique for			
a. 2D scaffold	b. 3D scaffold	c. Micro scaffold	d. Nano-patterned scaffold
18. Hydrogels can also be used as scaffolds for -----			
a. Cell growth	b. Cell delivery	c. Cell growth and cell delivery	d. None of these
19. GABA is a -----			
a. Neurotransmitter	b. Neuro inhibitor	c. Contact inhibitor	d. Contact excitator
20. The family of receptors that play an important role in cell adhesion is			
a. Somatostatin	b. Interleukins	c. Integrins	d. Interferons

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS

21. A) What are the different types of tissues in the mammalian body? B) Classify tissue based on their structure and function	(OR)
22. A) Briefly explain the different types of stem cells B) Briefly explain the process of cell placement on scaffold	(OR)
23. A) Describe different kinds of matrix materials used in tissue engineering B) Mention the importance of growth factors in the field of tissue engineering	(OR)
24. A) With the help of sketch, explain the process of differentiation of stem cells into cell lines B) What are the different risk factors involved with skin grafting?	(OR)
25. A) Mention the basic clinical goals and fundamental challenges of tissue engineering B) What are the basic criteria of a scaffold used for tissue reconstruction?	(OR)

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS

26. With the help of a flow-chart, explain the different processes involved in wound healing
27. Describe the signalling pathway for cell's response to the ligand
28. Describe the engineering materials used in scaffold fabrication. Mention the parameters for scaffold selection.
29. With the neat sketch, explain the mechanism of adhesion between leukocytes and endothelial cells
30. Demonstrate bioreactor for achieving nutrient transport in an engineered tissue construct

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

SBEC I
LAB IN IN FOOD PROCESSING AND TECHNOLOGY

Paper	: SBEC I	Total Hours	: 40
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 40
Paper Code	: 18U5BTS01	External	: 60

PREAMBLE

To make students on understanding basic concepts of food quality management and deals with various food processing concepts and technologies

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	To gain knowledge on the identification of fungi and algae	K4, K5 & K6
CO2	To gain knowledge on the identification basics of bryophytes	K4, K5 & K6
CO3	To gain knowledge on the economic importance of major plant kingdoms	K4, K5 & K6
CO4	To gain experimental knowledge on plant physiology	K4, K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	M
CO2	S	S	S	S	M
CO3	S	S	M	S	S
CO4	S	S	S	S	S

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
1	To study different types of blanching of fruits and vegetables	4
2	Preservation of food by canning	4
3	To perform cut out analysis of caned product	4
4	Preservation of food by high concentration of sugar i.e. jam	4
5	Preservation of food by high concentration of salt/acid i.e. pickle	4
6	Preservation of food by addition of chemicals i.e. tomato ketchup	4
7	Preservation of milk by pasteurization and sterilization	4
8	Determination of total fat, protein in milk and milk products	4
9	Estimation of synthetic Food colour in sweets, confectioneries and beverages	4
10	Detection of adulterants in edible oil and ghee	4

MODEL QUESTION PAPER (LAB IN FOOD PROCESSING AND TECHNOLOGY)

NAME OF THE COURSE: LAB IN FOOD PROCESSING AND TECHNOLOGY	COURSE CODE: 18U5BTS01	DURATION: 6Hrs
MAX MARKS: 60		

MAJOR EXPERIMENT			
Exp: 12	Obs: 5	Res: 3	Total: 20 MARKS
1. (i) Perform cutout analysis of the given canned food sample (A). Display the results for observation. (OR)			
(ii) Preserve the given food sample (A) by sugar/salt/acid (OR)			
(iii) Estimate the amount of total fat from the given milk sample (A)			
MINOR EXPERIMENT			
Exp: 6	Obs: 2	Res: 2	Total: 10 MARKS
2. (i) Perform food preservation by chemical additives for the given food sample (B) (OR)			
(ii) Perform pasteurization of milk from the given milk sample (B) (OR)			
(iii) Estimate the amount of synthetic Food colour in the given sweet/confectionary/beverage sample (B)			
SPOTTERS			(5 X 4 = 20 MARKS)
3. Identify the given spotters A, D, H, F & G and comment on them			
RECORD			(1 x 5 = 5 MARKS)
VIVA-VOCE			5 MARKS
TOTAL			60 MARKS

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

**SBEC I
DEVELOPMENTAL BIOLOGY**

Paper	: SBEC I	Total Hours	: 40
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 18U5BTS02	External	: 75

PREAMBLE

To make students on understanding basic concepts of mammalian developmental systems and also to deals with the developmental system plants

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	To understand the concepts of animal system development	K1, K2 & K3
CO2	To understand the concepts of vertebrate system development	K1, K2 & K3
CO3	To understand the concepts of plantsystem development	K1, K2 & K3
CO4	To understand the concepts of invertebrate system development	K1, K2 & K3

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	S	S	M	M
CO3	S	S	S	M	M
CO4	S	S	S	M	M

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
I	Basic concepts of development in animal system-I Stages of development- zygote, blastula, gastrula, neurula, cell fate & commitment – potency- concept of embryonic stem cells, lineages of three germ layers.	8
II	Basic concepts of development in animal system-II Mechanisms of differentiation- cytoplasmic determinants, embryonic induction, concept of morphogen, mosaic and regulative development, model organisms in Developmental biology.	8
III	Early Development in invertebrate / vertebrate models Drosophila, <i>C.elegans</i> , Xenopus, Mouse/ human, Cleavage, gastrulation, Axis specification (Dorsoventral, anterior posterior), and body plan patterning.	8

IV	Late Development in invertebrate /vertebrate models Organogenesis- development of central nervous system in vertebrates, vulval formation in <i>C.elegans</i>	8
V	Basic concepts of development in Plant system Organization of the plant cell, plant meristems and cell fate; root and shoot development; secondary growth; vascular development; Sexual reproduction; flower development; mechanisms of gametogenesis and fertilization.	8

MODEL QUESTION PAPER (DEVELOPMENTAL BIOLOGY)

NAME OF THE COURSE: DEVELOPMENTAL BIOLOGY	COURSE CODE: 18U5BTS02	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS			
1. How many cleavages are completed in 16 cell stages of frog's egg?			
a. 3	b. 8	c. 4	d. 12
2. The expulsion of completely developed foetus from the uterus is known as -----			
a. Ovulation	b. placentation	c. gestation	d. parturition
3. For fertilization of frog's egg -----			
a. Sperms of same species are essential	b. Sperms do not need penetration	c. Sperms of any animal can fertilize	d. Only presence of male is sufficient
4. Grey crescent is present in -----			
e. Zygote of frog	f. Brain of rabbit	g. Eye of frog	h. Retina of cockroach
5. Which of the following does not show metamorphosis?			
a. Frog	b. Housefly	c. Hydra	d. Mosquito
6. The first phase in the sexual reproduction of organisms is -----			
a. Spermatogenesis	b. Oogenesis	c. Spermiogenesis	d. Gametogenesis
7. The formation, development and maturation of the female gamete is called -----			
a. Ovulation	b. Oogenesis	c. Vitellogenesis	d. Folliculogenesis
8. During fertilization the spermatozoa penetrate through the egg membranes with the help of -----			
a. Flagellum	b. Acrosome	c. Sperm lysins released from the acrosome	d. Mitochondria located at the middle piece
9. During normal development the activation of the egg is achieved by -----			
a. Vitellogenesis	b. Oogenesis	c. Spermatogenesis	d. Fertilization
10. When the eggs are released from the ovary of frogs they are at the -----			
a. primary oocyte stage	b. secondary oocyte stage	c. ootid stage	d. matured ova stage
11. The formation of the neural tube is known as -----			
a. Neurulation	b. Tubulation	c. Craniation	d. None of the above
12. During metamorphosis, the disappearance of larval organs is called -----			
a. Histogenesis	b. Paedogenesis	c. Histolysis	d. Paedomorphosis
13. Cleidoic eggs are found in -----			
a. Birds	b. mammals	c. insects	d. molluscs
14. Metamorphosis is a characteristic feature of -----			

a. Direct ontogenic development	b. Indirect ontogenic development	c. Chordates	d. Embryogenesis in mammals
15. The sexual embryo of the male and female frogs is called -----			
a. Copulation	b. Amphimixis	c. Syngamy	d. Amplexus
16. Human egg is -----			
a. Centrolecithal	b. Microlecithal	c. Mesolecithal	d. Telolecithal
17. Which of the following develops from ectoderm?			
a. Spinal cord and brain	b. Liver and heart	c. Eye and skin	d. Notochord and vertebral column
18. In order to become structurally and functionally a spermatozoan, each spermatid has to undergo a process of differentiation called -----			
a. Spermiation	b. Spermiogenesis	c. Spermatogenesis	d. Androgenesis
19. In the human female, the primary oocytes remain small without any growth for -----			
a. 4-5 years	b. 6-8 years	c. 8 - 10 years	d. 12 -14 years
20. The sperm produces substances of enzymatic nature of sperm lysin. In mammals, it is called			
a. Hyaluronidase	b. Hyaluronic acid	c. Androgamone	d. Cryanogamone

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS	
21. A) What is differentiation? How it differs from redifferentiation? B) What is meant by embryonic period of development?	(OR)
22. A) State the functions of cytoplasmic determinants. B) Define inductive signals with an example.	(OR)
23. A) Define cleavage and mention its importance. B) What is gastrulation? State its significance.	(OR)
24. A) How the nervous system develops in human? B) What make up the central nervous system of vertebrates?	(OR)
25. A) Define plant meristem. State its types. B) Draw the structure of a flower and label its parts.	(OR)

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS	
26. What are the stages of a developing embryo? Give illustrations.	
27. Why <i>Drosophila melanogaster</i> is used as model organisms? Comment on it.	
28. Justify the statement - <i>Caenorhabditis elegans</i> as an emerging model for studying the basic biology.	
29. Describe germ layers and organs produced by them in detail.	
30. Draw the structure of plant cell and elaborate its cell inclusions.	

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

SBEC I
FOOD BIOTECHNOLOGY

Paper	: SBEC I	Total Hours	: 40
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 40
Paper Code	: 18U5BTS03	External	: 60

PREAMBLE

To make students on understanding basic concepts of food preservation methods by applying technological basics. The paper also deals with the food spoilage, food adulteration and development of value added products

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	To understand the concepts of basic food preservation methods	K1 & K2
CO2	To understand the role of water in food spoilage and preservation	K1 & K2
CO3	To explore the physical factors involving in food processing	K1 & K2
CO4	To make familiar with food sanitation and its importance	K2, K2 & K3

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	M	M	M

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
I	Food Preservation by application of Heat: Principles of Heat Transfer, Blanching, Pasteurization, Heat Sterilization.	8
II	Food Preservation through Water Removal: Forms of Water in Foods, Sorption of Water in Foods, Water Activity, Drying Technology, Evaporation Technology.	8
III	Food Preservation through Temperature Reduction: Chilling, Freezing, Food Preservation by Radiation, Ionizing Radiation, Microwave.	8
IV	Food Preservation by use of: Salt, Smoke, Sugar, Other Chemical Additives, Food Packaging, Food Plant Sanitation, Environmental Aspects of Food Processing.	8
V	Roles and Scientific Use of Water in Food Processing, Food Processing Waste Management, Process Operations, Principles, Good Manufacturing Practices, Food Laws and Regulations.	8

MODEL QUESTION PAPER (FOOD BIOTECHNOLOGY)

NAME OF THE COURSE: FOOD BIOTECHNOLOGY	COURSE CODE: 18U5BTS03	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS

1. Pasteurization is the process of heating milk -----			
a. Above 121°C	b. Above boiling point	c. Below boiling point	d. Above 150 °C
2. Cold sterilisation refers to the preservation of food by -----			
a. Refrigeration	b. Radiation	c. Dehydration	d. Lyophilisation
3. Who is regarded as the father of canning?			
a. Nicolas appert	b. Louis Pasteur	c. John hall	d. Bryan dokin
4. The reason for food spoilage is -----			
a. Growth of microorganism	b. Autolysis	c. Rancidity	b. All the above
5. Before drying, vegetables should be -----			
a. Autocleave	b.Salted	b. Blanched	c. Sulfured
6. A food additives that prevent colour and flavour loss -----			
a. Enzymes	b. Yeast	c. Fruit buffer	d. Ascorbic acid
7. Preventing the growth of pathogens in food -----			
a. Danger zone	b. Contamination	c. Food preservation	d. Cross contamination
8. Jam and jellies and preserves can be preserved by adding sugar at concentration of -----			
a. 65%	b. 75%	c. 40%	d. 30%
9. A fungus that causes fermentation -----			
a. Bacteria	b. Mold	c. Yeast	d. Virus
10. A type of food preservation technique that involves sealing food in sterilized air light containers -----			
a. Irradiating	b. Canning	c. Freezing	d. Drying
11. Iodized salt contains iodine in the form of -----			
a. NaCl	b. KIO3	c. KI	d. Na
12. The first synthetic sweetening agent used as _____?			
a. Cyclamates	b. Aspartame	c. Sucralose	d. Sacchavrin
13. Agar-agar is used as -----			

a. Antibiotic	b. Stabilizer and thickness	c. Nutrient supplement	d. Colouring agent
14. Frozen storage is generally operated at temperature of -----			
a. -0°C	b. -18°C	c. -50°C	d. 60°C
15. What is the best method in storing nuts?			
a. Vacuum packing	b. Smoking	c. Drying	d. Freezing
16. _____ Standard help ensure food quality?			
a. National	Packing	b. Legal	c. All of these
17. The freezing point for pure water is _____			
a. 10	b. 28	c. 15	d. 32
18. Corn syrup is a mixture of -----			
a. dextrose and maltose	b. Dextrose and Galactose	c. Galactose and Maltose	d. Glucose and Galactose
19. _____ is essential for forming haemoglobin in the blood			
a. Calcium	b. Iron	c. Phosphorn	d. Magnesium
20. Fat is completely digested in the -----			
a. Stomach	b. Mouth	c. Small intestine	d. Mouth

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS

21. A) Write short notes on pasteurization B) Write a short notes on principles of food preservation	(OR)
22. A) Explain drying B) Define contamination? What is the role of water in contamination?	(OR)
23. A) Notes short notes on freezing? B) Explain the role of radiation in food preservation	(OR)
24. A) Write short notes on chemical additives? B) Describe the role of salt and sugar in food preservation?	(OR)
25. A) What is food processing? Explain? B) Food laws and regulations?	(OR)

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS

26. Write the essay on food preservation principles and application?
27. Explain the evaporation methodology?
28. Write an essay on the physical, chemical methods of food preservation?
29. Write an essay on the environmental aspects of food processing?
30. Roles and scientific uses of water in food processing industries?

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

SBEC – II

LAB IN POULTRY SCIENCE

Paper	: SBEC I	Total Hours	: 40
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 17U5BTS04	External	: 75

PREAMBLE

To make students on gaining practical exposure on poultry science and technology and its economic management and quality analysis of poultry products

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	Evaluate quality control parameters of poultry for disease Diagnosis	K4, K5 & K6
CO2	To evaluate the microbial contamination of poultry products for quality enhancement	K4, K5 & K6
CO3	To evaluate poultry micro flora	K4, K5 & K6
CO4	To validate the preservation of poultry products and evaluation of its nutritive quality	K4, K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	S	S
CO2	S	S	M	S	S
CO3	M	S	S	S	S
CO4	M	S	S	S	S

S: Strong; M: Medium; L: Low

Ex.no	CONTENT	HOURS
1.	Post-mortem examination of chickens and laboratory diagnosis of diseases	4
2.	Sero monitoring of viral infections in poultry	4
3.	Surveillance of common diseases prevailing in commercial poultry farms	5
4.	Screening of Salmonella of zoonotic importance in poultry and related Products	4
5.	Monitoring the health management in commercial poultry farms	5
6.	Isolation and prevalence of Microbes in poultry products	5
7.	Egg preservation by various methods	4
8.	Egg quality analysis	4
9.	Protein and Lipid estimation from egg samples	5

MODEL QUESTION PAPER (LAB IN POULTRY SCIENCE)

NAME OF THE COURSE: LAB IN POULTRY SCIENCE	COURSE CODE: 17U5BTS04	DURATION: 6Hrs
MAX MARKS: 60		

MAJOR EXPERIMENT			
Exp: 12	Obs: 5	Res: 3	Total 20 MARKS
1. (i) Perform the enumeration of microbes from the given poultry sample (A) (OR)			
(ii) Perform preservation of the given egg sample (A) by salt method (OR)			
(iii) Estimate the protein level in the given poultry sample (A) by Lowry's method			
MINOR EXPERIMENT			
Exp: 6	Obs: 2	Res: 2	Total: 10 MARKS
2. (i) Perform lipid estimation from the given poultry sample (B) (OR)			
(ii) Perform preservation of given egg sample (B) by freezing (OR)			
(iii) Find out the thickness of given egg shell sample (B) by Gauge meter			
SPOTTERS			(5 X 4 = 20 MARKS)
3. Identify the given spotters C, D, E, F & G and comment on them			
RECORD			(1 x 5 = 5 MARKS)
VIVA-VOCE			5 MARKS
TOTAL			60 MARKS

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

SBEC – II
MARINE BIOTECHNOLOGY

Paper	: SBEC I	Total Hours	: 40
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 18U5BTS05	External	: 75

PREAMBLE

To make students on understanding the significance and importance of marine micro biota and its rational applicability in the development of industrially important products. The students also gain knowledge on the environmentally hazardous management marine ecosystem.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	To understand basics of marine ecosystem and its pollution issues	K1 & K2
CO2	To understand basic biodegradation and bioremediation marine ecosystem pollutants	K2 & K4
CO3	To understand the principles of bio fouling	K2 & K4
CO4	To acquire knowledge of wastewater treatment in marine ecosystem	K4 & K5

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	M	M
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S

S: Strong; **M:** Medium; **L:** Low

UNIT	CONTENT	HOURS
I	Marine organisms and environment interaction: Types of marine environment - Physical, Chemical and Biological aspects and their interaction with marine life; Air – Sea interaction; Green - house gases (CO ₂ and Methane)	8
II	Pollution: Marine pollution-major pollutants (heavy metal, pesticide, oil, thermal, radioactive, plastics, litter and microbial); Biological indicators (Marine microbes, algae and crustaceans) and accumulators: Application of Protein biomarkers; Biosensors and biochips.	8
III	Biomaterial interaction: Biodegradation and Bioremediation; Biodegradation of natural and synthetic waste materials; Bioremediation;	8

	Separation, purification and bio removal of pollutants.	
IV	Fouling and corrosion: Biofouling; Biofilm formation; Marine fouling and boring organisms - their biology, adaptation; Factors influencing the settlement of macrofoulers; Antifouling and Anti boring treatments; Corrosion Process and control of marine structures.	8
V	Wastewater bio treatment: BOD, COD; Biosensors; Biomolecules; membrane and transducer; Bioaugmentation-estimation of microbial load; Methods of Inorganic and Organic waste removal.	8

SUGGESTED READINGS:

1. Recent Advances in Marine Biotechnology Volume 3 – Milton fingerman et al., 1999.
2. Cynobacterial and Algal Metabolisms and Environment Biotechnology – Tasneem Fatma, 1999.
3. Environmental Biotechnology and cleaner Bioprocess – Olguni, E.J. et al., 2000.
4. Environmental Biotechnology Theory and applications – Evans et al., 2000.
5. Environmental Biotechnology – Gareth M.Evams et al., 2003
6. Biotechnology, Recombinant DNA Technology, Environmental Biotechnology – S.Mahesh et al., 2003

MODEL QUESTION PAPER (MARINE BIOTECHNOLOGY)

NAME OF THE COURSE: MARINE BIOTECHNOLOGY	COURSE CODE: 18U5BTS05	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS			
31. Which of the following is/are example(s) of conventional source of energy?			
e. Fossil fuels	f. Solar energy	g. Tidal energy	h. all of the above
32. Global warming is caused due to -----			
e. Decrease in CO ₂ conc.	f. Decrease in CO ₂ conc.	g. Decrease in SO ₂ conc.	h. increase in NO ₂ conc.
33. Which is the most primitive group of algae?			
e. Blue green algae	f. Red algae	g. Brown algae	h. Green algae
34. Ability to fix atmospheric nitrogen is found in -----			
e. Leaves of some crop plants	f. Chlorella	g. Some marine Red algae	h. Some Blue green algae
35. Which of the following bacterium is called as the superbug that could clean up oil spills?			
e. <i>Bacillus subtilis</i>	f. <i>Pseudomonas putida</i>	g. <i>Pseudomonas denitrificans</i>	h. <i>Bacillus denitrificans</i>
36. Which of the following is a major cause of pollution?			
e. Plants	f. Bacterial spore	g. Fungi	h. Hydrocarbon gas
37. Minamata disease is caused by pollution of water by -----			
e. Mercury	f. Lead	g. Tin	h. Methyl iso cyanide
38. To reduce the water pollution which of the following genetically modified organism will be the best choice?			
a. Plant	b. Animal	c. Bacteria	d. None of the above
39. Purification strategies in municipal water supplies involves -----			
e. Sedimentation	f. Filtration	g. Disinfection	h. All the above
40. Sedimentation of large particulate matter is enhanced by -----			
a. Aluminium	b. Potassium	c. Potassium	d. Chlorine
41. Septic tank is -----			
e. An aerobic condition with growth treatment system	f. An aerobic condition with suspended growth biological treatment system	g. An anaerobic condition with growth biological treatment system	h. An anaerobic condition with suspended growth treatment system

42. The process of converting environmental pollutants into harmless products by naturally occurring microbes is called -----			
e. Ex situ bioremediation	f. Intrinsic bioremediation	g. Extrinsic bioremediation	h. None of these
43. Dry corrosion is also called as -----			
e. Chemical corrosion	f. Electrochemical corrosion	g. Wet corrosion	h. Oxidation corrosion
44. Which of the following comes under the wet corrosion?			
e. Concentration cell corrosion	f. Oxidation corrosion	g. Liquid metal corrosion	h. Corrosion by other gases
45. Initial attachment of microorganisms often involves -----			
e. Flagella and is reversible	f. Flagella and is irreversible	g. Exopolymers and is reversible	h. Exopolymers and is irreversible
46. What is the value of fouling factor for sea water?			
e. 0.0001-0.0002 m ² K/W	f. 0.0002-0.0003 m ² K/W	g. 0.0003-0.0004 m ² K/W	h. 0.0004-0.0005 m ² K/W
47. The stage in which the biological processes are used to purify water in a wastewater treatment plants is called -----			
e. secondary sewage treatment	f. primary sewage treatment	g. wastewater reduction	h. biochemical reduction
48. Aggregates of microbes as tiny masses in activated sludge process is called -----			
e. Activated sludge	f. Masses	g. Colloidal masses	h. Floccules
49. High BOD indicates -----			
e. Less polluted water	f. Less number of organisms	g. More polluted water	h. None of the above
50. BOD/COD ratio will always be -----			
e. = 1	f. > 1	g. < 1	h. None of the above

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS

51. A) Describe the food and feeding habits of marine organisms (OR) B) Briefly describe the pigments present in marine organisms
52. A) Discuss the role of microbes in the sea (OR) B) Discuss the sources of pollution in marine environment
53. A) Discuss the current status of seaweed farming in India. (OR) B) Give an account on the NMR characterization of biomolecules.
54. A) Discuss the role of biotechnology in fouling and corrosion (OR) B) Give an account of bio-deterioration in marine environment
55. A) Describe the composition, fate and effects of sewage pollution in sea (OR) B) Give account of the sources and treatment of oil pollution in sea.

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS
56. Discuss “Sea is a Biological Environment”.
57. Discuss the sources of pollution and treatment methods in marine environment.
58. Give a detailed account on Biodegradation and Bioremediation
59. Describe the Corrosion process and control measures
60. Give detailed account on various techniques involved in waste water treatment using Microbes

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
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SBEC – II

FORENSIC SCIENCE AND TECHNOLOGY

Paper	: SBEC I	Total Hours	: 40
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 18U5BTS06	External	: 75

PREAMBLE

To make students on understanding the importance of forensic principles and technology and its practical applicability in identifying the candidate who convicted the crime scenery. The students also gain added skills in terms tracing the victim death by means of adapting the measurable molecular approaches.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	Gain knowledge on forensic science laboratories across India	K1, K2 & K3
CO2	Acquires knowledge on fingerprint identification system	K3, K4, & K5
CO3	Know whereabouts on the FAI and the concepts of fatality forensics	K3, K4, & K5
CO4	Understand the concepts of DNA finger printing technology	K3, K4, K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
I	Introduction, definition, Scope and branches of forensic science. Central F.S.L. and State F.S.L. Biological Evidence: Nature, collection, identification, evaluation of hair and fibres.	6
II	Definition and Classification of fingerprints (Henry system). Taking fingerprints from living and dead persons. Automatic fingerprint identification system (AFIS).	7
III	Forensic Art Illustration: Introduction, Finding and identifying human face image. Post mortem drawing, methods of superimposition.	5
IV	Fatality Forensics: Introduction, cause, manner and characteristics of death, Road traffic fatality (RTF) investigation. General classification of RTFs.	5
V	DNA Fingerprinting (DFP) technology: An overview, Applications of DFP in forensic investigations, paternity disputes. DNA Profiling practice in India with reference to criminal cases.	7

SUGGESTED READINGS:

1. Richard Saferstein, 2001, *Criminalistic: An Introduction to Forensic Science*. 7th edition Prentice-Hall, New Jersey.
2. Chowdhri, S., *Forensic Biology B.P.R. &D*, Govt. of India.
3. Cammins, H. and Middle C., 1961. *Fingerprints Palms and Soles*. Dover Publications.
4. Furley, M.A. and Hamington, J.J. *Forensic DNA Technology*.
5. Kirby, *DNA Fingerprinting Technology*.
6. Epplen, J.T. and Eabjulm, T., 1999. *DNA Profiling and DNA Fingerprinting* Bukhaagar Verlag, Switzerland.
7. Taylor, 2000. *Forensic Art and Illustration*, CRC Press.

MODEL QUESTION PAPER (FORENSIC SCIENCE AND TECHNOLOGY)

NAME OF THE COURSE: FORENSIC SCIENCE AND TECHNOLOGY	COURSE CODE: 18U5BTS06	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS

1. The dark portion of the fingerprint is called -----			
a. Core	b. Valley	c. Delta	d. Ridge
2. The most common type of fingerprint pattern is -----			
a. Whorl	b. Accidental	c. Loop	d. Arch
3. Fingerprints dissolved in this only grow back with scars on them making them more unique			
a. Base	b. Water	c. Acid	d. Neutral
4. Most common fingerprint pattern. It has ridges that enter from the right and exit from the same side they enter			
a. Arch	b. Whorl	c. Wheel	d. Loop
5. The region in skin found in between the epidermis and dermis is the _____ layer			
a. Top	b. Subcutaneous	c. Cuticle	d. Basal
6. The study of fingerprint is called -----			
a. Dactylography	b. Printology	c. Anthropometry	d. None of the above
7. Fingerprints on paper can be sprayed with this chemical that reacts with amino acids in sweat to make a purple print appear			
a. Ninhydrin	b. Iodine	c. Cyanocrylate	d. Silver nitrate
8. What is the basis for the determination of the primary classification of fingerprints?			
a. The presence or absence of arch patterns	b. The presence or absence of whorl patterns	c. The presence or absence of loop patterns	d. The presence or absence of minutiae
9. For most fingerprint examiners, the chemical of choice for visualizing latent prints is -----			
a. Ninhydrin	b. Iodine	c. Chlorate	d. Silver nitrate
10. The oldest chemical method used to visualize latent prints is -----			
a. Laser illumination	b. Iodine fuming	c. Cyanocrylate ester fuming	d. Silver nitrate reagent
11. Identical twins have identical -----			
a. Genetic makeup	b. Eyes	c. Fingerprints	d. None of the above
12. Fingerprints formation is -----			
a. An on-going lifetime process	b. Complete by the age	c. Occurring at birth	d. Occurring during fetal development
13. The only way to permanently change your fingerprint is to -----			

a. Damage dermal papillae	b. Wash with acid	c. Sand the ridges	d. Burn the skin
14. The most common ridge pattern is -----			
a. Arch	b. Whorl	c. Wheel	d. Loop
15. Fingerprints are -----			
a. Valuable evidence	b. Individual evidence	c. Class evidence	d. Always good
16. DNA finger printing was developed by -----			
a. Francis Crick	b. Khorana	c. Alec Jeffrey	d. James Watson
17. The technique to distinguish the individuals based on their DNA print patterns is -----			
a. DNA fingerprinting	b. DNA profiling	c. Molecular fingerprinting	d. All the above
18. The DNA fingerprint pattern of a child is -----			
a. Exactly similar to that of both of the parents	b. 100% similar to the father's DNA print	c. 100% similar to the mother's DNA print	d. 50% bands similar to father and rest similar to mother
19. Each individual has a unique DNA fingerprint as individuals differ in -----			
a. Number of minisatellites on chromosome	b. Location of minisatellites on chromosome	c. Size of minisatellites on chromosome	d. All the above
20. DNA profiling technique to demonstrate the similarity between different plant species with reference to some specific protein coding DNA sequences is called -----			
a. Phyto blot	b. Garden blot	c. Plant profiling	d. All the above

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS	
21. A) Write short notes Organizational set up of Forensic Science Laboratories (OR) B) Write short notes on Scope and branches of forensic science	
22. A) Write about Classification of fingerprints (OR) B) How will you take fingerprints from living and dead persons?	
23. A) How will you find and identify human face image? (OR) B) How will you perform post mortem drawing?	
24. A) Write about Road traffic fatality (RTF) investigation (OR) B) Explain the basic injury mechanisms	
25. A) Explain the applications of DNA fingerprinting technology (OR) B) Write short notes on statutory considerations	

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS

26. Give a detailed account on Organizational set up of Forensic Science Laboratories

27. Write an essay on digital comparison of finger prints

28. Write elaborately on Forensic artist in court

29. Give a detailed fatality forensic science

30. Write an essay on quality assurance measures of DNA fingerprinting

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

SEMESTER VI

BIOPROCESS TECHNOLOGY

Paper	: Core VII	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 18U6BTC07	External	: 75

PREAMBLE

To make students on understanding basic principles of fermentation techniques and applying them in the production value added products such as antibiotic, vitamins and organic acids. The students also gain added knowledge on the production of agrobased products for human welfare.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	Understand the concepts of fermentation principles and its scope in downstream processing	K1 & K2
CO2	Understand the concepts of designing fermentor both in laboratory and pilot scale and its mode of operation	K1, K2 & K3
CO3	Gaining added information on the production of value added products from microorganisms	K4, K5 & K6
CO4	Propagate mass production of agriculturally important value added products	K4, K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	S
CO2	S	S	S	M	S
CO3	S	S	S	M	S
CO4	S	S	S	S	S

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
I	BASICS OF BIOPROCESS TECHNOLOGY: Introduction, Definition, Scope and applications of Bioprocess. Introduction to fermentation and downstream processing technology. Isolation and screening of industrially important microorganism. Strain improvement, preservation of microorganisms.	15

II	DESIGN OF FERMENTOR: Fermentation types. Design of fermentor – parts and its functions. Types of Bioreactors (Air lift, cyclone, column, packed tower) Mixed bioreactor systems. Monitoring and controlling Bioreactors (pH, temperature and dissolved oxygen), Instrumentation for process control - Heat and mass transfer, oxygen transfer mechanism.	13
III	DOWN STREAM PROCESSING: Basic principles of Down-stream processing – microbial cell disruption methods (Centrifugation, filtration fermentation broths). Cell separation techniques (Ultra filtration, Liquid-Liquid extraction) Chromatographic techniques: (Column & Ion exchange), Physical methods (Distillation, Fluid extraction and Electro dialysis).	15
IV	INDUSTRIAL BIOTECHNOLOGY: Microbial synthesis and applications – organic acids (Citric acid & acetic acid), Enzymes (Amylase), Antibiotics (Penicillin & Streptomycin), Vitamins (ascorbic acid & B12) an amino acids (Lysine & Aspartic acid).	17
V	PRODUCTION OF AGRICULTURAL PRODUCTS: Importance of micro algae and its cultivation (<i>Spirulina</i> & <i>Chlorella</i>). Mass production of Biofertilizer (<i>Rhizobium</i> & <i>Azolla</i>). Mushroom cultivation (Milk and button mushroom). Production and applications of Biopesticide (<i>Bacillus thuringiensis</i>).	15

SUGGESTED READINGS:

1. Pepler H.J. and Perlman D. 2006. Microbial Technology: Microbial Processes, 2nd Edition, Vol I, Academic Press
2. Stanbury F, Whittaker A and Hall J.S. 1997. Principles of Fermentation Technology, Adithya Books, New Delhi.
3. Jogdand S.N. 2000. Medical Biotechnology, Himalayan Publishing House.
4. Jayanto A. 2006. Fermentation Biotechnology, Dominant Publishers and Distributors, New Delhi.
5. Cassida J.R. 2005. Industrial Biotechnology, New Age International (P) Ltd, New Delhi.
6. Juan A and Senjo A. 2007. Separation Process Biotechnology, Taylor & Francis group.
7. Patel A.H. 1997. Industrial Microbiology, Macmillan India limited.
8. Glazer A.N. and Nikaido, H. 2007. Microbial Biotechnology: Fundamentals of Applied Microbiology, 2nd Edition, Cambridge University Press.
9. Prescott C and Dunn G. 2006. Industrial Microbiology, Agrobios (India).
10. Purohit S.S. Saluja A.K. and Kakrani H.N. 2004. Pharmaceutical Biotechnology. 1st Edition, Agrobios (India).

MODEL QUESTION PAPER (BIOPROCESS TECHNOLOGY)

NAME OF THE COURSE: BIOPROCESS TECHNOLOGY	COURSE CODE: 18U6BTC07	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS			
1. Fed batch process belong to -----			
a. Closed system	b. Continuous system	c. Intermediate fed batch system	d. Discontinuous system
2. Soyameal, peptone and tryptone are used as the source of -----			
a. Carbon	b. Carbon & nitrogen	c. Mineral	d. Nitrogen
3. Batch sterilization cycle time consists of -----			
a. Two phases	b. Three phases	c. Four phases	d. Five phases
4. Protected fermentation uses which of the given below -----			
a. Sterilized media	b. Pasteurized media	c. Pasteurized media with low pH	d. Unsterilized media
5. A spray dryer works on the principle of -----			
a. Contact drying	b. Sublimation	c. Lyophilisation	d. Adiabatic drying
6. Which is not a fruit or a vegetable based fermented product?			
a. Wine	b. Beer	c. Vinegar	d. Sauerkraut
7. Which of the following is an upstream process?			
a. Product recovery	b. Product purification	c. Media formulation	d. Cell lysis
8. Pyrogen free water is related to -----			
a. Endotoxin	b. O-polysaccharide	c. Peptidoglycan	e. Teichoic acid
9. Which one is down steaming process?			
a. Product recovery	b. Screening	c. Media formulation	d. Sterilization of media
10. Which is the following is not a physical method for the cells rupturing?			
a. Milling	b. Homogenization	c. Ultra sonication	d. Enzymatic digestion
11. Ethanol fermentation is carried by -----			
a. <i>Lactobacillus</i>	b. <i>E.coli</i>	c. <i>Saccharomyces cerevisiae</i>	d. <i>Bacillus</i> sp.
12. What is the percentage range of variation in recovery costs?			
a. 50-55%	b. 0-20%	c. 5-7%	d. 15-75%
13. Cell lysis becomes an important operation if the product is -----			

a. Extra cellular	b. Heat labile	c. Toxic	d. Intra cellular
14. <i>Bacillus thuringiensis</i> is used as -----			
a. Insecticide	b. Fungicide	c. Microbicidal agent	d. Rodenticide
15. Yeast cells are good sources of -----			
a. Vitamin A&B	b. Vitamin A&D	c. Vitamin B&D	d. All the above
16. The sugar concentration of molasses used in fermentation ranges between -----			
a. 10-18%	b. 20-30%	c. 4-5%	d. 30-38%
17. The protein found in milk is -----			
a. Rennin	b. Pepsin	c. Casein	d. Trypsin
18. <i>Spirullina</i> is a -----			
a. Edible fungus	b. Bio fertilizer	c. Biopesticidal	d. Single cell protein
19. What is the scientific name of mushroom?			
a. <i>Funaria</i> sp.	b. <i>Dryopteris</i> sp.	c. <i>Agaricus campestris</i>	d. <i>Fergus</i> sp.
20. Agar-Agar is obtained from -----			
a. <i>Diatoms</i>	b. <i>Gracilaria</i>	c. <i>Fomes</i>	d. <i>Laminaria</i>

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS	
21. A) State the scope and application of bioprocess technology	(OR)
B) Write notes on strain improvements	
22. A) Explain about airlift bioreactors	(OR)
B) Illustrate the packed tower bioreactor with its uses.	
23. A) Briefly mention the principles and uses of centrifugation	(OR)
B) Elaborate on cell separation techniques	
24. A) List out the application of amylases	(OR)
B) Explicate the production and applications of lysine	
25. A) Highlight the importance of bio fertilizers	(OR)
B) What are mushrooms? Explain its cultivation methods	

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS	
26. How will you develop an improved strain through recombination technique?	
27. Illustrate the criteria for design of fermenters and specify its functions.	
28. Explain basic principles of down streaming process	
29. Explain the large scale production of penicillin and state its uses.	
30. Describe the production and application of <i>Bacillus thuringiensis</i> .	

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

ANIMAL BIOTECHNOLOGY

Paper	: Core VIII	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 18U6BTC08	External	: 75

PREAMBLE

To make students on understanding the concepts of biotechnological approaches in animals so as to produce therapeutically products from animal systems.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	Understanding the development of animal cell culture techniques and basic concepts of cell lines	K1 & K2
CO2	Gain knowledge on cell culture, animal cell growth dynamics	K1 & K2
CO3	Manipulating animal cell for genetic improvement by modern recombinant techniques	K3 & K4
CO4	Knowing about the principles of ethical, legal and public issues on using genetically animals in producing value added products	K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
I	Introduction and history of animal cell culture development. Types of cell culture methods (Primary & secondary). Animal Cell lines (Primary & Continuous cell lines). Suspension culture and organ culture. Culturing of lymphocytes, epithelial cells & stem cells.	15
II	Basics of cell culture: Different types of animal cell culture media, growth supplements serum free media, Balanced salt solutions. Behaviour of cells in culture cell division, Cell growth kinetics, Metabolism and estimation of cell number.	15

III	Gene transfer methods in animals: Microinjection, Embryonic stem cell gene transfer, Retroviral gene transfer. Transgenic animals (Production of transgenic Mice, Cow and Sheep). Animal viral vectors (SV40 virus and Retro virus). Baculo virus expression system. Improvement of silk production and quality.	15
IV	Animal Propagation and health care: Artificial insemination, Embryo transfer techniques. Gene therapy and its types. Production and development of animal vaccines for FMD, BTD, Rabbits and anthrax.	15
V	Public aspects if Animal Biotechnology: Ethical issues in Animal Biotechnology, Management aspects of Biotechnology and Genetic Engineering. Manipulation of animal growth using hormones and probiotics. Manipulating lactation and wool growth in sheep and rabbits.	15

SUGGESTED READINGS:

1. Portner R. Animal Cell Biotechnology: Methods and Protocols, Second Edition, Humana Press, 2007.
2. Babink L.A. and Philips J.P. Animal Biotechnology, Comprehensive Biotechnology First Supplement, Pergamon press, Oxford, 1989.
3. Rossant J. and Pederson R.A. Experimental approaches to Mammalian Embryonic Development, Cambridge University Press, Cambridge, 1996.
4. Ian Gordon. Reproductive Technologies in farm animals, first edition, CABI Inter., 2004.
5. Lewis R. Human Genetics: Concept and applications. McGraw Hill Company, 2003.
6. Barrer JSF, Hammond K, McClintok AE, Eds., Future Developments in the Genetic improvements of Animals. Academic Press, 1992.
7. Freshney R.L. Animal Cell culture – A practical approach, IRL press, 1992.
8. Freshney R.L. Culture of animal cells: A manual of basic technique and specialized applications. 6th Edition, Wiley and Blackwell publications, 2010.
9. Ian Gordon. Reproductive Technologies in farm animals, first edition, CABI Inter., 2004.

MODEL QUESTION PAPER (ANIMAL BIOTECHNOLOGY)

NAME OF THE COURSE: ANIMAL BIOTECHNOLOGY	COURSE CODE: 18U6BTC08	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS			
1. The growth of animal cells in vitro in a suitable culture medium is called _____?			
a. LB medium	b. MS medium	c. NITCH's medium	d. MEM medium
2. Who introduced HAT medium?			
a. Littlefield	b. Ham	c. Amold	d. Rous and Jones
3. Name the type of culture which is prepared by inoculating directly from the tissue of an organism to culture media?			
a. Primary cell culture	b. Secondary cell culture	c. Cell lines	d. Transformed cell culture
4. What is cell line?			
a. Multilayer culture	b. Transformed cells	c. Multiple growth of cells	d. Sub culturing of primary culture
5. Which of the following is NOT the part of growth medium for animal culture?			
a. Starch	b. Serum	c. Carbon source	d. Inorganic salts
6. Which of the following is NOT the major function of the serum?			
a. Promotion of tuber and bulb formation	b. Stimulate cell growth	c. Enhance cell attachment	d. Provide transport proteins
7. For culturing, plasma from the adult chicken is preferred to mammalian plasma because			
a. It forms a clear and solid coagulum even after dilution	b. It is too opaque	c. It doesn't produce solid clots	d. It forms a semi solid coagulum
8. Disaggregating of cells can be achieved by			
a. Physical disruption	b. Enzymatic digestion	c. Treating with chelating agents	d. All the above
9. The technique of organ culture may be divided on the basis of employing			
a. solid medium	b. liquid medium	c. semi-solid medium	d. both (a) and (b)
10. What are the main constituents of culture for animal cell growth?			
a. Glucose and Glutamine	b. Growth factors	c. Cytokines	d. All of the above
11. In animal cell culture, particularly mammalian cell culture, transformation means:			

a. Uptake of new genetic material	b. Phenotypic modifications of cells in culture	c. both (a) and (b)	d. Release of genetic information
12. During the growth of animal cells in culture, it is noticed that the cells do not look very healthy. After an investigation, this is found that there is a lot of lactic acid in the culture fluid. What is probably wrong with this culture?			
a) Ethyl alcohol is being produced in excess	b) The cells have too much oxygen	c) Glycolysis is being inhibited	d) The cells do not have enough oxygen
13. Sometimes cell lines can be cultured for such a long time that they apparently develop the potential to be sub-cultured indefinitely in vitro. Such cells lines are called -----			
a) established cell lines	b) primary cell lines	c) secondary cell lines	d) propagated cell lines
14. Higher dissolved oxygen concentration in the culture media are toxic and leads to -----			
a) DNA degradation	b) lipid per oxidation	c) Rate of metabolism is greater than its consumption	d) all of the above
15. Which of the following is the technique used for the embryo culture?			
a) Organ cultures on plasma clots	b) Organ cultures on agar	c) Whole embryo cultures	d) All of these
16. The major problem associated with the isolation of free cells and cell aggregates from organs is that of -----			
a) releasing the cells from their supporting matrix	b) inhibiting the cells from their supporting matrix	c) disintegrating the cells from their supporting matrix	d) none of the above
17. The technique of organ culture may be divided on the basis of employing			
a) solid medium	b) liquid medium	c) both (a) and (b)	d) semi-solid medium
18. An established cell line can be called where it has been sub-cultured at least?			
a) 70 times at an interval of 3 days between subcultures	b) 40 times at an interval of 3 days between subcultures	c) 70 times at an interval of 1 day between subcultures	d) 50 times at an interval of 3 days between subcultures
19. In animal cell culture, particularly mammalian cell culture, transformation means			
a) Uptake of new genetic material	b) Phenotypic modifications of cells in	c) both (a) and (b)	d) Release of genetic information
20. Which of the following is not the explant technique?			
a) Slide culture	b) Carrel flask culture	c) Roller test tube culture	d) Adherent primary culture

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS

21. A) Write notes about primary cell culture techniques. (OR)
 B) Explain the techniques and application in organ culture.
22. A) Write a detailed account on different types of media used in animal cell culture. (OR)
 B) Explain the behaviour of cell division and cell kinetics.

23. A) Explain the principle and methodology of PCR Techniques	(OR)
B) Give detailed account of the mechanism application of Microinjection	
24. A) Explain the principle, methodology and application of embryo transfer technology	(OR)
B) Write detailed about production and development of animal vaccines.	
25. A) Explain various strategies of ethical issues in Animal Biotechnology.	(OR)
B) Discuss about a special features and applications of Stem cell culture.	

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS	
26. Write a detailed account on Animal cell culture Steps and maintenance?	
27. Explained in detail about the Animal cell culture Media and Balanced salt solutions?	
28. Describe about the Gene Transfer Techniques in Detail?	
29. Production and development of Animal vaccines with Good examples?	
30. Explain about cancer Gene therapy and Stem cell in detail?	

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

LAB IN BIOPROCESS TECHNOLOGY AND ANIMAL BIOTECHNOLOGY

Paper	: Core Practical VII	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 40
Paper Code	: 18U6BTCP07	External	: 60

PREAMBLE

To make students on exposing to practical principles of fermentation techniques and applying them in the production value added products such antibiotic, vitamins and organic acids. The students also gain added knowledge on the production of agrobased products for human welfare. To make students on exposing to practical principles of tissue culture media preparation, cell viability, subculturing and viability assay techniques

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	Understand the basic concepts on the production of alcohol, organic acid and SCP production. Prepare animal cell media and its sterilization techniques.	K1, K2 & K3
CO2	Understand in determining the microbial growth. To filter sterilize the sensitive media ingredients and filtration technique.	K1 & K2
CO3	Estimating the production of single cell protein by biochemical method. Prepare suspension culture and cultivating viruses in embryonated egg.	K2, K4 & K5
CO4	Analysing milk qualitatively and separating aflatoxin fungal species by chromatographic method. Observation of different types of animal cell lines.	K2, K4 & K5

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	M	S	S
CO3	M	S	S	S	S
CO4	M	S	M	S	S

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
1	Enumeration of microorganisms from bread	5
2	Production of alcohol from grapes	
3	Production and estimation of citric acid from <i>Aspergillus</i> species	10
4	Estimation of alcohol from grapes	

5	Production and estimation single cell protein from <i>Azolla</i> and <i>Spirullina</i> by Lowry's method	10
6	Immobilization of amylase by entrapment method	
7	Determination of bacterial growth by growth curve method	10
8	Determination of Thermal Death point (TDP) of the bacterial sample	
9	Quality analysis of milk a. MBRT test and b. Rezasurin test	10
10	Analysis of fungal aflatoxin by TLC	
11	Enumeration of microorganisms from bread	5
12	Production of alcohol from grapes	
13	Production and estimation of citric acid from <i>Aspergillus</i> species	5
14	Estimation of alcohol from grapes	
15	Production and estimation single cell protein from <i>Azolla</i> and <i>Spirullina</i> by Lowry's method	5
16	Immobilization of amylase by entrapment method	
17	Determination of bacterial growth by growth curve method	10
18	Determination of Thermal Death point (TDP) of the bacterial sample	
19	Quality analysis of milk c. MBRT test and d. Rezasurin test	5
20	Analysis of fungal aflatoxin by TLC	

MODEL QUESTION PAPER (LAB IN BIOPROCESS TECHNOLOGY AND ANIMAL BIOTECHNOLOGY)

NAME OF THE COURSE: LAB IN BIOPROCESS TECHNOLOGY AND ANIMAL BIOTECHNOLOGY	COURSE CODE: 18U6BTCP07	DURATION: 6Hrs
MAX MARKS: 60		

MAJOR EXPERIMENT			
Exp: 12	Obs: 5	Res: 3	Total: 20 MARKS
1. (i) Estimate the amount of alcohol from the given fruit sample (A) /Isolate genomic DNA from the given animal tissue sample (A) (OR)			
(ii) Estimate the amount of citric acid from the given batch culture medium (A)/ Perform single cell suspension culture from the given animal cell sample (A) (OR)			
(iii) Estimation single cell protein from the given sample (A) by Lowry's method/ Perform viability test of the given animal cell suspension (A) sample			
MINOR EXPERIMENT			
Exp: 6	Obs: 2	Res: 2	Total: 15 MARKS
2. (i) Perform immobilization of the given enzyme sample (B)/ Inoculate the given infectious sample in the embryonated egg sample (B) (OR)			
(ii) Determine thermal Death point (TDP) of the bacterial sample (B)/ Perform monolayer culture from the given chick embryo fibroblast cells (B)(OR)			
(iii) Determine the quality of the given milk sample (B) by MBRT/Resazurin test/ Disintegrate the given monolayer culture (B) by appropriate method			
SPOTTERS			(5 X 4 = 20 MARKS)
3. Identify the given spotters C, D, E, F & G and comment on them			
RECORD			(1 x 5 = 5 MARKS)
VIVA-VOCE			5 MARKS
TOTAL			60 MARKS

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

GENOMICS AND PROTEOMICS

Paper	: Elective II	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 18U6BTE04	External	: 75

PREAMBLE

This paper deals with the basic principles of genome and its manipulating strategies end up with the development of novel candidate gene.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	Understand the basic structure of genome map in prokaryotic and eukaryotic organisms	K2 & K3
CO2	To understand the mapping of different regions of DNA and its amplification protocols	K2 & K3
CO3	To acquire knowledge on different tools used in the fields of Proteomics	K2, K3 & K4
CO4	To explore with the different application of proteomics in terms of protein mapping	K4, K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S

S: Strong; **M:** Medium; **L:** Low

UNIT	CONTENT	HOURS
I	Genomics -Overview of Genome anatomies. Prokaryotic Genome Organization: operons. Eukaryotic Genomes, Nuclear Genomes and gene families, Organelle genomes: origin, Repetitive DNA contents, Tandem repeats, Transposons and transposable elements.	15
II	DNA sequencing methods: Shot gun sequencing – Contig assembly. Techniques for gene location: ORF findings, Northern Hybridization, RT-PCR, RACE, S1 nuclease mapping, exon trapping. Transcriptome analysis: SAGE and Microarray technology	15
III	Genome Mapping: Genetic Mapping: RFLP, SSLP, SNP-Physical	15

	Mapping, Restriction site Mapping: FISH, STS mapping. Human genome organization. Gene therapy for inherited disorders and infectious diseases and ethics.	
IV	Tools of Proteomics: The proteome – the life cycle of protein-analytical techniques. Protein separation: 1D PAGE, 2D-PAGE, RPHPLC, Protein digestion techniques: peptide analysis- MALDI-TOF-ESI, Tandem Mass analyzers, Peptide Mass finger printing.	15
V	Applications of Proteomics: Protein mining, SALSA algorithm for mining specific features. Protein expression profiling. Identifying protein - protein interactions. Mapping of protein modifications.	15

SUGGESTED READINGS

1. Terence A Brown.(2002) Genomes, 2nd Edition, Bios Scientific Publishers.
2. Tom Strachan and Andrew P Read (1999) Human Molecular Genetics, 2nd edition, Bios Scientific Publishers.
3. Daniel C. Liebler (2002) Introduction to Proteomics, tools for the New biology- Humana press. Totowa, NJ.
4. Pennington.S, M. Dunn (2001) Proteomics: From Protein Sequence to Function 1 edition Bios Scientific Publishers.

MODEL QUESTION PAPER (GENOMICS AND PROTEOMICS)

NAME OF THE COURSE: GENOMICS AND PROTEOMICS	COURSE CODE: 18U6BTE04	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS

1. The study of full complement of proteins expressed by a genome is called			
a. Proteome	b. Proteomics	c. Genomics	d. Protein formation
2. The effects of protein on an entire organism is described in			
a. Phenotypic function	b. Cellular function	c. Molecular function	d. Structural genomics
3. The precise biochemical activity of a protein is described in			
a. Structural genomics	b. Molecular function	c. Cellular function	d. Phenotypic function
4. The network of interactions engaged in by protein at cellular level is described in			
e. Molecular function	f. Phenotypic function	g. Structural genomics	h. Cellular function
5. The goal of structural proteomics project is to			
a. Crystallize and determine the structure of proteins	b. Identify and sequence of all the genes present in the human body	c. Introduce new genes to human beings	d. Remove disease causing genes from humans
6. Conserved gene order can be termed as -----			
a. Ortholog	b. Synteny	c. Paralog	d. Microarray
7. Sequencing of genomic DNA is included in			
a. Structural genomics	b. Molecular function	c. Cellular function	d. Phenotypic function
8. Genes of different species, possessing a clear sequence and functional relationship to each other are			
a. Ortholog	b. Synteny	c. Paralog	d. Microarray
9. <i>Rawolfia serpentina</i> , to save this plant under the threat of extinction, which of the following techniques is useful?			
a. Genetic engineering	b. In vitro culture	c. DNA fingerprinting	d. Hybridoma technology
10. Transgenic organisms are generally			
a. Extinct organisms	b. Naturally occurring and endemic	c. Produced by plant breeding technique	d. Produced by gene transfer technology
11. Genes of same species, similarly related to each other are			
a. Paralog	b. Ortholog	c. Microarray	d. Synteny
12. Dolly, the first animal produced by cloning is a			
a. Cow	b. Sheep	c. Rat	d. Dog

13. Collection of microscopic DNA spots attached to solid surface are?			
a. Ortholog	b. Microarray	c. Synteny	d. Paralog
14. Gene therapy is a technique preferred to cure inherited diseases by			
a. Repairing the faulty gene	b. Introducing the correct copy of the gene	c. Adding new cells to the body	d. PCR
15. Which of the following is a repressible operon?			
a. Lac	b. Trp	c. Gal	d. glu
16. Explant can be a -----			
a. Cut part of the plant used in tissue culture	b. Plant extract used in tissue culture	c. Source of growth regulators added to media	d. Solidifying agent
17. Which of the following is used to transfer genes in plants?			
a. Ti plasmid	b. pBR 322	c. EcoR 1	d. pUC 18
18. Which of the following bacterium is used for gene transfer in plants?			
a. Agrobacterium	b. Azotobacter	c. Rhizobium	d. <i>E.coli</i>
19. Which of the following is an inducible operon?			
a. Glu	b. Lac	c. Gal	d. trp
20. Integrated state of DNA from other organisms in host DNA is termed as			
a. Plasmids	b. Phasmids	c. Episomes	d. cosmids

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS	
21. A) Elaborate on the mechanism of DNA Gyrase in nucleic acid replication (OR) B) What are lampbrush chromosomes? State its special features.	
22. A) How DNA sequencing is achieved by shot gun method? (OR) B) Write notes on Pharmacogenomics.	
23. A) Enlist the inherited disorders and its treatment by gene therapy (OR) B) Derive the protocol for human pedigree analysis.	
24. A) State the features of MALDI proteome analysis. (OR) B) Briefly write about peptide mass finger printing.	
25. A) State the applications of Global Biochemical Network. (OR) B) Affirm about the micro array techniques for proteins.	

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS	
26. Illustrate the different levels of packaging of DNA in eukaryotes.	
27. State the mechanism of gene expression using RT-PCR technique.	
28. Describe the implication of Human Genome Project.	
29. Explain the principle, process and applications of 2-D gel electrophoresis.	
30. Elucidate the principle and mechanism of mass spectroscopy in the analysis of metabolomics.	

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

ELECTIVE II

BIOPHYSICS AND BIOINSTRUMENTATION

Paper	: Elective II	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 18U6BTE05	External	: 75

PREAMBLE

This paper deals with the basic instrumental principles leading to biological research outputs. It also describes the biophysical concepts of different biomolecules.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	Explores student towards the biophysical properties of nucleic acids proteins	K1 & K2
CO2	Acquiring knowledge with the basic concepts of chromatographic techniques	K1, K2 & K3
CO3	Acquiring knowledge with the basic concepts of spectroscopic techniques	K3, K4 & K5
CO4	Exploring towards the use of radiation principles in the field of biomedical science	K3, K4 & K5

MAPPING WITH PROGRAMME OUTCOMES

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	M	M
CO3	S	S	M	S	S
CO4	S	S	S	S	M

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
I	Biophysics Of Nucleic Acids: Transitional angles and their ranges. The pseudo-rotation cycle, syn – anti orientation of glycosyl bond. Geometries of Watson- Crick and Hoogsteen base pairs.	12
II	Biophysics Of Proteins: Amino acids – Conformations. Phi and Psi angles. Ramachandran plot. Peptide bond isomerisation. Disulphide bonds, electrostatic forces, van der waals interaction and hydrogen bonds.	12

III	Analytical techniques: Principles and applications of Chromatography (Paper, thin-layer, column, GC-MS, GLC, Ion exchange chromatography, HPLC).	12
IV	Analytical techniques: Principles and applications of spectroscopy. (UV-Vis, NMR, Raman spectroscopy, AAS and X-ray crystallography).	12
V	Radiation Biophysics: Basic concepts of radiography. Measurement of radioactivity: GM counter, Liquid and solid scintillation counter. Advantage and disadvantage of radio active compounds.	12

SUGGESTED READINGS

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. Biophyscial chemistry – principles and Techniques- Upadhyay, Upadhyay Nath.1997
3. Biophysical chemistry – Cantor and Schimmel. 2002
4. Biophysical chemistry – principles and Techniques- Upadhyay, Upadhyay Nath.1997
5. Biophysics – Arora, First edition, Himalaya Publications, New Delhi
6. Palanivelu, P (2001). Analytical Biochemistry, and separation techniques, Tulsi Book Centre. Madurai.

MODEL QUESTION PAPER (BIOPHYSICS AND BIOINSTRUMENTATION)

NAME OF THE COURSE: BIOPHYSICS AND BIOINSTRUMENTATION	COURSE CODE: 18U6BTE05	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS

1. The right handed double helix of DNA contains -----base pairs per turn			
a. 9.5	b. 10.5	c. 11.5	d. 12.5
2. Which of the following bas pair geometry is considered as a rotation of one base with respect to the other in the same base pair?			
a. Shear	b. Buckle	c. Propeller	d. Stagger
3. The twisting degree of B form of DNA is about -----			
a. 60°	b. 90°	c. 120°	d. 360°
4. When the ends of a piece of double stranded helical DNA are joined so that it forms a circle the strands are ----- knotted			
a. Topologically	b. Geometrically	c. Physically	d. Isometrically
5. A typical stability of a protein domain range from ----- to----- kcal/mol			
a. 2, 5	b. 3, 6	c. 3, 7	d. 2, 6
6. ----- spectroscopic suggest that lipid binding by apo lipoproteins is mediated via the molten globule-like state in plasma			
a. NMR	b. CD	c. AAS	d. Raman
7. The most common type of protein folding is described by the principle of -----			
a. Tunnel landscape	b. Folding funnel	c. Realistic landscape	d. Levinthal paradox
8. Which of the following angle of proteins folding is essentially flat and fixed to 180°?			
a. Alpha	b. Beta	c. Gamma	d. Omega
9. Retention factor is related to -----			
a. PC	b. TLC	c. a & b	d. GC
10. The sample prepared is sent in to the column in the form of gas so that ionic species are quantitatively determined. Which of the following chromatographic technique is employed?			
a. MS	b. GC	c. AAS	d. Ion exchange
11. Elemental species of the given sample is determined by -----			
a. TLC	b. GLC	c. GC-MS	d. AAS
12. Cationic and anionic resins are used in -----			
a. PC	b. TLC	c. AAS	d. IEC
13. The substances found in colourless solutions can be measured by -----			
a. Colorimeter	b. UV-VIS	c. NMR	d. X-ray

14. Sweep generator is used in -----			
a. NMR	b. X-ray	c. UV-VIS	d. Raman spectroscopy
15. Nickel oxide is used as monochromator in -----			
a. X-ray crystallography	b. Raman spectroscopy	c. UV-VIS	d. XRD
16. Activation energy of a given system can be conveniently determined by -----			
a. XRD	b. NMR	c. AAS	d. UV-VIS
17. Becquerel is a unit of measurement of -----			
a. Fossil age	b. Radioactivity	c. Carbon dating	d. None of the above
18. Which of the following particle has medium energy?			
a. Alpha	b. Beta	c. Gamma	d. Omega
19. GM counter is used for measuring -----			
a. Radiation frequency	b. Ionizing radiation	c. Effect of radiation	d. Gamma radiation
20. The main substance used for nuclear imaging in cardiology is -----			
a. Thallium isotope	b. Boron isotope	c. Uranium isotope	d. Tritiated water

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS

21. A) Write short notes on syn – anti orientation of glycosyl bond (OR) B) Write short notes on transition angles of nucleic acids
22. A) Write short notes on peptide bond isomerization (OR) B) Write notes on electrostatic forces involved in protein stability
23. A) Explain the applications of Thin layer chromatography (OR) B) Explain the principle of HPLC
24. A) Explain the instrumentation of Raman spectroscopy (OR) B) List out the applications of atomic absorption of spectroscopy
25. A) Explain the working principle of solid and liquid scintillation counter (OR) B) Briefly explain the disadvantages of radio active compounds

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS

26. Give a detailed account on the geometrics of Watson & Crick model.
27. Give detailed account on Ramachandran plot
28. Write an essay on the working principle, instrumentation, applications, advantages and disadvantages of GC-MS
29. Give a detailed account on NMR. Add a note on its applications in the fields of medicine and defence
30. Write an essay on GM counter

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

ELECTIVE II
ENVIRONMENTAL BIOTECHNOLOGY

Paper	: Elective II	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 18U6BTE06	External	: 75

PREAMBLE

This paper provides insight into environmental issues, relevant biotechnological concepts for facing environmental issues, available biotechnological applications in environmental issues, relevant policies. The course also tries to impart knowledge and skill in environmental biotechnology for sustainable development

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	To provide knowledge in environmental impacts in biotechnology	K1 & K2
CO2	To understand the concepts in various bioremediation techniques related environmental aspects	K2 & K3
CO3	To impart new thoughts about biotechnological applications on environmental issues	K3 & K4
CO4	To create awareness regarding the environmental policies for the improvement of environmental safety	K3, K4 & K5

MAPPING WITH PROGRAMME OUTCOMES

Cos	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	S	M
CO2	S	S	S	S	S
CO3	S	S	S	S	M
CO4	S	S	S	S	S

S: Strong; **M:** Medium; **L:** Low

UNIT	CONTENT	HOURS
I	Biodiversity - definition, hot spots of Biodiversity, National Parks, Sanctuaries and Biosphere reserves, gene pool. Aquatic common flora and fauna in India - phytoplankton, zooplankton and macrophytes, terrestrial common flora and fauna in India - forests, endangered and threatened species.	15
II	Strategies for Biodiversity Conservation, cryopreservation, gene banks, tissue culture and artificial seed technology, new seed development policy 1988, conservation of medicinal plants. International conventions, treaties and protocols for Biodiversity Conservation.	15

III	Bioremediation & Phytoremediation: Bio-feasibility, applications of bioremediation, Phytoremediation. Bio-absorption and Bioleaching of heavy metals: Cadmium, Lead, Mercury, Metal binding targets and organisms, Bio-absorption, metal - microbe interaction, Commercial biosorbents.	15
IV	Waste water Treatment: Biological treatment system (Oxidation ponds, aerobic and anaerobic ponds, facultative ponds, aerated ponds), Biological waste water treatment, activated sludge treatment, microbial pollution in activated sludge, percolating filters, waste water treatment by biofilms.	15
V	Solid waste pollution and its management: Current practice of solid waste management, composting systems, vermicomposting, sewage treatment.	15

SUGGESTED READINGS

1. Samit Ray and Arun K. Ray, Biodiversity and Biotechnology, New Central Book Agency (P) Ltd. (2007)
2. Pushpangadan P., Ravi K and V. Santhosh, Conservation and Economic evaluation of Biodiversity Vol.I& II (1997) Wealth of India CSIR, New Delhi.
3. An advanced text book of biodiversity. Principles and practice.By K. V. Krishnamurthy. Oxford and IBH company Pvt Ltd.
4. Biodiversity conservation: A Genetic Approach by S. Biswas. Oxford Book Company. 2007.
5. Alan Scragg. 1999. Environmental Biotechnology. Pearson Education Limited, England.
6. Jogdand, S. N. 1995. Environmental Biotechnology. Himalaya Publishing House, Bombay.
7. Technoglous, G., Burton, F. L. and Stensel, H. D. 2004. Wastewater Engineering-Treatment, Disposal and reuse. Metcalf and Eddy, Inc., TataMcGraw Hill, New Delhi.
8. De, A. k. 2004. Environmental Chemistry. Wiley Eastern Ltd. New Delhi.
9. Allsopp, D. and Seal, K. J. 1986. Introduction to Biodeterioration. ELBS/Edward Arnold, London.
10. Athie, D and Ceri, C. C. 1990. The use of Macrophytes in Water Pollution Control, Pergamon Press, Oxford.
11. Chin, K. K., and Kumarasivam. K. 1986. Industrial Water Technology Treatment, Reuse and Recycling. Pergamon Press, Oxford.

MODEL QUESTION PAPER (ENVIRONMENTAL BIOTECHNOLOGY)

NAME OF THE COURSE: ENVIRONMENTAL BIOTECHNOLOGY	COURSE CODE: 18U6BTE06	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS			
1. Phytoplanktons provide food to -----			
a. Whales	b. Shrimp	c. Snails	d. All the above
2. The term biodiversity hotspot specifically refers to----- biologically rich areas around the world			
a. 15	b. 25	c. 35	d. 45
3. The upper reaches of the Himalayas forming part of the -----			
a. Indomalaya ecozone	b. Palearctic ecozone	c. Indo-Burma	d. Sundaland
4. Endangered (EN), as categorized by			
a. LC	b. IUCN	c. VU	d. CR
5. Approximately----- per cent of the total geographical area of the country has been earmarked for extensive in situ conservation of habitats and ecosystems			
a. 4.7	b. 7.7	c. 5.7	d. 6.7
6. New policy on seed development was formulated by the ministry of -----			
a. Science and technology	b. Agriculture	c. External affairs	d. None of the above
7. The Convention of biodiversity was opened for signature at the Earth summit in -----			
a. 5 th June 1992	b. 5 th August 1992	c. 5 th June 1995	d. 5 th August 1995
8. The Cartagena Protocol on Biosafety of the Convention, also known as the Biosafety Protocol, was adopted in -----			
a. January 2000	b. February 2000	c. March 2000	d. June 2000
9. Arsenic contamination in soil is recovered by -----			
a. Bioleaching	b. Phytoremediation	c. Bioremediation	d. Bio feasibility
10. Heavy metal toxicity increases the production of -----thereby decreasing the antioxidant systems			
a. ROS	b. Hydrogen ions	c. Organic nutrients	d. Oxygen
11 ----- is defined as the removal of metal or metalloid species, compounds and particulates from a solution by low cost biological materials			
a. Bioleaching	b. Bioremediation	c. Biosorption	d. Phytoremediation
12. Algae are of special interest in search for and the development of new biosorbents materials due to their ----- and their ready availability in practically unlimited quantities in the seas and oceans			
a. High filtration capacity	b. High reflection capacity	c. High Adsorption capacity	d. High sorption capacity

13. The bacteria present in the pond decompose the biodegradable organic matter and release ----- -----			
a. CO ₂	b. Ammonia	c. Nitrate	d. All the above
14. Laggons are also called -----			
a. Aerobic ponds	b. Oxidation ponds	c. Facultative ponds	d. Aerated ponds
15. The activated sludge process is a type of wastewater treatment process for treating sewage or industrial wastewaters using aeration and a biological floc composed of bacteria and -----			
a. Viruses	b. Fungi	c. Helminthes	d. Protozoa
16. Research performed at the Division of Environmental Microbiology has over the last years resulted in the isolation of ----- with efficient nutrient removal properties			
a. <i>Comamonas denitrificans</i>	b. <i>Brachymonas denitrificans</i>	c. <i>Aeromonas hydrophila</i>	d. All the above
17. Which of the following is Not common, and generally not successful because of high capital, technical, and operation costs, high moisture content in the waste, and high percentage of inerts?			
a. Incineration	b. Land filling	c. Source reduction	d. Composting
18. Which of the following is NOT a component of bio compost?			
a. Carbon	b. Nitrogen	c. Oxygen	d. Hydrogen
19. The most common eath worm used for vermicomposting is -----			
a. <i>Eisenia foetida</i>	b. <i>Lumbricus terrestris</i>	c. <i>Lumbricus rubellus</i>	d. <i>Perionyx excavatus</i>
20. The most common worms used in composting systems, red worms feed most rapidly at temperatures of -----			
a. 10–25 °C	b. 15–20 °C	c. 15–25 °C	d. 10–20 °C

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS

21. A) Write short notes on hot spots of Biodiversity B) Write short notes on endangered and threatened species	(OR)
22. A) Write short notes on cryopreservation B) Write short notes on Biodiversity Conservation	(OR)
23. A) Write short notes on Bioleaching of heavy metals B) Write short notes on Commercial biosorbents	(OR)
24. A) Write short notes on activated sludge treatment B) Write short notes on percolating filters	(OR)
25. A) Write short notes on composting systems B) Write short notes on vermicomposting	(OR)

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS

26. Give a detailed account on Aquatic common flora and fauna in India
27. Give a detailed account on tissue culture and artificial seed technology

28. Give a detailed account on Bioremediation

29. Give a detailed account on Waste water Treatment

30. Give a detailed account on sewage treatment

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

SBEC – III

LAB IN BIOINFORMATICS

Paper	: SBEC III	Total Hours	: 30
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 17U6BTS07	External	: 75

PREAMBLE

To make students on understanding basic principles of biological soft wares and their usage for generating molecular and genetic databases of living organisms

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	To understand the basic concepts of functional and computational genomics and proteomics	K2, K3, K5 & K6
CO2	To acquire knowledge on the usage of biological software on generating databases both online/offline	K2, K3, K5 & K6
CO3	To understand the existence of globally available online soft wares and databases for nucleic sequence retrieval	K2, K3, K5 & K6
CO4	To understand the usage and deposition of sequences in to globally available structural databases	K2, K3, K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S

S: Strong; M: Medium; L: Low

Exp. No	TITLE	HOURS
1	Biological Databases with reference to Expasy and NCBI	2
2	Query finding based on biological databases	2
3	Sequence similarity searching using BLAST	3
4	Pairwise alignment	2
5	Multiple Sequence and Phylogenetic Analysis	3
6	Gene Prediction	3
7	Protein Structure prediction (Secondary and tertiary)	3

8	Homology Modeling Using Modeller	3
9	Protein- Ligand docking	2
10	Program to store a DNA sequence in NCBI : Bankit	3
11	Program to convert DNA to RNA/Protein	2
12	Program to find ORF	2

MODEL QUESTION PAPER (LAB IN BIOINFORMATICS)

NAME OF THE COURSE: LAB IN BIOINFOMATICS	COURSE CODE: 17U6BTS07	DURATION: 6Hrs
MAX MARKS: 60		

MAJOR EXPERIMENT			
Exp: 10	Obs: 5	Res: 5	Total 20 MARKS
1. (i) Retrieve the gene sequence from GenBank (A)			(OR)
(ii) Find out the given query sequence (A) by BLAST analysis			(OR)
(iii) Find out ORF in the given sequence sample (A)			
MINOR EXPERIMENT			
Exp: 8	Obs: 4	Res: 3	Total: 15 MARKS
2. (i) Retrieve the protein structure of haemoglobin (B)			(OR)
(ii) Perform Phylogenetic Analysis for the given organism (A)			(OR)
(iii) Find out the RNA sequence from the given DNA sequence (B)			
SPOTTERS			(5 X 4 = 25 MARKS)
3. Identify the given spotters C, D, E, F & G and comment on them			
RECORD			(1 x 5 = 5 MARKS)
VIVA-VOCE			5 MARKS
TOTAL			60 MARKS

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

SBEC – III

BIOSAFTEY, BIOETHICS & IPR

Paper	: SBEC III	Total Hours	: 30
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 18U6BTS08	External	: 75

PREAMBLE

To make students on understanding basic principles of biosafety guidelines and to understand concepts of intellectual property right and its types. The student also gain added knowledge on ethical, legal and social considerations on implementing/maketing biotechnological products.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	Understand the concepts of basic biosafety and biosafety levels	K1 & K2
CO2	Understand biosafety guidelines and role genetically modified Organisms	K1, K2 & K4
CO3	Understand the basic principles of IPR, its types and patenting Procedures	K4, K5 & K6
CO4	Understand the concepts of ethical, legal considerations on the release of genetically modified organisms	K4, K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
I	Bio safety: Introduction – bio safety issues in biotechnology - historical background. Biosafety Levels - Levels of Specific Microorganisms, Infectious Agents and Infected Animals.	6
II	Biosafety Guidelines: Guidelines and regulations (Cartegana Protocol). Definition of GMOs & LMOs. Roles of Institutional Biosafety Committee, RCGM, GEAC.	6
III	Intellectual Property Rights: Introduction to IPR, Types of IP - Patents, Trademarks, Copyright & Related Rights, Importance of IPR – patentable and non-patentable.	6
IV	Patents and Patent Laws: Objectives of the patent system - Basic, principles	6

	and general requirements of patent law. Patentable subjects and protection in Biotechnology.	
V	Bioethics: Introduction to ethics and bioethics, framework for ethical decision making. Ethical, legal and socioeconomic aspects of gene therapy. Ethical implications of GM crops, biopiracy and biowarfare.	6

SUGGESTED READINGS:

1. Beier F.K, Crespi R.S and Straus T. Biotechnology and Patent protection, Oxford and IBH Publishing Co. New Delhi.
2. Jeffrey M. Gimble, Academia to Biotechnology, Elsevier Academic Press.
3. Rajmohan Joshi (Ed.). 2006. Biosafety and Bioethics. Isha Books, Delhi.
4. Sasson A, Biotechnologies and Development, UNESCO Publications.
5. Senthil Kumar Sadasivam and Mohammed Jaabir M. S. (2008). IPR, Biosafety and Biotechnology Management, Jasen Publications, India.

MODEL QUESTION PAPER (BIOSAFETY, BIOETHICS AND IPR)

NAME OF THE COURSE: BIOSAFETY, BIOETHICS AND IPR	COURSE CODE: 18U6BTS08	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS			
2. Bio-related research activities may not involve -----			
a. Micro organisms	b. Animal cells	c. Plant cells	d. All
3. A pathogen that is unlikely to cause any disease in humans or animals			
a. Risk group I	b. Risk group II	c. Risk group III	d. Risk group IV
4. <i>Korean hemorrhagic</i> fever is example for -----			
a. Risk group II	b. Risk group III	c. Risk group IV	d. Risk group I
5. Physical containment is achieved by -----			
a. One type	b. Two types	c. Three types	d. Four types
6. Which one of the following is not relevant to sterilization technique?			
a. Ethanol	b. Incinerator	c. Microscope	d. Autoclave
7. Cartagena Protocol on Biosafety to the Convention on Biological Diversity Effective from -----			
a. 11 September 2003	b. 12 September 2003	c. 11 September 2004	d. 12 September 2004
8. Each Institutional Biosafety Committee has a nominee for -----			
a. DST	b. DBT	c. UGC	d. ICAR
9. How many RCGM meeting held in 2018?			
a. 7	b. 8	c. 9	d. 6
10. The RCGM shall not include the following representative			
a. DBT	b. ICMR	c. UGC	d. CSIR
11. GEAC established under			
a. MoEF & CC	b. UGC	c. DBT	d. DST
12. Trade name is otherwise called as -----			
a. Patent	b. Model	c. Business name	d. Trademark
13-----is any information of commercial value concerning production			
a. Trade name	b. Trade Secret	c. Patent	d. Industrial Design
14. IPR initially started in North Italy during the -----			
a. Renaissance era. In 1471	b. Renaissance era. In 1472	c. Renaissance era. In 1473	d. Renaissance era. In 1474
15. Protection of IPR not allow the following			

a. Innovator	b. Brand owner	c. Teacher	d. Copyright holder
16. Intellectual property not refers to creations of the mind			
a. Hard work	b. Inventions	c. Literary and artistic works	d. Names
17. Which one is comes under type of intellectual property (IP)?			
a. Copyright	b. Patent	c. Trademark	d. All the above
18. Mathematical algorithms are-----			
a. Patentable	b. Non patentable	c. Both	d. None of the above
19. Software is a -----			
a. Patentable	b. Non patentable	c. Both	d. None of the above
20. Patentable biotechnological inventions is -----			
a. Proteins	b. DNA sequences	c. Both of the (a) and (b)	d. None of the above
21. Early founders of bioethics put forth four principles which form the framework for moral reasoning			
a. 4	b. 3	c. 2	d. 1

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS	
21. A) Explain different levels of biosafety. B) Explain different types of sterilization methods.	
22. A) Explain the role of institutional committee. B) Explain RCGM and GEAC?	
23. A) explain object of Intellectual property law? B) Explain the importance of IPR?	
24. A) Write a note on benefits of patent. B) Explain patentable and non-patentable biotechnological inventions?	
25. A) Define bioethics, explain purpose and scope of bioethics? B) Explain perspectives and methodology of bioethics?	

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS	
26. Explain different types of bio-safety measures in laboratory?	
27. Explain Cartagena protocol on biosafety.	
28. What is IPR and explain their different types?	
29. Patent - Definition, History and Law	
30. Explain framework for making ethical decisions.	

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

SBEC – III

CANCER BIOLOGY

Paper	: SBEC III	Total Hours	: 30
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 18U6BTS09	External	: 75

PREAMBLE

To make students on understanding basic principles of biosafety guidelines and to understand concepts of intellectual property right and its types. The students also gain added knowledge on ethical, legal and social considerations on implementing/marketing biotechnological products.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	Understand the basic concepts of cancer biology and types of tumour	K1 & K2
CO2	Understand the mechanisms of cancer development and chemical involved in carcinogenesis	K1 & K2
CO3	Understand molecular mechanisms and genetic principles of oncogene expression	K3, K4 & K5
CO4	Acquiring the knowledge on developing drug discovery approach in the management and detection of cancer	K4, K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
I	Fundamentals of cancer biology: Regulation of Cell cycle, Mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes. Development and causes of cancer, Types of cancer, Benign and malignant tumours.	6
II	Principles of carcinogenesis: Chemical Carcinogenesis, Metabolism of Carcinogenesis, Natural History of Carcinogenesis.	6
III	Principles of molecular biology of cancer: Oncogenesis: Oncogenes, identification of Oncogenes, Retroviruses and Oncogenes, detection of Oncogenes, Growth factors related to transformations.	6

IV	Principles of cancer metastasis: Clinical significances of invasion, heterogeneity of metastatic phenotype, three step theory of invasion, Proteinases and tumor cell invasion.	6
V	New molecules for cancer therapy: Different forms of therapy, Chemotherapy, Radiation Therapy, Detection of Cancers, Prediction of aggressiveness of Cancer, Advances in Cancer detection.	6

SUGGESTED READINGS:

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

MODEL QUESTION PAPER (CANCER BIOLOGY)

NAME OF THE COURSE: CANCER BIOLOGY	COURSE CODE: 18U6BTS09	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS			
1. Cell cycle is regulated by -----			
a. Kinase	b. CDKs	c. Cyclins	d. cAMP
2. Which of the following is tumour suppressor gene?			
a. MAP	b. EGF	c. RB	d. p53
3. Which of the following is an example for malignant tumour?			
a. Skin cancer	b. Hyperchromic macrocytic anaemia	c. Lung cancer	d. Liver cancer
4. Which of the following is not a process of metastasis?			
a. Attachment & Detachment	b. Invasion	c. Angiogenesis	d. Tissue degeneration
5. Which of the following chemical causes cervical cancer?			
a. Asbestos	b. Benzopyrene	c. Ethidium bromide	d. Acrylamide
6. Continuous exposure to asbestos causes -----			
a. Intestinal cancer	b. Lung cancer	c. Liver cancer	d. All the above
7. Development of cancer in a specific site by the formation active tumour polyps is induced by the formation of -----			
a. Blood vessels	b. Blood venous	c. Blood capillaries	d. None of the above
8. Metastatic mode cancer spreading is mainly achieved by ----- system			
a. Respiratory	b. Nervous	c. Circulatory	d. Excretory
9. Development of blood cancer is induced by which of the following factor?			
a. Epithelial growth factor	b. Endothelial growth factor	c. Christmas factor	d. Vascular growth factor
10. Oncogenes are expressed from -----			
a. RB gene	b. Protogenes	c. Tumor supressor genes	d. Proto oncogenes
11. Which of the following gene is responsible for cancer development by retroviruses?			
a. RTase	b. DNase	c. Retro transposons	d. None of the above
12. Eye cancer is caused due to the mutation in----- gene			
a. CAT	b. RB	c. Rho	d. CRISPER
13. Cancer cells of epithelial origin can even shed their typical qualities and characteristics and adopt a ----- like phenotype			

a. Parenchyma	b. Cholenchyma	c. Mesenchyma	d. All the above
14. Interaction between the tumour cell and the surrounding stroma is extremely important in the development of tumor -----			
a. Vasculogenesis	b. Capillary synthesis	c. A & B	d. Angiogenesis
15. The cell adhesion complex runs from the apical to the basal membranes and composed of -----			
a. Tight junctions	b. Adherent junctions	c. Gap junctions	d. All the above
16. Which of the following factor is responsible for the development of liver cancer?			
a. EGF	b. VGF	c. HGF	d. EnGF
17. Treatment of cancer cells by targeting them with cytokines is mode of -----			
a. Chemotherapy	b. Radiation therapy	c. Immunotherapy	d. Hormone therapy
18. The early stage of colon cancer is detected due to the expression of ----- gene			
a. dMMR	b. MACC 1	c. MACC 2	d. dMMR 2
19. Prostate cancer aggressiveness can be conveniently detected by -----			
a. MALDI	b. ESR	c.pCaP	d. NMR
20. Mammary gland tumour is detected accurately by -----			
a. Fluorescence imaging technique	b. Electrical impedance scanning	c. Digital mammography & Computer aided detection system	d. Nanotechnology based detection

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS

21. A) Explain the regulation of cell cycle B) Write short notes on signal switches	(OR)
22. A) Write short notes on chemical carcinogenesis B) Write briefly on the metabolic consequences of carcinogenesis	(OR)
23. A) How will you identify oncogenes B) Write shortly about the growth factors involved in the transformation of normal cell in to cancer cell	(OR)
24. A) Write briefly on the clinical significances of invasion B) Write about three step theory of invasion	(OR)
25. A) Explain the different forms of cancer therapy B) Write short notes on radiation cancer therapy	(OR)

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS

26. Give a detailed account on tumour suppressor gene
27. Give a detailed account on metabolism of carcinogenesis
28. Write an essay on retroviral oncogenes
29. Explain the basic principles of cancer metastasis
30. Write elaborately on the detection and prediction of cancer

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

SBEC – IV

LAB IN ENTREPRENEURSHIP IN BIOTECHNOLOGY

Paper	: SBEC IV	Total Hours	: 40
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 18U6BTS10	External	: 75

PREAMBLE

To make students in understanding the basic concepts of developing entrepreneurship quality, so as to produce biologically generated value added products for the development of human welfare.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	Develop the practical concepts of mushroom, spirullina, sericulture	K3, K4, K5 & K6
CO2	Develop the practical concepts of apiculture, aquaculture and vermicomposting technology	K3, K4, K5 & K6
CO3	Develop the practical concepts of wine production and sauerkraut production	K3, K4, K5 & K6
CO4	Develop the practical concepts of biogas production	K3, K4, K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	M	S
CO2	M	S	S	M	S
CO3	M	S	S	M	S
CO4	M	S	S	M	L

S: Strong; **M:** Medium; **L:** Low

Ex.no	CONTENT	HOURS
1.	Mushroom cultivation	4
2.	Azolla cultivation	4
3.	Spirullina cultivation	4
4.	Sericulture	4
5.	Epiculture	4
6.	Aquaculture (Fish/Prawn/Pearl)	4

7.	Vermicomposting	4
8.	Biogas production	4
9.	Sauerkraut production	4
10.	Wine production	4

MODEL QUESTION PAPER (LAB IN ENTREPRENEURSHIP IN BIOTECHNOLOGY)

NAME OF THE COURSE: LAB IN ENTREPRENEURSHIP IN BIOTECHNOLOGY	COURSE CODE: 18U6BTS10	DURATION: 6Hrs
MAX MARKS: 60		

MAJOR EXPERIMENT			
Exp: 12	Obs: 5	Res: 3	Total 20 MARKS
1. (i) Perform <i>Azolla</i> cultivation using the given sample (A)		(OR)	
(ii) Perform <i>Spirullina</i> cultivation using the given sample (A)		(OR)	
(iii) Perform vermi composting using the given earth worm sample (A)			
MINOR EXPERIMENT			
Exp: 6	Obs: 2	Res: 2	Total: 10 MARKS
2. (i) Perform wine production using the given fruit sample (B)		(OR)	
(ii) Perform biogas production using the given raw sample material (B)		(OR)	
(iii) Perform sauerkraut production using the given cabbage sample (B)			
SPOTTERS		(5 X 4 = 20 MARKS)	
3. Identify the given spotters C, D, E, F & G and comment on them			
RECORD		(1 x 5 = 5 MARKS)	
VIVA-VOCE		5 MARKS	
TOTAL		60 MARKS	

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

SBEC – IV
NANO BIOTECHNOLOGY

Paper	: SBEC IV	Total Hours	: 40
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 18U6BTS11	External	: 75

PREAMBLE

To make students in understanding the basic concepts of developing entrepreneurship quality, so as to produce biologically generated value added products for the development of human welfare.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	Know basic concepts of nanotechnology and nano materials	K1, K2 & K3
CO2	Know the concepts of fabrication of bio molecular structures	K3 & K4
CO3	Develop miniaturized nano elements	K3 & K4
CO4	Understand various applications of nanotechnology in the field medicine, health care and drug discovery	K4, K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	S	S
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	M	S	S	S	S

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
I	Nanobiotechnology: Definition, prospects and challenges; Topology of DNA, protein and lipids and self-assembly from Natural to artificial structures. Top up and bottom down approaches in nanomaterial fabrication.	8
II	Nanomaterials and its properties: Carbon nanotubes and nanorods, Quantum dots, metal based nanostructures (Iron oxide nanoparticles), nanowires, polymer based nanostructures (dendrimers), Gold nanostructures (nanorods, nanocages, nanoshells), nanocomposites.	8
III	Fabrication and Analysis of biomolecular nanosturctures: Atomic Force Microscopy, Scanning Probe Electron Microscopy and	8

	Lithography. Nanoscale detection: Lab on a Chip. Fabrication of bionanochip & microarray technology.	
IV	Miniaturized devices in nanobiotechnology: Types and applications; Nanobiosensors: different classes, molecular recognition elements (MRE), transducing elements, applications of MRE in nanosensing of different analytes.	8
V	Applications of Nanobiotechnology: Nanomedicine, Diagnosis and treatment of infectious diseases, cancer research and therapy, tissue engineering and regenerative therapy; Nanostructures in drug discovery & drug delivery.	8

SUGGESTED READINGS:

1. Nanobiotechnology: concepts, applications and perspectives. Christ of M. Niemayer, chad A. Mirkin, Wiley VCH publishers 2004.
2. Bionanotechnology: Lessons from Nature, David. S. Goodshell, Jhonwiley 2006.
3. Buddy, D.R. Allan, S.H. Frederick, J.S. and Jack, E.L. Biomaterials Sciences: An Introduction to Materials in Medicine. 2nd edition.
4. David, L.N. and Michael, M.C. (2006). Lehninger's principles of Biochemistry. 4th edition.
5. David, S. and Goodshell, J. (2006). Bionanotechnology: Lessons from Nature.
6. Molecular Design and Synthesis of Biomaterials. (2005). Biological Engineering Division, MIT Open Course Ware.

MODEL QUESTION PAPER (NANO BIOTECHNOLOGY)

NAME OF THE COURSE: NANO BIOTECHNOLOGY	COURSE CODE: 18U6BTS11	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS			
1. Who first used the term nano biotechnology?			
a. Norio taniuchi	b. Richard Feynman	c. Eric Drexler	d. Sumio
2. 10 nm = _____m			
a. 10^{-8}	b. 10^{-9}	c. 10^{-7}	d. 10^{-10}
3. The size of the nano particles range from _____nm			
a. 100 to 1000	b. 0.1 to 10	c. 1 to 10	d. 1 to 100
4. Nano science can be studied with the help of -----			
a. Quantum mechanics	b. Newtonian mechanism	c. Macro dynamics	d. Geophysics
5. The size of <i>E.coli</i> bacteria is _____nm			
a. 2000	b. 5000	c. 50	d. 90
6. What does „F“ stands for in AFM?			
a. Fine	b. Force	c. Flux	d. Front
7. The two important properties of nano substances are -----			
a. Pressure and friction	b. Sticking and temperature	c. Sticking and friction	d. Temperature and friction
8. 1 nanometer is = _____cm			
a. 10^{-9}	b. 10^{-8}	c. 10^{-7}	d. 10^{-6}
9. Protein-coding genes can be identified by _____			
a. Transposons tagging	b. ORF scanning	c. Zoo -blotting	d. Northern analysis
10. Nano particles target the _____causing cells and remove them from blood			
a. Tumor	b. Fever	c. Infection	d. Cold
11. The _____to the ceramics are superior coating			
a. Nano particles	b. Nano power	c. Nano crystal coding	d. Nano materials
12. Which one is used in electron microscope?			
a. Electron beams	b. Magnetic fields	c. Light waves	d. Electron beams and magnetic fields

13. Electron microscope can give a magnification up to _____			
a. 400,000x	b. 100,000x	c. 15000x	d. 100x
14. Which of these biosensors use the principle of heat released or absorbed by a reaction?			
a. Potentiometric biosensor	b. Optical biosensor	e. Piezo-electric biosensors	f. Calorimetric biosensors
15. Biosensor made up of _____			
a. A probe and a surface	b. A sensing layer and a transducer	c. Transfer the probe molecule	
		d. of theses	
		e	
16. Which materials are suitable for electrical signal transducing?			
a. PDMS	b. Sillicon	c. Glass	d. Polyethylene
17. Which one is anti-cancerous agent?			
a. Paclitaxol	b. Insulin	c. Polyethylene glycol	d. Poly glutamic acid
18. Which of the following co-solvents are used to increase the solubility of a drug?			
a. Ethanol	b. Sorbitol	c. Glycerin	d. All of these
19. The size of the RBC is _____ nm			
a. 50	b. 90	c. 20000	d. 5000
20. The width of a typical DNA molecule is _____ nm			
a. 1	b. 2	c. 5	d. 10

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS

21. A) What are the challenges faced in the field of nano biotechnology? B) Write a short note on nano material fabrication
22. A) Explain nano materials and its properties B) Write short notes on quantum dots
23. A) Explain atomic force microscope B) Explain about scanning probe microscope
24. A) Write short notes on types of biosensors B) Explain the molecular recognition elements (MRE)
25. A) What is drug? Explain its discovery? B) Short notes on nano medicine

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS

26. Write the essay on topology of DNA
27. Explain the structure and function nano tubes nanowires
28. Write an essay on micro array technology and its applications

29. Write an essay on mode action of biosensors and application of biosensors

30. Explain about cancer research and cancer therapy

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

SBEC – IV
BIOFARMING

Paper : SBEC IV
Hours/Week : 2
Credit : 2
Paper Code : 18U6BTS12

Total Hours : 40
Exam Hours : 03
Internal : 25
External : 75

PREAMBLE

To make students in understanding the basic concepts of developing entrepreneurship quality, so as to produce biologically generated value added products for the development of human welfare.

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	Understand the principles of conventional cropping systems and natural farming	K1 & K2
CO2	Manipulate integrated pest management of the development of pesticide free plant products	K2 & K3
CO3	Develop the concepts of organic farming	K4 & K5
CO4	Understand the concepts of organic agricultural policy and GMOs	K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	L	L
CO2	S	S	S	M	M
CO3	S	S	S	M	M
CO4	S	S	S	M	S

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
I	Agro-ecological zones and geographical distribution of crop plants in Tamil Nadu. Cropping systems - different types and their importance in food production- Package and practices followed for major crops and cropping systems in Tamil Nadu.	8
II	Green revolution in India - After effects - Definitions of Natural Farming, Traditional farming - Their concepts and scope - Natural Farming - Institutions- their activities and role.	8
III	Pest - Definition - categories of pests-pest control - natural, artificial-pest management IPM. Store grain pest management. Pesticides consumption and hazards. Role of biopesticides and biofertilizers in IPM.	8
IV	Organic farming - concept and relevance in the agriculture - problems and	8

	remedies - Encouragement and dissemination for effective practicing of organic farming. Production and marketing of Organic products.	
v	Organic agriculture policy, Genetically Modified Organisms as organic regulation	8

SUGGESTED READINGS:

1. Basu, D.N. and Guha, G.S. (1996). Agroclimatic regional planning in India, ARPU, Ahmedabad
2. Krishna, K. R., (2010). Agroecosystems of south India, Brownwalker press, Florida
3. John H. Perkins, *Geopolitics and the Green Revolution: Wheat, Genes, and the Cold War*, Oxford University Press, 1997.
4. Lester R. Brown, *Seeds of Change: The Green Revolution and Development in the 1970's*, 1970, Praeger Publishers, New York.
5. Kogan, M 1998. Integrated Pest Management: Historical Perspectives and Contemporary Developments, Annual Review of Entomology Vol. 43: 243-270 (Volume publication date January 1998)
6. Dharam P. Abrol (Editor), Uma Shankar 2013. Integrated Pest Management: Principles and Practice Amazon text book store
7. NPCS Board of Consultants & Engineers, (2008). The complete book on organic farming and production of organic compost, Asia Pacific Business Press Inc.
8. Shalini Suri, APH, (2012). Organic farming Vedams books from India.

MODEL QUESTION PAPER (BIOFARMING)

NAME OF THE COURSE: BIOFARMING	COURSE CODE: 18U6BTS12	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS			
1. Agro ecological zoning can be used as the basis of a methodology for -----			
a. Calculating maximum yield	b. Natural source analysis	c. Land resource appraisal	d. Land use planning
2. Some of the nutrients contained in the dead tissues are made available to crops during decomposition, reducing the need of -----inputs			
a. Forage leaves	b. Fertilizer	c. Chemical fertilizer	d. Soil organic matter
3. World geographical scheme for recording plant distributions (WGSRPD) is included within the larger region of India in -----			
a. Fauna of India	b. Flora of India	c. Fauna of Tamilnadu	d. Flora of Tamilnadu
4. In Tamilnadu, Coimbatore receives an average rainfall from North east Monsoon of -----			
a. 444.3mm	b. 443.4 mm	c. 434.4 mm	d. 344.4 mm
5. Natural farming is an ecological farming established by -----			
a. Yamamoto Kombai	b. Masanobu Fukuoka	c. Shizen noho	d. Yoshikazu Kawaguchi
6. Crop rotation and companion planting are the methods adopted when -----farming is carried out			
a. Traditional	b. Organic	c. Mixed crop	d. Natural
7. Green revolution in India refers to a period when -----			
a. Indian agriculture was converted into revenue generating system	b. Indian agriculture was converted into waste management system	c. Indian agriculture was converted into renewable resource system	d. Indian agriculture was converted into industrial system
8. HYV seeds technically can be applied only in a land with assured -----			
a. Fertilizer supply	b. Soil supply	c. Water supply	d. Seed supply
9. Pery Adkisson and Ray F. Smith received the ----- World Food Prize for encouraging IPM			
a. 1995	b. 1996	c. 1997	d. 1998
10. The most important insect damaging pulses in field and storage are referred as -----			
a. Bruchids	b. Weevils	c. Beetles	d. None of the above
11. Biopesticides are important tools in integrated pest management programs for conserving the natural enemies and maintaining environmental health was described in -----			
a. 2014	b. 2015	c. 2016	d. 2017
12. Which of the following pesticide is responsible for -----			
a. Carcinogen	b. Susceptibility to fungal infection	c. Egg shell thinning	d. Decline in juvenile population
13. Which of the following is NOT the advantage of organic farming?			

a. Maintains environment by reducing pollution level	b. Helps in keeping agriculture at a sustainable level	c. Ensures optimum utilization of natural resources for short term benefit	d. Enhances crop production by tillage utilization and forage cropping system
14. Which of the following state first received the organic certification in India?			
a. Madhya Pradesh	b. Rajasthan	c. Maharashtra	d. Uttar Pradesh
15. NPOF stands for -----			
a. National project on organic farmers	b. National Project on organic farming	c. National Project on organic fertilizers	d. National project on organic forages
16. Indian agricultural policy was framed and drafted by -----			
a. ICAR	b. IARI	c. CSIR	d. ICAS
17. The genetically engineered seeds were introduced in -----			
a. 1994	b. 1995	c. 1996	d. 1997
18. „Round-up ready crops“ is a common name of -----			
a. Pesticide crops	b. Herbicide crops	c. Saline resistant crops	d. Drought resistant crops
19. The use of toxic and pervasive pesticides and petroleum based fertilizers is not allowed in the production of -----			
a. Organic farm products	b. Biopesticides	c. Bioinsecticides	d. Bt - Cotton
20. Organic food production act (OFPA) was amended in -----			
a. 1990	b. 1991	c. 1992	d. 1993

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS

21. A) Write shot notes on the different types of cropping systems (OR) B) List out the packages and practice methods followed for major crops
22. A) Briefly write about green revolution (OR) B) Explain the benefits of natural farming
23. A) Explain about store gain pest management (OR) B) Explain the role of biopesticides in IPM
24. A) Explain in brief about Organic farming (OR) B) Explain the marketing of organic products
25. A) List out the organic agriculture policies (OR) B) Explain the use of organic policies in the development of forage products

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS

26. Write an essay on different types and their importance of cropping system
27. Give a detailed account on natural farming
28. Write an essay in Integrated Pest Management (IPM)
29. Give a detailed account on organic farming, their production and marketing
30. Write elaborately on the role genetically modified organisms in framing the organic farming policies

	NAME	SIGNATURE
PREPARED BY		
COMPILED BY	Dr. M. Balasubramanian	
AUTHORISED BY	Dr. M. Ram Mohan	

BIOTECHNOLOGY FOR SOCIETY

Paper	: NMEC II	Total Hours	: 40
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 17U3BTN04	External	: 75

PREAMBLE

To make students on understanding the applied part of biotechnology to non-major and non-life science back ground students

COURSE OUTCOMES

On successful completion of the course, students will be able to,

COs	Outcome	CPD
CO1	To understand basic knowledge of silk worm, earth worm cultivation and its applications	K3, K5 & K6
CO2	To understand the concepts of bio fertilizers, bio plastics and Bioweapons	K3, K5 & K6
CO3	To understand the basic concepts of biodegradation of xenobiotic Compounds	K3, K5 & K6
CO4	To understand the concepts of generating genetically modified/transgenic organisms	K3, K5 & K6

MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S

S: Strong; M: Medium; L: Low

UNIT	CONTENT	HOURS
I	Seri culture, Aquaculture, Apiculture, Vermi culture and Mushroom Technology	8
II	Biofertilizers, Biopesticides, Bio repellents, Pest control and management, Biomass (SCP), Bioplastics, Bioweapons.	8
III	Bio dyes, Bio fuels – Biodiesel & Biogas, Bio indicators, Biodegradation – Role of genetically modifies organisms	8
IV	Production of penicillin, Recombinant Vaccines (HBV), Recombinant Insulin, Plantibodies, Vaccines in animal cells, Gene therapy.	8
V	Transgenic animals and their applications. Mice, Sheep and Fish. Transgenic plants and their applications – BT cotton, Flavr-Savr tomato and golden rice	8

SUGGESTED READINGS:

1. Animal Biotechnology, Ranga MM (2000). Agrobios
2. Introduction to Plant Biotechnology. Chawla (2003).2nd edition. Oxford and IBH publications.
3. Biotechnology, Sathyanarayana U (2008), Books and Allied (p) ltd.
4. Industrial Microbiology Patel AH (2005). Mac Millan Publishers.
5. A text book of Biotechnology, Dubey RC (2007). S.Chand & Company Ltd, New Delhi.
6. Environmental Biotechnology, Chatterji AK, 3rd edition, PHI Learning Pvt Ltd, Newdelhi.

MODEL QUESTION PAPER (BIOTECHNOLOGY FOR SOCIETY)

NAME OF THE COURSE: BIOTECHNOLOGY FOR SOCIETY	COURSE CODE: 17U3BTN04	DURATION: 3 Hrs
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS

1. Sericulture is a rearing of -----			
a. Silk worm	b. Lac insect	c. Honey bee	d. Fish
2. Aquaculture is a rearing of -----			
a. Silk worm	b. Lac insect	c. Honey bee	d. Fish
3. Which of the following is used as food to feed <i>Bombyx mori</i> ?			
a. Hibiscus leaves	b. Mulberry leaves	c. Palm leaves	d. None of the above
4. The seeds used for mushroom cultivation is called as -----			
a. Callus	b. Bed	c. Spawn	d. Altman
5. Which of the following can be used as bioweapons?			
a. <i>Bacillus</i>	b. <i>Escherichia</i>	c. <i>Streptococcus</i>	d. <i>Clostridium</i>
6. Which of the following is used as SCP to feed cattle?			
a. Azolla	b. Spirulina	c. Mushroom	d. Yeast
7. Which of the following is an example for bioplastic?			
a. PBH	b. PVC	c. PCC	d. PCV
8. <i>Bacillus thuringiensis</i> is used as -----			
a. Biofertilizer	b. Biopesticide	c. Bioplastic	d. Biorepellent
9. The chemical functional group that gives color to the substance is called as -----			
a. Iodophore	b. Basophore	c. Chromophore	d. None of the above
10. Which organism produces biodiesel?			
a. <i>Chrococcus</i>	b. <i>Botrycoccus</i>	c. <i>Scenedesmus</i>	d. Both b & c
11. Biogas is produced by certain bacteria by the process of -----			
a. Acetogenesis	b. Chlorogenesis	c. Methanogenesis	d. Nitrification
12. Petroleum hydrocarbons are greatly degraded by -----			
a. <i>Serratia</i>	b. <i>Bacillus</i>	c. <i>Proteus</i>	d. <i>Pseudomonas</i>
13. Recombinant vaccines are produced by -----			
a. Cutting	b. Grafting	c. Harvesting	d. Cloning
14. Hepatitis is commonly caused by -----			
a. Bacteria	b. Fungi	c. Virus	d. Protozoa
15. Penicillin is produced by -----			
a. Bacteria	b. Fungi	c. Virus	d. Protozoa
16. Insulin is pancreatic hormone composed of -----peptide chains			
a. 1	b. 2	c. 3	d. 4
17. Which of the following product is produced from animals systems through transgenic technology?			

- a. Fibrin b. Antithrombin c. Insulin d. Interferon

18. Recombinant proteins (RPs) are extensively produced by using one of the following cell line

- a. MCF b. CHO c. HeLa d. MG-63

19. BT cotton is generated for the purpose of -----

- a. Controlling cotton production b. Controlling Honey bee population c. Controlling butterfly propagation d. Controlling cotton pests

20. Transgenic tomato was produced by recombinant DNA technology for the purpose of -----

- a. Increasing CHO content b. Increasing vitamin content c. Increasing lipid content d. Increasing protein content

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS			
21. A) Write short notes on the rearing of silkworm			(OR)
B) Write a short note on the applications of vermin compost			
22. A) Explain the uses of SCP.			(OR)
B) List out the hazardous consequences of bioweapons			
23. A) List out the composition of biogas			(OR)
B) Write short notes on pest control management			
24. A) Write short notes on plantibodies			(OR)
B) Write short notes on gene therapy			
25. A) How will you produce golden rice?			(OR)
B) Briefly write about uses of Flavr-Savr Tomato			

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS

26. Give a detailed account on mushroom cultivation technology
27. Give a detailed account on biopesticide production
28. Give a detailed account on bio diesel production
29. Give a detailed account on penicillin production
30. Give a detailed account on the production of transgenic mice

	NAME	SIGNATURE	
PREPARED BY			
COMPILED BY	Dr. M. Balasubramanian		
AUTHORISED BY	Dr. M. Ram Mohan		
