VIVEKANANDHA

COLLEGE OF ARTS AND SCIENCES FOR WOMEN [AUTONOMOUS]

An ISO 9001:2008 Certified Institution,
Affiliated to Periyar University, Salem,
(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., Tamilnadu, INDIA.

DEPARTMENT OF BIOTECHNOLOGY

BACHELOR IN SCIENCE (B.Sc.)

B. Sc., BIOTECHNOLOGY

REGULATIONS AND SYLLABUS

[FOR CANDIDATES ADMITTED FROM 2017-18 ONWARDS UNDER AUTONOMOUS & CBCS PATTERN]

SPONSORED BY
ANGAMMAL EDUCATIONAL TRUST
Elayampalayam – 637 205, Tiruchengode Tk., Namakkal Dt., Tamil Nadu.
Veerachipalayam - 637 303, Sankari Tk., Salem Dt., Tamil Nadu.
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About the College

Vivekanandha College of Arts and Sciences for Women (Autonomous) was established and hailed into Women's Educational Service in the Year 1995. Angammal Educational Trust Chaired by the great Educationalist 'Vidhya Rathna' Prof. Dr. M. KARUNANITHI, B.Pharm., M.S., Ph.D., D.Litt., sponsors this college and other institutions under the name of the great Saint Vivekanandha. Our institutions are situated on either side of Tiruchengode-Namakkal Main Road at Elayampalayam, 6 kms away from Tiruchengode. This is biggest women's college in India with more than 7500 girl students and more than 18 departments. The strength of the college was just 65 at the time of its establishment. With the dedication, work, sacrifice and long vision of the chairman, this institution has grown into a Himalaya stage. As a result of which UGC, New Delhi, awarded 2f and 12b, extended Autonomous status for second cycle. The National Assessment and Accreditation Council reaccredited with grade 'A' for its successful performance.

As an Autonomous Institution, academic professionals of the college framed Curriculum and Syllabi in consultation with all its stakeholders to cater the needs of the young women to fulfill the women empowerment and present Industrial needs to the local benefits. The students are empowering with confidence and required skills to face the society.

Quality Policy

To provide professional training by establishing a high level center of learning that provides quality education at par with the international standards and Provide excellence education with well equipped infrastructure to all the rural women.

Our Vision

To be an academic institution exclusively for women, in dynamic equilibrium with the social and economic environment, strive continuously for excellence in education, research and technological service to the nation.

Our Mission

The mission of our institution is to discover, teach and apply knowledge for the intellectual, cultural, ethical, social and economic growth of women students.

REGULATIONS

I SCOPE OF THE COURSE

Projections for the next 20 years indicate that there will be thousands of unfulfilled science and engineering jobs. The demand for highly trained workers and scholars will be great. Scientists are rushing to use their new techniques to unravel the secrets of life, to tap that knowledge to create valuable products, and to develop a new generation of sophisticated techniques that will unlock new knowledge. Biotechnology is one of the most revolutionary and beneficial scientific advances of the last quarter century. It is an interdisciplinary science including not only biology but also subjects like mathematics, physics, chemistry and many more. It is also a conglomeration of various combined technologies applied to living cells for production of a particular product or enhancing its quality according to our preferences. Biotech is undoubtedly the future for drug discovery and design, structural biology, microbial biotechnology, agricultural biotechnology, enzyme technology, gene technologies, metabolic engineering, biomaterials and tissue engineering, biosensors and food biotechnology.

II. SALIENT FEATURES

The course covers how life began on earth (Cosmogenesis & Evolution), what are the molecules of Life (Biochemistry, Molecular Biology), what is the structure of life (Cytology & Developmental Biology), how life continues (Principles of Genetics, Molecular Biology) how is it maintained (Comparative physiology, Biophysics), how does it respond to the environment (Ecology & Environmental Biotechnology), how organisms interact with each other (the offense & defence), how mathematics helps biology (elementary mathematics & Biostatistics), what aids we need to study organisms (Biophysics, Biotechniques), how life may be manipulated (Genetic Engineering), what organisms offer us and how they might be turned into factories (Microbial, Plant, Animal resources & technology, Fermentation Technology).

III. OBJECTIVES

- Impart importance of biological processes that guide to evolve technology that sustain living organisms on the globe
- Encourage women students to imbibe interest in present and future biotechnological research
- Evolve biotechnological skills for present and future global needs in food, shelter and medicine towards their livelihood options.

IV. ELIGIBILITY FOR ADMISSION

Candidates seeking admission to the first year Degree course shall be required to have passed

- PUC/12th Std. / 10+2/ its equivalent with at least Biology and Chemistry as two optional subjects.

V. DURATION OF THE COURSE

- The course shall extend over a period of three academic years consisting of six semesters. Each academic year will be divided into two semesters. The First semester will consist of the period from July to November and the Second semester from December to March.
- The subjects of the study shall be in accordance with the syllabus prescribed from time to time by the Board of Studies of Vivekanandha College of Arts and Sciences for Women with the approval of Periyar University.

VI ASSESSMENT

Assessment of the students would be made through Continuous Internal Assessment (CIA) and External Assessment (EA) for passing each subject both theory and practical papers.

A candidate would be permitted to appear for the External Examination only on earning 75 % of attendance and only when his / her conduct has been satisfactory. It shall be open to grant exemption to a candidate for valid reasons subject to conditions prescribed.

A. CONTINUOUS INTERNAL ASSESSMENT (CIA)

The performance of the students will be assessed continuously by the teacher concern and the Internal Assessment Marks will be as follows:

Distribution Of Continuous Assesment Marks (25/40)

Activity	Period (WD)	Marks (25)	Activity	Marks (40)
Attendance	90	5	Attendance	5
CA Test I	30 to 35	2.5	CA Test I/Review	5
CA Test II	60 to 65	2.5	CA Test II/Review II	5
Model	After 90	10	Model/Model Presentation	10
Assignment	15 to 20	1	Observation note	10
Poster	30 to 35	1	Results in lab/Work	5
PowerPoint	45 to 50	1		
Skit	60 to 65	1		
Group discussion	65 to 70	1		
Total		**25**		**40**

Distribution of attendance mark

S. No.	Percentage	Marks	
		Theory	Practical
1	76-80	1	2
2	81-85	2	4
3	86-90	3	6
4	91-95	4	8
5	96-100	5	10

A. EXTERNAL ASSESSMENT (EA)

The performance of the students would be assessed by examination at the end of each semester with a written test for theory for three hours and practical examination at the end of even semesters for six hours. Question papers would be set by the selected external examiners in the prescribed format and valuated by the external examiners with the help of the teacher concern.

The pattern of assessment is as follows:

Distribution Of Final Assesment Marks (75/60)

Section	Activity	Marks (75)	Activity	Marks (60)
A	One mark (20)	20	Record work	5
B	Five marks (Either or)	25	Viva Voce	5
C	Ten marks (3/5)	30	Spotter	20
			Major (Performance)	5
			Major (Result)	5
			Major (Writeup)	10
			Minor (Performance)	2
			Minor (Result)	3
			Minor (Writeup)	5
Total		**75**	**Total**	**60**

VII. PASSING MINIMUM

INTERNAL

There is no passing minimum for CIA

EXTERNAL

In the EA, the passing minimum shall be 30% out of 75 Marks. (30 Marks)

VIII. CLASSIFICATION OF SUCCESSFUL CANDIDATES

Successful candidates passing the examination of Core Courses (main and allied subjects) and securing marks

a) 75 % and above shall be declared to have passed the examination in first class with Distinction provided they pass all the examinations prescribed for the course at first appearance itself.
b) 60% and above but below 75 % shall be declared to have passed the examinations in first class without Distinction.
c) 50%and above but below 60% shall be declared to have passed the examinations in second class.
d) All the remaining successful candidates shall be declared to have passed the examinations in third class.
e) Candidates who pass all the examinations prescribed for the course at the first appearance itself and within a period of three consecutive academic years from the year of admission only will be eligible for University rank.

IX. ELIGIBILITY FOR AWARD OF THE DEGREE

A candidate shall be eligible for the award of the degree only if she has undergone the above degree for a period of not less than three academic years comprising of six semesters and passed the examinations prescribed and fulfilled such conditions has have been prescribed therefore.

X. PROCEDURE IN THE EVENT OF FAILURE

Candidates fail in any subject would be permitted to appear for each failed subject or subjects in the subsequent EA. However, final year students failed in one or two subjects would be allowed to appear for a supplementary exam within a month of the final result.

XI. COMMENCEMENT OF THESE REGULATIONS

These regulations shall take effect from the academic year 2011-12 (i.e.,) for the students who are to be admitted to the first year of the course during the academic year 2011-12 and thereafter.

XII. COURSE PATTERN

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS)
SYLLABUS FRAME WORK

Subjects	Inst. Hour/Week	Credit	Exam Hours	Internal	External	Total Marks	Subjects	Inst. Hour/Week	Credit	Exam Hours	Internal	External	Total Marks
YEAR I													
Semester I							**Semester II**						
Language I	4	3	3	25	75	100	Language II	4	3	3	25	75	100
English I	4	3	3	25	75	100	English II	4	3	3	25	75	100
Core I	5	5	3	25	75	100	Core II	5	5	3	25	75	100
Core I Practical	5	3	3	40	60	100	Core II Practical	5	3	3	40	60	100
Allied I	4	4	3	25	75	100	Allied II	4	4	3	25	75	100
Allied I Practical	4	3	3	40	60	100	Allied II Practical	4	3	3	40	60	100
Valued added course	2	2	3	25	75	100	Valued added course	2	2	3	25	75	100
Library	1	0	0	0	0	0	Library	1	0	0	0	0	0
Sports	1	0	0	0	0	0	Sports	1	0	0	0	0	0
Total	**30**	**23**	21	**205**	**495**	**700**	**Total**	**30**	**23**	21	**205**	**495**	**700**
II YEAR TOTAL									**46**	**42**	**410**	**990**	**1400**
YEAR II													
Semester III							**Semester IV**						
Language III	4	3	3	25	75	100	Language IV	4	3	3	25	75	100
English III	4	3	3	25	75	100	English IV	4	3	3	25	75	100
Core III	5	5	3	25	75	100	Core IV	5	5	3	25	75	100
Core III Practical	5	3	3	40	60	100	Core IV Practical	5	3	3	40	60	100
Allied III	4	4	3	25	75	100	Allied IV	4	4	3	25	75	100
Allied III Practical	4	3	3	40	60	100	Allied IV Practical	4	3	3	40	60	100
SBEC I	2	2	3	25	75	100	SBEC II	2	2	3	25	75	100
Library	1	0	0	0	0	0	Library	1	0	0	0	0	0
Sports	1	0	0	0	0	0	Sports	1	0	0	0	0	0
Total	**30**	**23**	**21**	**205**	**495**	**700**	**Total**	**30**	**23**	**21**	**205**	**495**	**700**
II YEAR TOTAL									**92**	**84**	**820**	**1980**	**2800**
YEAR III													
Semester V							**Semester VI**						
Core V	5	5	3	25	75	100	Core VII	5	5	3	25	75	100
Core VI	5	5	3	25	75	100	Core VIII	5	5	3	25	75	100
Core V Practical	5	3	3	40	60	100	Core VII Practical	5	3	3	40	60	100
Core VI Practical	5	3	3	40	60	100	Core VIII Practical	5	3	3	40	60	100
Elective I	4	3	3	25	75	100	Elective II	4	3	3	25	75	100
NMEC I	2	2	3	25	75	100	NMEC II	2	2	3	25	75	100
SBEC III	2	2	3	25	75	100	SBEC IV	2	2	3	25	75	100
Library/Sports	1	0	0	0	0	0	Library/Sports	1	0	0	0	0	0
Mini project	1	1	6	0	0	0	Extension work	1	1	0	0	0	100
Total	**30**	**24**	**29**	**245**	**555**	**800**	**Total**	**30**	**24**	**23**	**21**	**205**	**495**
TOTAL CREDIT FOR THE COURSE									**140**	**126**	**1230**	**2970**	**4200**

Distribution Of Duration And Credit Under Different Papers

Part	Paper	Hours/Week	Weeks/Semester	Hour/Paper	No. of Papers	Credit/Paper	Total Hours	Total credit
I	**Language**	4	15	60	4	3	240	12
II	**English**	4	15	60	4	3	240	12
III	**Core paper**	5	15	75	8	5	600	40
III	**Core practical**	5	15	75	8	3	600	24
III	**Allied**	4	15	60	4	4	240	16
III	**Allied practical**	4	15	60	4	3	240	12
IV	**Value Education**	1	15	15	2	2	30	4
IV	**SBEC**	2	15	30	4	2	120	8
III	**Elective**	4	15	60	2	3	120	6
IV	**NMEC**	2	15	30	2	2	60	4
IV	**Mini project**	1	15	15	1	1	15	1
IV	**Extension work**	1	15	15	1	1	15	1
TOTAL								**140**

Distribution Of Duration And Content Under Different Papers

S. No.	Hours/Week	Duration/Unit	Topic/Unit
1	1	3	3
2	2	6	6
3	3	9	9
4	4	12	12
5	5	15	15

SYLLABUS FOR YEAR I

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS)
DEPARTMENT OF BIOTECHNOLOGY
CBCS SYLLABUS - UG
(For candidates admitted from 2017-2018 onwards)

COURSE PATTERN WITH PAPERS

Subject code	Part	Course	Title	Hrs/ week	Credit	Internal	External	Total
SEMESTER I								
17U1LT01 17U1LM01 17U1LH01 17U1LF01	I	Language I	Tamil I Malayalam I Hindi I French I	4	3	25	75	100
17U1LE01	II	Language II	Foundation English I	4	3	25	75	100
17U1BTC01	III	Core I	Cell Biology and Evolution	5	5	25	75	100
17U1BTCP01	III	Core I Practical	Lab in Cell Biology	5	3	40	60	100
17U1BTA01	III	Allied I	Plant Science	4	4	25	75	100
17U1BTAP01	III	Allied Practical I	Lab in Plant science	4	3	40	60	100
17U1VE01	IV	Value Education I	Yoga	2	2	25	75	100
		Library	Reference	1	-	-	-	-
		Sports	Health Maintenance	1	-	-	-	-
Total				**30**	**23**	**205**	**495**	**700**
SEMESTER II								
17U2LT02 17U2LM02 17U2LH02 17U2LF02	I	Language II	Tamil II Malayalam II Hindi II French II	4	3	25	75	100
17U1LE02	II	Language II	Foundation English II	4	3	25	75	100
17U2BTC02	III	Core II	Genetics and Molecular Biology	5	5	25	75	100
17U2BTCP02	III	Core Practical II	Lab in Genetics and Molecular Biology	5	3	40	60	100
17U2BTA02	III	Allied II	Animal science	4	4	25	75	100
17U2BTAP02	III	Allied Practical II	Lab in Animal Science	4	3	40	60	100
17U2VE02	IV	Value Education II	Environmental Studies	2	2	25	75	100
		Library	Reference	1	-	-	-	-
		Sports	Health Maintenance	1	-	-	-	-
Total				**30**	**23**	**205**	**495**	**700**
Grand Total of First Year					**46**	**410**	**990**	**1400**

YEAR II 2017-18

Subject code	Part	Course	Title	Hrs/ Week	Credit	Internal	External	Total
SEMESTER III								
17U3LT03 17U3LM03 17U3LH03 17U3LF03	I	Language III	Tamil III Malayalam III Hindi III French III	6	3	25	75	100
17U3LE03	II	Language III	Foundation English III	6	3	25	75	100
17U3BTC03	III	Core III	Immunology	5	5	25	75	100
17U3BTCP03	III	Core Practical III	Lab in Immunology	5	3	40	60	100
17U3BCA03	III	Allied III	Allied biochemistry	4	4	25	75	100
17U3BCAP03	III	Allied III	Lab in Allied biochemistry	4	3	40	60	100
17U3BTS01	IV	SBEC I	Bio-farming techniques	2	2	25	75	100
Total				**30**	**23**	**205**	**495**	**700**
SEMESTER IV								
17U4LT04 17U4LM04 17U4LH04 17U4LF04	I	Language IV	Tamil IV Malayalam IV Hindi IV French IV	6	3	25	75	100
17U4LE04	II	Language IV	Foundation English IV	6	3	25	75	100
17U4BTC04	III	Core IV	Recombinant DNA Technology	5	5	25	75	100
17U4BTCP04	III	Core Practical IV	Lab in Recombinant DNA Technology	4	3	40	60	100
17U4BTA04	III	Allied IV	Allied Microbiology	4	4	25	75	100
17U4BTAP04	III	Allied practical II	Lab in Allied Microbiology	3	3	40	60	100
17U4BTS02	IV	SBEC II	Food Processing Technology	2	2	25	75	100
Total				**30**	**23**	**205**	**495**	**700**
Total of Second Year					**92**	**820**	**1980**	**2800**

CBCS SYLLABUS – UG (OBE PATTERN)
(For candidates admitted from 2017-2018 onwards)

YEAR III

Subject code	Part	Course	Title	Hrs/ week	Credit	Internal	External	Total
SEMESTER V								
17U5BTC05	III	Core V	Plant Biotechnology	5	5	25	75	100
17U5BTC06	III	Core VI	Animal Biotechnology	5	5	25	75	100
17U5BTCP05	III	Core practical V	Lab in Plant Biotechnology	5	3	40	60	100
17U5BTCP06	III	Core practical VI	Lab in Animal Biotechnology	5	3	40	60	100
17U5BTE01	III	Elective I	Bioprocess Technology	4	3	25	75	100
17U5BTS03	IV	SBEC III	Lab in Bioinformatics	2	2	25	75	100
17U5BCN02	IV	NMEC I	Biochemistry in Diagnosis	2	2	25	75	100
17U5BTEX01	IV	Internship		1	1	40	60	100
		Library/Sports	Reference/Health Management	1	-	-	-	-
Total				**30**	**23**	**245**	**555**	**800**
SEMESTER VI								
17U6BTC07	III	Core VII	Nanobiotechnology	5	5	25	75	100
17U6BTC08	III	Core VIII	Environmental biotechnology	5	5	25	75	100
17U6BTCP07	III	Core practical VII	Lab in Bioprocess technology & Environmental biotechnology	5	5	40	60	100
17U6BTE02	III	Elective II	Enzymology & Enzyme Technology	5	4	25	75	100
17U6BTS04	IV	SBEC IV	Biosafety, Bioethics and IPR	2	2	25	75	100
17U6BCN03	IV	NMEC II	Molecular basis if human diseases	2	2	25	75	100
17U6BTMP01	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**

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	: **17U1BTC01**	External	: 75

SUBJECT DESCRIPTION:

Cell biology deals with brief information on the structural behavior of a cell with respect to its organization and function. The paper also gives introduction to basic concepts of evolution.

OBJECTIVES:

- Impart knowledge on cell, its classification and its importance.
- Understand cellular architecture and its physiological functions.
- Study structure and function of sub cellular organelles.
- Study chromosomal organization.
- Understand biological evolution.

OUTCOME:

Upon successful completion of the course, students will be exceptionally well prepared to pursue career in cellular and sub cellular biological research.

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 Peroxysomes.

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.

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)
MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER I (2017-18)
CELL BIOLOGY AND EVOLUTION

Paper	: Core Paper I	Section - A (20X1)	: 20
Examination	: External	Section – B (5X5)	: 25
Time	: Three Hours	Section – C (3X10)	: 30
Paper Code	: **17U1BTCO1**	Maximum Marks	: 75

Section A (Answer all the questions)

1. The cell theory is one of the unifying themes of biology. Which of the following statements would be part of the cell theory?

a. All life is made of cells.
c. Cells are the smallest units of life.
b. Cells come from preexisting cells.
d. All of the above

2. The type of cell division that occurs in body cells is known as.

a. Cytosis
c. Osmosis
b. Meiosis
d. Mitosis

3. You look at them through a microscope and see cell walls and membrane-bound organelles. You conclude that the cells.

a. are plant cells.
c. are animal cells.
b. could be either plant or bacterial.
d. could be plant, animal, or bacterial.

4. The diameter of most animal and plant cells ranges from.

a. 1.0 to 10 microns.
c. 10 to 100 microns.
b. 0.01 to 0.1 microns
d. 100 to 1000 microns.

5. Cells without a membrane-bound nucleus and membrane systems in the cytoplasm are ____ cells.

a. Prokaryotic
c. Fungal
b. Eukaryotic
d. Protest

6. The cytoskeleton is a system of ___ in ___ cells.

a. Proteins – prokaryotic
c. DNA – prokaryotic
b. Proteins – eukaryotic
d. DNA – eukaryotic

7. The cytoskeleton is a system of ___ in ___ cells.

a. Proteins – prokaryotic
c. DNA – prokaryotic
b. Proteins – eukaryotic
d. DNA – eukaryotic

8. DNA is stored in the cell nucleus as.

a. Ribosomes
c. Chlorophyll
b. Chromosomes
d. Lysosomes

9. What is the immediate source of energy for active transport?

a. carbohydrates
c. ATP
b. lipids
d. A & B

10. Microtubules, microfilaments and intermediate filaments are components of the.

a. cell wall in plants
c. chromosome in eukaryotes
b. plasma membrane in prokaryotes
d. chromosome in prokaryotes

11. Most organelles in a eukaryotic cell are found in the.

a. Cell wall
c. Nucleus
b. Cytoplasm
d. Capsule

12. The nucleus of a cell.

a. Is the region of the cell where ribosomes are degraded
c. is contained inside the nucleolus.
b.contains DNA and controls cell activities
d. is surrounded by a single layer of membrane.

13. The function of mitochondria is.

a. intracellular transport of proteins.
c. intracellular digestion.
b. photosynthesis.
d. cellular respiration (ATP synthesis)

14. Lysosomes.

a. Destroy harmful bacteria engulfed by white blood cells.
c.Recycle materials within the cell.
b. Help to digest worn-out or damaged organelles
d.All of the choices are correct

15. The function of chloroplasts is.

a. Intracellular transport of proteins.
c. Lipid synthesis.
b. Intracellular digestion.
d. Photosynthesis.

16. 16. Darwin began to formulate his concept of evolution by natural selection after.

a. experimentation with animals
c. reading the writings of Wallace.
b. observations of many species and their geographical locations.
d. agreeing with Lamarck about the driving force behind evolution

17 Lamarck proposed that organisms.

a. **have an innate tendency toward complexity and perfection**.
b. inherit all of the adaptations they display
b. have an innate tendency to become more simple as time passes
d. belong to species that never change.

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
c. Nucleus and nucleolus
b. Cell walls and plasmodesmata
d. cytoplasm and endoplasm

19. Unlike animal cells, plant cells have _____ and _____ and _____.

a. chloroplasts . cell walls . mitochondria
c. chloroplasts . cell walls . vacuoles
b. centrioles . cell walls . glycocalyx
d. centrioles . chloroplasts . vacuoles

20. located within the Nucleus, it is responsible for producing ribosomes.

a. Centrosome
c. Lysosme
b. Nucleolus
d. Endoplasmic reticulum

Section-B (Answer All The Questions)

1. a) Write about the history of cell biology. **(or)**
   b) Differentiate mitosis and meiosis.
2. a) Elucidate the Cell Membrane Model. **(or)**
   b) Write short notes on Passive transport.
3. a) Draw a neat diagram of chloroplast and explain its structure. **(or)**
   b) Write short note on structure and function of Endoplasmic reticulum.
4. a) Write a brief account on the structure of DNA. **(or)**
   b) Discuss about the types of chromosome.
5. 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)

1. Explain the ultra structure of plant cell with neat labeled diagram
2. Discuss structure and function of cytoskeletons (microtubules, microfilaments and intermediate filaments).
3. Explain the structure and function of mitochondria.
4. Give an account on structure of chromosomes.
5. 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	: **17U1BTCPO1**	External	: 60

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, solation of chloroplast from spinach leaves and ChlorophyII 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

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MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER I (2017-18)

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	: **17U1BTCPO1**	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 (2017-18)

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	: **17U1BTCPO1**	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	: **17U1BTA01**	External	: 75

SUBJECT DESCRIPTION:

The gives brief idea of Plant Kingdom, its classification, characteristics and importance.

OBJECTIVES:

- To enable the students to understand the character and life cycle of Algae and Fungi
- To understand the characters of Pteridophytes and Gymnosperms
- To understand the classification of Bentham and Hooker's system
- To identify various angiospermic plants
- To understand the economic importance of botany

OUTCOME:

Students would be acquiring indepth knowledge on plant kingdom, their classification, characterization and their importance in biotechnology.

CONTENT:

Unit I – (15 Hrs.): Algae – General characteristics, Life cycle and Economic importance of the following *scenedesmus*, *Chlorella*, *Sargassum*, *Gracilaria*, *Gelidium* and *spirulina*.

Unit II – (15 Hrs.): Fungi – General characteristics, Life cyle and Economic importance of the following: *Saccharomyces*, *Penicillium Apergillus* and *Mucor*.

Unit III – (15 Hrs.): Pteridophyta and Gymnosprms – General characters – Structure and life cycle of *Lycopodium* and *Cycas* (Development details are not required).

Unit IV – (15 Hrs.): Plant Taxonomy - Outline of Bentham and Hookers system of classification – study of the following families and their economic importance – Apocynaceae, Asclepiadaceae, Euphorbiaceae and Solanaceae.

Unit V – (15 Hrs.): Economic importance of Botany – Cereals, Legumes, Millets, Pulses, Medicinal plants, Fiber yielding plants, Timber yielding plants, Spices and condiments.

TEXT BOOKS:

- Sing, V., Pande, P. C. and Jain, D. K. 2017. 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.

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 Publising Company Limited, New Delhi, p-365.
- Vashishta, P. C., Sinha, A. K. and Kumar, A. 2006. Botany for Degree Strudents Pteridophyta, S. Chand & Company, Private, Ltd. New Delhi, p-628.
- Ragland, R., Kumaresan, V. and Arumugam, N. 2014. Algae, Fungi, Bryophytes, and Plant Pathology, Saras Publication Nagercoil, p-668.
- Verma, V. 2009. A Text Book of Economic Botany, Ane Book India, p-332.

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MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER I (2017-18)
PLANT SCIENCE

Paper	: Core Paper I	Section - A (20X1)	: 20
Examination	: External	Section – B (5X5)	: 25
Time	: Three Hours	Section – C (3X10)	: 30
Paper Code	: **17U1BTAO1**	Maximum Marks	: 75

Section A (Answer all the questions)

1. Phycology is the study of _____

a. Fungai
b. Algae
c. Bacteria
d. Protozoa

2. The term algae was coined by

a. Theopharastus
b. Engler
c. Fritsch
d. Linnaeus

3. Mannitol is the reserve food in _____

a. Rhodophyceae
b. Chlorophyceae
c. Phaephyceae
d. Xanthophyceae

4. An antibiotic has been extracted from

a. Chlorella
b. Laminaria
c. Gelidium
d. All of these

5. Fungi usually store the reserve food material in the form of

a. Starch
b. Lipid
c. Glycogen
d. Protein

6. Fungi producing usually eight spores in a sac like structure belong to

a. Phycomycetes
b. Ascomycetes
c. Basidiomycetes
d. Deuteromycetes

7. The fruiting body of Aspergillus is called

a. Apothecium
b. Perithecium
c. **Cleistothecium**
d. Hypanthodium

8. The main plant body in pteridophyte is

a. Sorus
b. Sporophyte
c. Gametophyte
d. Prothallus

9. 'Bakers yeast" is _____

a. Mucor
b. Saccharomyces
c. Aspergillus
d. Agaricus

10. Club mass is the common name of

a. Lycopodium
b. isoetes
c. Selaginella
d. Pleopeltis

11. Which of the following is considered as 'living fossil'?

a. Pinus
b. Cycas
c. Zamia
d. Podocarpus

12. Cycas stem is a good source of edible starch called

a. Cyco
b. Sago
c. cycas starch
d. sigo

13. Classical taxonomy is also termed

a. β taxonomy
b. Systematics
c. **Descriptivie taxonomy**
d. Experimental taxonomy

14. Classification given by Bentham and Hooker is

a. Artificial
b. Natural
c. Numerical
d. Phylogenetic

15. Number of sepals in family Solanaceae is

a. 2
b. 3
c. 5
d. 6

16. Almost all plants have latex in

a. Fabacea
b. Asteraceae
c. Euphorbiaceae.
d. Musaceae

17 Fiber of great commercial importance derived from epidermis is

a. Flax
b. Hemp
c. Coir
d. Cotton

18 A drug which reduces high blood pressure is obtained from

a. *Acontium chasmanthum*
b. *Rouwolfia serpentine*
c. *Centella asiatica*
d. *Solanum nigrum*

19. One of the following plants is a rich variety of timber

a. *Cassia fistula*
b. *Dalbergia sissoo*
c. *Acacia Arabica*
d. *Morus alba*

20. Which one of the following is a plant of great medicinal value?

a. *Brassica oleraceae*
b. *Coffea robusta*
c. *Rauwolfia serpentine*
d. *Cryptostegia grandiflora*

Section-B (Answer All The Questions)

1. a) Describe the general characteristics of algae **(or)**
   b) Explain the thallus structure and life cycle of *chlorella*
2. a) Describe the process of sexual reproduction in *Penicillium*. **(or)**
   b) Enumerate any five economic importances of fungi.
3. a) Draw and describe the morphology of *lycopoidum.* **(or)**
   b) Bring out the asexual reproduction in cycas.
4. a) Describe the characteristics of *Apocynaceae*. **(or)**
   b) Outline the economic importance of *Euphorbiaceae*.
5. a) Describe the importance of pulse crop in India. **(or)**
   b) Discuss the economic importance of spices and condiments.

Section-C (Answer Any Three Questions)

1. Briefly explain about the thallus structure and life cycle of *Sargassum*.
2. Discuss in detail the morphology and life cycle of *Aspergillus*.
3. Illustrate the sexual and asexual reproduction in *lycopodium.*
4. Give a detailed account on the Bentham and Hookers system of classification.
5. Enumerate the economic importance of medicinal and fiber yielding plants in India.

YEAR I – SEMESTER I
LAB IN PLANT SCIENCE

Paper	: Allied Practical I	Total Hours	: 75
Hours/Week	: 4	Exam Hours	: 06
Credit	: 4	Internal	: 40
Paper Code	: **17U1BTAP01**	External	: 60

MAJOR PRACTICAL:

Lab 1 – (8 hrs.): Study of the vegetative and reproductive organs of Algae and Fungi.

Lab 2 – (8 hrs.): Study of morphology and anatomy of Pteridophytes.

Lab 3 – (8 hrs.): Study of vegetative and reproductive organs of Pteridophytes.

Lab 4 – (8 hrs.): Study of morphology and anatomy of Gymnosperms.

Lab 5 – (8 hrs.): Study of vegetative and reproductive organs of Gymnosperms.

MINOR PRACTICAL:

Lab 1 – (3 hrs.): Preparation of plant herbarium.

Lab 2 – (3 hrs.): Identification of Apocynaceae family.

Lab 3 – (3 hrs.): Identification of Asclepiadaceae family.

Lab 4 – (3 hrs.): Identification of Euphorbiaceae family.

Lab 5 – (3 hrs.): Identification of Solanaceae family.

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

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.

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YEAR I – SEMESTER I (2017-18)

LAB IN PLANT SCIENCE

Paper	: Allied Practical I	Major (1X20)	: 20
Examination	: External	Minor (1X10)	: 10
Time	: Three Hours	Spotters (5X4)	: 20
Paper Code	: **17U1BTAPO1**	Record (1X5)	: 5
Batch	:	Viva Voce	: 5
Date	:	Maximum Marks	: 60

MAJOR (Answer All the Questions)

a. Identify the organism based on vegetative and reproductive organs and describe. **(or)**

b. Identify the organism based on morphology and anatomy and describe.

MINOR (Answer All the Questions)

a. Identification of family 1

b. Identification of family 2.

SPOTTERS

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

RECORD

VIVA-VOCE

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
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MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER I (2017-18)

LAB IN PLANT SCIENCE

Paper	: Allied Practical I	Major (1X20)	: 20
Examination	: External	Minor (1X10)	: 10
Time	: Six Hours	Spotters (5X4)	: 20
Paper Code	: **17U1BTAPO1**	Record (1X5)	: 5
Batch	:	Viva Voce	: 5
Date	:	Maximum Marks	: 60

KEY

MAJOR

Vegetative and reproductive organ of Algae glass slide and Microscope.

MINOR

Branch and flower of a plant.

SPOTTERS

1. Amoeba,
2. Taenia scolex, Fasciola hepatica.
3. Taenia solium,
4. Sea and
5. Blastula of frog, 24 and 48 hours of chick embryo.

RECORD

VIVA-VOCE

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	:**17U2BTCO2**	External	: 75

SUBJECT DESCRIPTION:

This paper emphasizing the science of heredity and variation in living organism and ways in which the traits are passed down from generation to another and also it imparts the molecular structure of different constituents of a cell.

OBJECTIVE:

- Describing Mendelian principles of inheritance.
- Reviewing the chromosomal changes.
- Highlighting the genetic developments
- Explaining the basics of the molecular processes of DNA replication, transcription and translation.
- Highlighting the gene regulation and cancer biology.

OUTCOME:

Students were exposed with the strong basic knowledge in Genetics and Molecular biology which elevate them to the next level in their academic.

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. Transcrption- Transcrption 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- Begnin 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 Publising 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 Benjamine /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.

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MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER II (2017-18)
CELL 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	: **17U2BTCO2**	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. **c. Dihybrid**.
b. Monohybrid 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 c. Gene
b. Allele d. locus

3. Interaction among the products of nonalleles is kinown as

a. Epitasis c. Dominance.
b. Suppression. d. Co dominance.

4. The exchange of chromosomes materials through breakage and reunion is called as

a. Covalent bond. c. Cross breedings**.**
b. Transformation **d. Crossing over**.

5. A rearrangement in chromosomes that reverses the order of a linear array of genes is known as

a. Deletion **c. Inversion**
b. Subtraction d. Multiplication

6. An agent that causes the mutation is called as

a. Protein c. Chemical
b. Mutagen d. Mutation

7. DNA elements that can move from one position to another position is known as

a. Ribosomes c. Chromosomes
b. Transposons d. Lysosomes

8. The chromosome compliment of Turner syndrome is

a. 44+XY c. 46+XY
b. 45+X d. 44+XX

9. Replicon is a

a. Unit of Transcription c. Unit of Repair system
b. Unit of Translation **d. Unit of Replication**

10. The point on chromosomes where crossing over occurs during recombination is called

a. **Chiasmata** c. Locus
b. Recombination point d. Gene

11. The process of RNA synthesis is called as

a. Translation c. Replication
b. Transcription d. RNA production

12. RNA polymerase enzyme synthesis

a. Protein **c. RNA**
b. DNA d. Amnio acids

13. 70S ribosomes consist two subunits are

a. 40S and 30S . c. 50S and 20S
b. 40S and 40S **d. 50S and 30S**

14. Proteins are made up of

a. Proteins c. Sugars
b. Amnio acids d. None of the above

15. DNA region to which the RNA polymerase binds is called

a. i Enhancer . c. Terminator.
b. intracellular digestion **d. photosynthesis**

16. 16. Darwin began to formulate his concept of evolution by natural selection after

a. experimentation with animals c. reading the writings of Wallace.
b. Promoter d. Activator

17 Exchange of genetic material between the chromosomes are called as

a. Exchange . **c. Recombination**
b. Transfer d. Translocation

18 Dimer repair mechanism include

a. Excision Repair c. Photoreactivation
b. Recombinational Repair **d. All of these**

19. Which of the following is dark repair

a. Nucleotide excision repair c. Base excision repair
b. Both a and b d. None of these

20. Cancer is caused by

a. Unconcontrolled mitosis c. Uncontrolled meiosis
b. Rupturing of cells d. Loss of immunity of the cells

Section-B (Answer All The Questions)

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

Section-C (Answer Any Three Questions)

1. write an account on Linkage and crossing over.
2. Explain in detail about Transposable elements.
3. Write an elaborate note on the Lac and Trp operons.
4. Give an account on Translation of protein.
5. 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	: 25
Paper Code	: **17U2BTCPO2**	External	: 75

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 *Coenorrabditis 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, Ist Edition, Rastogi publications,India, p-617.

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

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YEAR I – SEMESTER I (2017-18)

GENETICS AND MOLECULAR BIOLOGY

Paper	: Core Practical II	Major (1X20)	: 20
Examination	: External	Minor (1X10)	: 10
Time	: Six Hours	Spotters (5X4)	: 20
Paper Code	: **17U1BTCPO2**	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.).

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YEAR I – SEMESTER I (2017-18)

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	: **17U1BTCPO2**	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
FOR B.Sc. BIOTECHNOLOGY

Paper	: Allied II	Total Hours	: 60
Hours/Week	: 4	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: **17U2BTA02**	External	: 75

SUBJECT DESCRIPTION:

This paper emphasizing basic animal science in which classification and anial kingdom based on their morphological, anatomical characteristers, their reproduction and development.

OBJECTIVE:

- To enhance their knowledge on classification of animal kingdom.
- Idetification of animals based on morphological and anatomical features.
- Understand animal reporuction and development.

OUTCOME:

Students will acquire knowledge on animal kingdom their classification based on morphology, anatomoical characterists, their reproductive and growth nature.

CONTENT:

Unit I – (15 Hrs.): Animal Kingdom: Introduction to animal Kingdom, Classification and Protozoa.

Unit II – (15 Hrs.): Porifera, Coelenterata, Ctenophora and Platyhelminthes.

Unit III – (15 Hrs.): Nematoda, Annelida, Arthropoda and Mollusca.

Unit IV – (15 Hrs.): Echinodermata, Hemichordata and Chordata.

Unit V – (15 Hrs.): Animal cells and Tissues, Organs and Organ systems, Reproduction and Development.

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
- Jordan, E. L and Verma, P. S. 2000. Chordate Zoology, S. Chand & Co, New Delhi.
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- Wolpert, L. 2007. Principles of Development (III edition) Oxford University Press, UK.
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VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)
MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER II (2017-18)

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	: **17U2BTAO2**	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
c. Spinal cord.
b. Notochord
d. Vertebral column

16. Which of the following is a characteristic chordate character?

a. Autonomy
c. Pharyngotomy
b. Myotomy
d. Dermatotomy

17 Animal cells do not contain

a. Chloroplast .
c. Nucleus
b. Cytoplasm
d. Cell membrane

18 The layer of actively dividing cells of skin is termed as.

a. Stratum compactum
c. Stratum lucidium
b. Stratum corneum
d. Stratum malpighii

19. Genetic idientity of a human male is determined by.

a. Autosomes
c. Cell organelles
b. Nucleolus
d. **Sex chromosomes**

20. Fertilization of ova in human take place in.

a. Ovary
c. **Fallopian tube**
b. Vagina
d. Uterus

Section-B (Answer All The Questions)

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

Section-C (Answer Any Three Questions)

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

YEAR I – SEMESTER II
ANIMAL SCIENCE PRACTICAL

Paper	: Allied II	Total Hours	: 60
Hours/Week	: 4	Exam Hours	: 03
Credit	: 3	Internal	: 40
Paper Code	: **17U2BTA02**	External	: 60

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.

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(AUTONOMOUS)
MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER I (2017-18)

LAB IN ANIMAL SCIENCE

Paper	: Allied Practical I	Major (1X20)	: 20
Examination	: External	Minor (1X10)	: 10
Time	: Three Hours	Spotters (5X4)	: 20
Paper Code	: **17U1BTAPO2**	Record (1X5)	: 5
Batch	:	Viva Voce	: 5
Date	:	Maximum Marks	: 60

MAJOR (Answer All the Questions)

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

b. Depict key to common taxa to Animal Kingdom and identify the given species B.

MINOR (Answer All the Questions)

a. Characterize the given animal cells and tissues.

b. Identify structure and function of given animal organ .

SPOTTERS (Answer All the Questions)

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

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YEAR I – SEMESTER I (2017-18)

LAB IN ANIMAL SCIENCE

Paper	: Allied Practical I	Major (1X20)	: 20
Examination	: External	Minor (1X10)	: 10
Time	: Three Hours	Spotters (5X4)	: 20
Paper Code	: **17U1BTAPO2**	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

FOR ALL UNDER GRADUATE STUDENTS

Paper	: Value Education II	Total Hours	: 30
Hours/Week	: 4	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: **17U2VE02**	External	: 75

SUBJECT DESCRIPTION:

In spite of the deteriorating status of the environment, study of environment have so far not received adequate attention in our academic programmes. Recognizing this, the Hon'ble Supreme Court directed the UGC to introduce a basic course on environment at every level in college education. Accordingly, the matter was considered by UGC and it was decided that a six months compulsory core module course in environmental studies may be prepared and compulsorily implemented in all the University/Colleges of India. The experts committee appointed by the UGC has looked into all the pertinent questions, issues and other relevant matters. This was followed by framing of the core module syllabus for environmental studies for undergraduate courses of all branches of Higher Education. We are deeply conscious that there are bound to be gaps between the ideal and real. Geniune endeavour is required to minimize the gaps by intellectual and material inputs. The success of this course will depend on the initiative and drive of the teachers and the receptive students.

OBJECTIVES:

- Inculcate the importance of environmental science and environmental studies.
- Enhanced the need for sustainable development is a key to the future of mankind in the minds of students.
- Create awareness on problems of pollution, solid waste disposal, degradation of environment, issues like economic productivity and national security, Global warming, the depletion of ozone layer and loss of biodiversity
- Importance of managing environmental hazards.

OUTCOME:

Create environmentally conscious citizen of the country.

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 resoureces 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, Inida as a mega-diversity nation, Hot-sports 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, Diaster 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 rahabilitation of people; its problems and concerns. Case Studies, **Environmental ethics**: Issues and possible solutions. Climate change, global warming, 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)
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- Clark, R. S. 2001. Marine Pollution, Clanderson Press Oxford (TB)
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- De, A. K. 1993. Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
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- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi p-284.
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- 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.

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)
MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR I – SEMESTER II (2017-18)
ENVIRONMENTAL STUDIES

Paper	: VALUE EDUCTION II	Section - A (20X1)	: 20
Examination	: External	Section – B (5X5)	: 25
Time	: Three Hours	Section – C (3X10)	: 30
Paper Code	: **17U2VE2**	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

10 Sequence of eating and being eaten in a ecosystem is called.
a. Food web
b. Ecological Pyramid
c. Natural cycle
d. Food chain

11 Biodiversity means.
a. The living natural resources
b. Oceans and sea
c. Land and forest
d. Atmosphere

12 Gaseous nitrogen can be used by plants only after the process of.
a. Nitrogen cycling
b. Ammonification
c. Nitrogen fixation
d. Nitrifications

13 Conversion of ammonia to nitrite and then nitrate is called.
a. Nitrogen fixation
b. Nitrification
c. De nitrification
d. Ammonification

14 The subsurface sources of water is.

a. River
b. Stream
c. Dug well
d. Ocean

15 71% of earth surface is covered with.

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

16 Major cause of increment in population growth

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

17 Which of the following is an air pollutant

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

18 Which of the following are major causes of land degradation?

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

19 Biochemical oxygen demand means

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

20 Eutrophication means

a. Thermal change in water
b. Solid waste
c. Filling up of water body with aquatic plants
b. 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 econlogical sucession and its role. **(or)**
   b) State Biogeographical classification of India.
4. a) Write a brief account on endangered and endemic specie 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. Discribe social issues related to environment.
2. Enumerate different types of environmental pollution and explain.
3. Give an account of different types biodiversity conservation.
4. Classify different types of ecosystems and descrive.
5. What are renewable and non renewable resources explain.

YEAR II – SEMESTER III

IMMUNOLOGY

Paper	: Core III	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: **17U3BTCO3**	External	: 75

Subject description

The chapters in the paper provide a fundamental knowledge on principle and concepts in immunology.

Objectives

To enable the students to understand the basic concepts of immunology and molecular mechanism behind immunological reactions that enables them to apply them to develop methods for diagnostic assays, treatment strategies, vaccine production, therapeutical drugs and Monoclonal antibody production.

Goal

The thorough understanding of this paper enables the students to confidently pursue their career in the field of Immunology, diagnostics, Healthcare, Pharmaceuticals, Clinical research, Biomedical and Genetic engineering research and Allied health fields.

UNIT	CONTENT	HOURS
I	**History and scope of immunology**; Infection & Immunity – types and mechanisms; Haematopoiesis and cells of the immune system. Organs of immune system – Primary and secondary lymphoid organs – structure and functions	15
II	**Antigen and immunogen – Properties**; Haptens, mitogens, adjuvants, epitopes. Immunoglobulin – Basic structure, classes, function, Generation of antibody diversity. Immune responses – Humoral & Cell mediated immune responses & antigen recognition. Generation of lymphocyte specificity and clonal selection of lymphocytes. MHC – types, organization and its role in antigen processing and presentation.	15
III	**Antigen- antibody interactions**: Principle and applications of Precipitation & Agglutination reactions; Complement – components, properties and activation of pathways (Classical, alternative and lectin), biological significance of complements; Cytokines- properties, structure and function.	15

IV	**Hypersensitivity reactions**: Types and mechanisms; Mechanism of transplantation and graft rejection; Immunosuppressive therapy; Autoimmune diseases; Immunodeficiency diseases.	**15**
V	**Principles of vaccination:** Passive & active immunization, immunization programs & role of WHO in immunization programs. Vaccines types – Live and attenuated vaccines, inactivated vaccines, Polysaccharide capsular vaccine, peptide vaccine, DNA vaccines, recombinant vaccines, multivalent subunit vaccines to other infectious agents, edible vaccines.	**15**

REFERENCES

1. Goldsby RA, Kindt TJ. Osborne BA, Kuby J (2003) Immunology 6th Edition. WH Freeman & Co. New York.
2. Kuby J (2000) Immunology 4 th Edition. WH Freeman & Co. New York.
3. Benjamini E, Coico R and Sunshine G (2000). Immunology 4th Edition. A John Wiley & Sons, Inc. Publications.
4. Roitt I, Brostoff J and Male D (1993). Immunology 3 rd Edition. Mosby
5. Tizard IR (1995). Immunology 4th Edition. Saunders College Publishing Harcourt. Brace College Publishers.
6. J. Darnell, H. Lodish and D. Baltimore (1994). Molecular Biology 2nd Edition. Scientific American Book, USA

Paper Code: 17U3BTC03

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS) ELAYAMPALAYAM, TIRUCHENGODE
DEPARTMENT OF BIOTECHNOLOGY
MODEL EXAMINATION
B.Sc. BIOTECHNOLOGY
II SEMESTER
IMMUNOLOGY

Time: 3 Hours **Max. Marks : 75**

SECTION – A **(20 X 1 = 20)**

Answer all the questions

1. Formation and development of red and white blood cells from stem cells is called as
   a) Hemopoiesis b) Hematopoiesis c) Hemoglobin d) None of these.
2. Which of the following is a primary lymphoid organ?
   a) Spleen b) Thymus c) Peyer's patch d) Lymph node
3. Which of the following cell produce antibodies?
   a) T cells b) NK cells c) Plasma cells d) Dendritic cells
4. In Thymus the cortex is densely packed with immature T cels called _____
   a) Dead cell b) Thymocytes c) Epithelial cell d) Macrophage
5. Both mast cells and basophils are _____
   a) Phagocytic b) Circulate in the blood strean
   c) Found primarily in lymph nodes d) Release histamine
6. Which of the following antibody cross from mother to child through the placenta?
   a) IgA b) IgM c) IgG d) IgE
7. _____ is responsible for quick secondary response.
   a) Antibodies b) Plasma cells c) B cells d) Memory cells
8. Class I MHC molecules are found on
   a) B cells and macrophages b) erythrocytes, B cells and T cells
   c) T cells only d) all nucleated cells
9. _____ is a substance which makes the hapten immunogenic
   a) T cells b) B cells c) carriers d) complex haptens
10. _____ of an antigen is complementary to the paratope of an antibody.
    a) MHC b)TCR c) Fab d) Epitope
11. The complement cascade can be initiated by
    a) antibody:antigen complexes. b) properdin:antigen complexes
    c) peptidoglycan:LPS complexes. d) None of these.
12. Activation of alternative pathway involves
    a) C1 b) C2 c) C3 d) C4
13. Immediate hypersensitivity usually involves _____
    a) Mast cells b) Antibodies to mast cells c) Platelets d) IgG
14. Which hypersensitivity is caused by T-lymphocytes?
    a) Acute b) Delayed c) Chronic d) None of these
15. A graft that is transplanted from one person to a genetically identical individual is ____
    a) Allograft b) Autograft c) Isograft d) None of these

16. Transplanted cells are mainly destroyed by _____
    a) Neutrophils b) Macrophages c) B-cells d) T-cells
17. Which is considered the gold standard of existing vaccines?
    a) Purified proteins b) Whole-organism c) DNA-based d) Inactivated exotoxin.
18. The organism suitable for use in recombinant vaccines is _____.
    a) Influenza virus b) Poliovirus c) Small pox D) Vaccinia virus.
19. The process of weakening a pathogen is called
    a) Vaccination b) Attenuation c) Immunization d) None of these.
20. A Vaccine can be _____
    a) An antigenic protein b) Weakened pathogen
    c) Live attenuated pathogen d) All of these

SECTION - B (5 X5 = 25)

Answer ALL the question

21. a) Describe the contribution of Edward jenner and Louis pasteur to immunology.

Or

b) What is immunity? Discuss about innate immunity.

22. a) What is immunogen? Discuss the properties of immunogen.

Or

b) Draw and describe structure of Immunoglobulin.

23. a) Discuss the biological functions of complement system.

Or

b) What are cytokines? Explain about its properties.

24. a) Describe the mechanism of graft rejection.

Or

b) What is autoimmunity? Mention any two organ specific auto immune diseases.

25. a) Describe the steps involved in the production of DNA vaccine.

Or

b) What are edible vaccines? How are they produced?

SECTION - C (3X10=30)

Answer any THREE questions

26. What are primary lymphoid organs? Discuss in detail about its structures and functions.
27. Give an elaborate note on structure and functions of class I and class II MHC molecules.
28. Illustrate the Classical pathway of complement system.
29. What is hypersensitivity? Discuss in detail about the mechanism of Type I reaction.
30. What are vaccines? Describe the production of recombinant vaccine using rDNA technology.

YEAR II – SEMESTER III
LAB IN IMMUNOLOGY

Paper	: CORE PRACTICAL III	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: **17U3BTCPO3**	External	: 75

Experiment No.	Title	Hours
1	Determination of blood grouping and Rh typing in human beings.	5
2	Preparation of serum and plasma.	5
3	Total count of blood cells - WBC & RBC.	10
4	Differential count of WBC.	5
5	Ouchterclony double immunodiffusion technique (ODD)	10
6	Radial immune diffusion (RID)	5
7	Rocket immunoelectrophoresis.	5
8	ELISA.	10
9	Western blotting.	10
10	WIDAL Test.	10

YEAR II – SEMESTER IV
RECOMBINANT DNA TECHNOLOGY

Paper	: Core IV	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: **17U4BTCO4**	External	: 75

Subject description

The chapters in the paper provide a fundamental knowledge on principle and concepts in Recombinant DNA technology.

Objectives

To enable the students to understand the basic concepts of genetic engineering and importance of cloning vectors for recombinant DNA technology enabling students to apply vectors on cloning new therapeutically important candidate gene. The subject also deals with the new regulation and guideline of recombinant molecules as suggested by Department of Biotechnology(DBT)-India.

Goal

The thorough understanding of this paper enables the students to confidently pursue their career in the field of Cloning, Genetic engineering, Biosafety levels and Biocontainment, Vector Biology and in the field of Pharmaceutical Industries for developing Genetically cloned products.

UNIT I: 15 Hrs

Tools in rDNA technology: Scope and applications: 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.

UNIT II: 15 Hrs

Cloning vectors: Plasmids (PBR322, PUC and BAC), Lambda vectors, Phagemids, Cosmids, M13 vectors, Shuttle vectors (YEP, YIP & YRP) and Artificial chromosomes (YAC and BAC).

UNIT III: 15 Hrs

Nucleic acid technology: Purification and yield analysis of DNA. Nucleic acid sequencing methods (Maxam-Gilbert and Dideoxy methods). PCR - Principles and Types (RT PCR & Nested PCR). DNA Library construction and screening:

(Genomic & cDNA libraries). mRNA enrichment.

UNIT IV: 15 Hrs

Gene transfer techniques: Transformation ($CaCl_2$ mediated, microinjection, Biolistic-Particle bombardment). Protein expression from recombinant clones: Protein expression in E.coli and Yeast (Glucose & Alcohol).

Screening & Selection of recombinant clones: Hybridization techniques (Northern, Southern & Western), microarray, Site directed mutagenesis: Yeast two hybrid system. Positive and negative selection (IPTG-Xgal, insertional inactivation). Selectable markers and reporters.

UNIT V: 15 Hrs

Regulations and Guidelines of recombinant DNA: Scope and regulations in rDNA research. rDNA Advisory Committee (RAC), Review Committee on genetic manipulation (RCGM), Institutional Biosafety committee (IBC), Genetic engineering appraisal Committee (GEAC), State Biotechnology Coordinators Committee (SBCC). Biocontainment-Laboratory maintaining, decontamination and disposal (BSL-1, 2, 3) (Plant, animal and microbe)

REFERENCES:

1. dbtindia.nic.in

2. www.who.int

3. Molecular cloning: a laboratory manual. J. Sambrook, EF. Frisch and T. Maniatis, Cold Spring Harbor Laboratory Press, New York.2000.

4. DNA cloning: a practical approach, DM. Glover and BD Hames, IRL Press, Oxford, 1995.

5. Molecular and Cellular Methods in Biology and Medicine, PB. Kaufman, W.Wu. D, Kim and L.J Cseke, CRC Press, Florida, 1995.

6. Methods of Enzymology vol. 152, Guide to molecular cloning techniques, SL. Berger and AR. Kimmel Academic Press, Inc. An Diego, 1998.

7. Methods in Enzymology. Vol 185, gene expression technology, DV. Goeddel Academic Press, inc. San Deigo, 1990.

8. DNA science. A first Course in Recombinant Technology. DA. Mickloss and GA. Freyer; CokJ Spring Harbor Laboratory Press, New York, 1990.

9. Molecular Biotechnology. SB. Primrose, Blackwell Scientific Publishers, Oxford, 1994.

10. Milestones in Biotechnology. Classic papers on genetic Engineering. JA. Davis and WS. Reznikoff, Butterworth-Heinemann, Boston, 1992.

11. Route maps in Gene technology, MR. Walker and R. Rapley, BlackwelScience Ltd., Oxford, 1997.

12. Genetic Engineering. An Introduction to gene analysis and exploitation in eukaryotes, SM. Kingsman and AJ. Kingsman, Blackwell Scientific Publications, Oxford, 1998.

13. Molecular Biotechnology - Glick and Pasternak.

14. Principles of gene manipulations - Old & Primrose.

B.Sc. BIOTECHNOLOGY
II SEMESTER
MODEL QUESTION PAPER (RECOMBINANT DNA TECHNOLOGY)
Section - A (Answer all the questions) (20 x 1 = 20 marks)

1. *Taq* Polymerase is isolated from
   a. *E.coli* b. *Thermus aquaticus* c. *Thermus marinus*
   d. *Bacillus stereothermophilus*
2. Which of the following sequence is
3. recognized by Hin d III?
   a. AA GCTT b. A AGCTT c. GTCGA C d. GT CGAC
4. RNase H cleaves --------- hydrid
   a. DNA-DNA b. DNA-RNA c. RNA-RNA d. RNA-Protein
5. Which of the following enzyme is used to create the sticky ends on DNA?
   a. Acid phosphatase
   b. Polynucloetidyl kinase
   c. Terminal deoxy nucleotidyl transferase
   d. Alkaline phosphatase
6. Which of the following vectors contains Ori 'C' sites from two different species?
   a. Cosmids b. M13 vectors c. Shuttle vectors d. Phagemids
7. The insertional vector λgt10 can able carry up to ------ of new DNA
   a. 4 kb b. 5 kb c. 7 kb d. 8 kb
8. The size of YRp7 is --------
   a. 5.8 kb b. 6.8 kb c. 5.7 kb d. 6.7 kb
9. Which of following contains covalently closed circular DNA strands?
   a. Phagemids b. M13 vectors c. Shuttle vectors d. Cosmids
10. Which of the following DNA is used as template in Chain termination method of DNA sequencing?
    a. Plasmid DNA b. Genomic DNA c. Viral DNA d. λ DNA
11. Denaturation of DNA during PCR is usually carried out at -------^{o}C
    a. 94 b. 84 c. 64 d. 74
12. 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
13. In the 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
14. The glucoamylase (GOX) promoter found in *Aspergillus nidulans* is induced by ------ and repressed by -------
    a. Starch, Glucose b. Starch, Fructose c. Starch, Galactose d. Starch, Xylose
15. The chemical method of DNA sequencing can be used to rapidly sequence DNA that are ---------- kb
    a. < than 0.5 b. > than 0.5 c. < than 1.0 d. > than 1.0

16. The DNA-phosphate containing mixture is incubated with the recipient cells for --------
    a. 24 hrs b. 48 hrs c. 72 hrs d. 98 hrs
17. 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
18. Which of the competent authority involved in policy regulations of recombinant DNA?
    a. RAC b. RCGM c. SBCC d. DLC
19. A micro organism that is usually causes serious/lethal human or animal disease but does not ordinarily spread from one infected individual to another comes under the risk group ---------
    a. RG - 4 b. RG - 3 c. RG - 2 d. RG - 1
20. Arthropods and insect biosafety level comes under ------- to -------
    a. BSL-1 to BSL-4 b. ASBL-1 to ASBL-4 c. PBSL-1 to PBSL-4
    d. AQBSL-1 to AQBSL-4
21. Genetic engineering Appraisal Committee has been established under the ----------
    a. Ministry of Science & Technology (MST)
    b. Ministry of Human Resource Development (MHRD)
    c. Ministry of Environment, Forest and Climate Change (MoEF & CC)
    d. Council for Scientific and Industrial Research (CSIR)

Section - B (Answer all the questions) (5 x 5 = 25 marks)

22. A) Write short notes on type III endonucleases (or)
    B) Write short notes on DNA modifying enzymes
23. A) Write about PBR322 with neat illustrations (or)
    B) Write about YEP and YIP vectors
24. A) Write about Maxam-Gilbert method of DNA sequencing (or)
    B) Explain RT PCR
25. A)Write about microinjection method of DNA transformation (or)
    B) Explain site directed mutagenesis
26. A) Explain IBC & GEAC (or)
    B) Write short notes on BSL-1 & BSL-2

Section - C (Answer any THREE of the following questions) (10 x 3= 30 marks)

27. Give a detailed account on restriction endonucleases
28. Give a detailed account on M13 vectors
29. Explain the DNA library construction and its screening
30. Give a detailed account on DNA transfer techniques
31. Write elaborately on various committees involved in framing regulations and guidelines of recombinant DNA.

YEAR II – SEMESTER IV

LAB IN rDNA TECHNOLOGY

Paper	: CORE PRACTICAL IV	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: **17U4BTCPO4**	External	: 75

Experiment No.	**Title**	**Hours**
1	Isolation of Genomic DNA from *E.coli*	
2	Isolation of Plasmid DNA mini prep and maxi prep from *E.coli*	
3	Restriction digestion of plasmid DNA by Hind III and BamHI	
4	Ligation of DNA and plasmid by T4 DNA ligase (Vector-Vector & Vector-Target)	
5	Purification of DNA fragment from gel by electro-elution	
6	Amplification of ligated plasmid by PCR	
7	Transformation of recombinant DNA in Host *E.coli* by CaCl method	
8	Selection of recombinant clones by IPTG-X-gal method	

YEAR II – SEMESTER IV
FOOD PROCESSING TECHNOLOGY

Paper	: **SBEC II**	Total Hours	: 32
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 17U3BTS02	External	: 75

DESCRIPTION

This paper deals with the technological aspects of food and their preservation,processing, industries etc.,developments in the field

Objectives

- To help the students understand the basic concepts of food preservation and processing
- To enable them to be aware of the food industries and food safety.

Unit I

Introduction: Historical aspects of food preservation – ancient (Wine, dry fish) medieval (cheese), modern (Packaged food – aerated packets)- Significance of food preservation.

Unit II Food processing and preservation

Packaged foods – food colorants (Natural & artificial) – food flavoring agents – food stabilizers – emulsifiers – processing of food (Pasteurization, refrigerated and deep-frozen food)

Unit III Food industry

General principal – Industry design & construction - machinery (fermenter) - working - maintenance of process industries – quality control

Unit IV Food spoilage and food safety

Food contamination – Shelf life – food carcinogens and mutagens – food allergens;Food safety – foodpreservatives (class I& II).

Unit V Agencies & regulations governing food processing

Grading of packaged food – quality factor for consumer safety – PFA – FSSAI – Training and education for safe methods of handling and food processing.

REFERENCES:

1. **B.Siva**2011.Food Processing & Preservation –PHI Learning Pvt Ltd**.**
2. **D.G. Rao,** 2010. Fundamentals of Food Engineering –PHI Learning Pvt Ltd.
3. **Narang,** Food Microbiology
4. **Michael P. Doyle, Larry. R.** Food Microbiology – Fundamentals & Frontiers
5. **Frazier,** Food Microbiology
6. **Yiu Hui & G. Khachatourians,** Food Biotechnology
7. **Ibek, Laramie &Bhunia,** Fundamentals of Food Microbiology, CRC Press**.**

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)
MODEL QUESTION PAPER B.Sc. BIOTECHNOLOGY
YEAR II – SEMESTER IV (2017-18)

B.Sc., BIOTECHNOLGY

QUESTION PAPER PATTERN

Section – A (20 marks)

1. Most spoilage bacteria grow at
   a. acidic pH
   b. alkaline pH
   c. neutral pH
   d. any of the pH

2. The undesirable change in a food that makes it unsafe for human consumption is referred as
   a) food decay
   b) food spoilage
   c) food loss
   d) all of the above

3.Food preservation involves
   a) increasing shelf life of food
   b) ensuring safety for human consumption
   c) both a and b
   d) none of these

4.Pasteurization is a
   a) low temperature treatment
   b) steaming treatment
   c) high temperature treatment
   d) low and high temperature treatment

5. Common food poisoning microbes are
   a) Clostridium and Salmonella
   b) Clostridium and E.coli
   c) E.coli and Salmonella
   d) Clostridium and Streptococcus

6. Botulism is caused by
   a) clostridium botulinum
   b) all clostridium species
   c) clostridium tetenai
   d) clostridium subtilis

7. Statement 1: All food additives are carcinogenic.
   Statement 2: Food additives must be avoided as far as possible.
   a) True, False
   b) True, True
   c) False, False
   d) False, True

8. A substance intentionally added that preserves flavour and improves taste is called _____
   a) Food additive
   b) Food adulterant
   c) Food contaminant
   d) Food material

9. Who is non toxic to fumigants
   a) insects
   b) humans
   c) microbes
   d) all the above
10. Most common pest in the food processing unit
   a) bandicoots
   b) cockroaches
   c) flies
   d) all the above
11. Food processing unit requires
   a) Sufficient water supply
   b) Pest control management
   c) Convenient plant location
   d) all the above
12. which cannot be found in the food processing unit
   a) meat mincher
   b) fumigator
   c) hot air oven
   d) fermentor
13. What has been banned for tea bag products by FSSAI from 2018?
   a. Use of stapler pins
   b. Thread for dipping
   c. Cloth bag containing the tea leaves
   d. Herbal tea leaves
14. FDA stands for
   a) food and drug authority
   b) food and drug administration
   c) food drug adulteration authority
   d) none of the above
15. FSSAi stands for
   a)food safety and standards authority of India
   b) Food Safety Satisfy All India
   c) Food Safely Storage Authority of India
   d) Food Storage Standards Authority of India
16. **Process control is carried out**
   a) before production
   b) during production
   c) after production control
   d) All of the above
17. Edible vaccines are produced from
   a) genetically modified plant
   b) genetically modified microbe
   c) produced in laboratory
   d) none of the above
18. Which foods use genetically modified organisms in their production to the largest extent?
   a)Cheese
   b)Vegetables
   c) Meat
   d) all the above

19. Which of the following is a biodegradable waste?
    a) Polythene bags
    b) Synthetic fiber
    c) Food waste
    d) Paper
20. Food is a ____ commodity.
    a) global b) local c) national d)state

SECTION – B (5 X 5 = 25 marks)

1. Write a short note on three major food borne pathogens? (or)
   Which organisms are key in food spoilage?
2. Define Food borne disease. (or)
   Write about the role of salt or sugar in food preservation?
3. What is true of food poisoning? (or)
   Write short notes on pest management in food industry?
4. What is FDA? (or)
   Write about the role of QC?
5. Define Solid waste management (or)
   Give an account on Genetically Modified Food?

SECTION – C (3 X 10 = 30 marks)
Any three out of five (open choice)

1. Give an account on of food contaminants ?
2. Write about the importance of food preservation
3. Give an example of plant layout of food industry.
4. Write about FSSA, HACCP
5. Explain the classification & Characterization of waste from food industry

DEPARTMENT OF BIOTECHNOLOGY
ALLIED BIOTECHNOLOGY
SEMESTER IV

PAPER CODE: 17U4BTA04
CREDIT:3 **Hrs/Week : 4**

Aim

To provide a fundamental knowledge about applications of molecular biology and recombinant DNA technology in different field of Science

Objective

- To enhance the basic understanding about plant, animal and microbial culture systems
- To make the students to explore the commercial opportunities of biotechnology in different fields like medicine, environment and industrial aspects.
- **Learning outcome**
- Students are able to understand the potential application in Biotechnology in different fields including plant, animal, medical, industrial and environmental Sciences.

UNIT	CONTENT	HOURS
I	**Plant biotechnology** –Basic principles and techniques in plant tissue culture, Secondary metabolites in plants, Plant growth Hormones, Plant based vectors for gene transfer in plants, transgenic production in plants	**12**
II	**Animal biotechnology**- Animal cell culture techniques: Basic principles and applications. Animal as a bioreactor, Animal viral vectors, Cloning strategies and production of transgenic mice and sheep. *Invitro*fertilization, embryo transfer and Cryopreservation	**12**
III	**Medical biotechnology** – Stem cell technology, Gene therapy, DNA fingerprinting, Production and applications of Monoclonal antibodies, DNA Vaccine, Tissue engineering, Molecular diagnosis.	**12**
IV	**Industrial biotechnology**- Production of microbial products, Production of Antibiotics, Citric acid and Vinegar, Industrial uses of enzymes in detergents, leather, food, beverages and pharmaceutical industries	**12**
V	**Environmental biotechnology-** Genetically modified Microorganisms, Microbial and phyto bioremediation of xenobiotics, Biological weapons, Biogas, Biomass and Single cell proteins.	**12**

Text books

1. Animal biotechnology, **M.M.Ranga**, (2000), Agro bios (India)
2. Introduction to plant biotechnology **Chawla,** 2003(2nd edition) oxford and IBH Publisher
3. Biotechnology, **Satyanarayana.U** (2008), Books and allied (p) Ltd.
4. Biotechnology and Genomics, **Gupta .P.K.** (2004) Rastogi Publication.
5. A Textbook of Biotechnology**, R.C.Dubey**, (2001), Rajendra printer, New Delhi.

Reference books

1. Principles of gene manipulation**, Old and Primrose**, (1989)), 3rd Edition
2. Culture of Animal cells, **R.Ian freshney**, 2000 (4th edition). Wiley-liss.
3. Industrial biotechnology-**A.H.Patel**, Macmillan Publisher, 2005
4. Gene cloning and DNA Analysis, **T.A.Brown** (1996), Blackwell science, osney mead, Oxford.

Cyber source

Plant tissue culture: Current status and opportunities
www.intechopen.com/books/recent-advances-in-plant-in-vitro-culture/plant-tissue-culture-current-status-and-opportunities

Use of Transgenic Animals in Biotechnology: Prospects and Problems

www.intechopen.com/books/recent-advances-in-plant-in-vitro-culture/plant-tissue-culture-current-status-and-opportunities
Stem cell technologies: Basic and applications: https://accessengineeringlibrary.com/browse/stem-cell-technologies-basics-and-applicationsIndustrial enzymes – Present status and future perspective for India. http://nopr.niscair.res.in/bitstream/123456789/17451/1/JSIR%2072%285%29%20271-286.pdf
Industrial Biotechnology and Biomass Industrieshttps://industry.gov.au/industry/IndustrySectors/nanotechnology/IndustrialBiotechnology/Pages/default.aspxGenetically modified organisms https://www.britannica.com/science/genetically-modified-organism

LAB IN ALLIED BIOTECHNOLOGY

PAPER CODE : 17U3BTAP04
CREDIT : 3 Hrs/Week :3

1. Preparation and sterilization of PTC media.
2. Surface sterilization of explants and inoculation
3. Callus induction
4. Micro propagation of explants
5. Preparation of animal cell culture media and sterilization
6. Disaggregation of tissues and Establishment of primary cell culture
7. Cell counting and viability assay
8. RAPD fingerprinting
9. Production of citric acid using *A. niger*
10. Clarification of fruit juice using enzymes (cellulose, pectinase and amylase)
11. Biogas production- Demo
12. Production of SCP

REFERENCE BOOKS

1. R. Ian Freshney and R. Alan. (1987). Culture of Animal Cells. Liss. Inc.
2. G. Shanmugam. (1988). Cell Biology: A Laboratory Manual. Macmillan Publications.
3. Razdan. (2003) Methods in plant tissue culture
4. Jha & Ghosh. (2005). Plant tissue culture: Basic and applied. Orient Blackswan Publishers
5. Gamborg., O. and Phillips, G.(1995) .Plant cell, Organ & tissue culture. Springer Lab Manuals
6. J. Sambrook, E. F. Fritsch & T. Maniatis. (1989). Molecular cloning: A laboratory Manual. Cold Spring Harbour Laboratory.
7. Benson H. J. Microbiology Applications – (A Laboratory Manual in General Microbiology), Wm C Brown Publishers.
8. Cappuccino J.G. and Sherman N., A Laboratory Manual, Addison-Wesley.
9. Pandey, A.: Handbook of plant-based biofuels. In CRC Press, New York, 2009, 297 p. ISBN 978-1-56022-175-3

SEMESTER V

PLANT BIOTECHNOLOGY

Paper	: Core V	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 17U5BTC05	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: **17U5BTC05**	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	b. 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.Micro shoot	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. *vir* A,B	b. *vir* G,C	c.*vir* D,E	d. All the above

10. Which of the following are used as selection marker for the cells transformed with *Agrobacterium*?			
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**	

ANIMAL BIOTECHNOLOGY

Paper	: Core VIII	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 17U5BTC06	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, Rabbies 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 Biotehcnology First Supplement, Pregamon press, Oxford, 1989.
3. Rossant J. and Pederson R.A. Experimental approaches to Mammalian Embryonic Development, Cambdrige 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: **17U5BTC06**	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 PLANT BIOTECHNOLOGY

Paper	: CORE PRACTICAL V	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 3	Internal	: 40
Paper Code	: 17U5BTCP05	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: **17U5BTCP05**	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**	

LAB IN ANIMAL BIOTECHNOLOGY

Paper	: CORE PRACTICAL VI	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 3	Internal	: 40
Paper Code	: 17U5BTCP06	External	: 60

PREAMBLE

To make students familiar on basic animal tissue culture techniques and handling of animal cell lines and its establishment.

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 animal tissue culture laboratory and preparing various tissue culture media	**K1, K2 & K3**
CO2		**K4, K5, & K6**
CO3		**K4 & K5**
CO4		**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 genomic DNA from animal tissues	**5**
2	Culturing of chick embryo fibroblast cells (Preparation of monolayer)	**5**
3	Disintegration of animal tissues using trypsin (trypsinization)	**10**
4	Viability test and cell counting	**5**
5	Preparation of animal cell culture media	**10**
6	Preparation and sterilization of BSS & DMEM	**10**

7	Single cell suspension culture	**10**
8	Inoculation and cultivation of animal viruses in embryonated egg (Ave)	**5**
9	Sterilization of animal cell culture media by membrane filtration technique	**10**
10	Observation & Characterization of Different types of cell lines (MCF-7, HEP G-2, HeLa & Vero)	**5**

MODEL QUESTION PAPER (LAB IN ANIMAL BIOTECHNOLOGY)

NAME OF THE COURSE: **LAB IN ANIMAL BIOTECHNOLOGY**	COURSE CODE: **17U5BTCP05**	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 animal tissue sample (A) (OR)			
(ii) Perform chick embryo fibroblast culture from the given embryo sample (A) (OR)			
(iii) Determine the viability of the given suspension culture sample (A) and total number of cells.			
MINOR EXPERIMENT			
Exp: 6	Obs: 2	Res: 2	Total: **10 MARKS**
2. (i) Perform single cell suspension culture of the given tissue sample (B) (OR)			
(ii) Inoculate the given infectious sample (B) in the given embryonated egg by appropriate route (OR)			
(iii) Disintegrate the given monolayer sample (B) by appropriate enzymatic 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

BIOPROCESS TECHNOLOGY

Paper	: ELECTIVE I	Total Hours	: 75
Hours/Week	: 4	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: 17U5BTE01	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 (*Spirullina* & *Chlorella*). Mass production of Biofertilizer (*Rhizobium* & *Azolla*). Mushroom cultivation (Milk and button mushroom). Production and applications of Biopesticide (*Bacillus thuringiensis*).	**15**

SUGGESTED READINGS:

1. Peppler 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: **17U5BTE01**	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. *Lactobacillus*	b. *E.coli*	c. *Saccharomyces cerevisiae*	d. *Bacillus* 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. . *Bacillus thuringiensis* 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. *Spirullina* is a ----------

a. Edible fungus b. Bio fertilizer c. Biopesticidal d. Single cell protein

19. What is the scientific name of mushroom?

a. *Funaria* sp. b. *Dryopteris* sp. c. *Agaricus campestris* d. *Fergus* sp.

20. Agar-Agar is obtained from ----------

a. Diatoms b. *Gracilaria* c. *Fomes* d. *Laminaria*

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 *Bacillus thuringiensis.*

SBEC – III

LAB IN BIOINFORMATICS

Paper	: SBEC III	Total Hours	: 30
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 17U5BTS03	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: **17U5BTS03**	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**	

SEMESTER VI

NANOBIOTECHNOLOGY

Paper	: CORE VII	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 17U6BTC07	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.	**15**
II	**Nanomaterials and its properties**: Carbon nanotubes and nanorods, Quantom dots, metal based nanostructures (Iron oxide nanoparticles), nanowires, polymer based nanostructures (dendrimers), Gold nanostructures (nanorods, nanocages, nanoshells), nanocomposites.	**15**
III	**Fabrication and Analysis of biomolecular nanostuructures:** Atomic Force Microscopy, Scanning Probe Electron Microscopy and Lithography. Nanoscale detection: Lab on a Chip. Fabrication of bionanochip & microarray technology.	**15**

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.	**15**
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.	**15**

SUGGESTED READINGS:

1. Nanobiotechnoogy: 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 (NANOBIOTECHNOLOGY)

NAME OF THE COURSE: **NANO BIOTECHNOLOGY**	COURSE CODE: **17U6BTC07**	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 taniquchi	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 *E.coli* 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 thes 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 RBCis_____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

ENVIRONMENTAL BIOTECHNOLOGY

Paper	: CORE VIII	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 17U6BTC08	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: **17U6BTC08**	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. 5th June 1992	b. 5th August 1992	c. 5th June 1995	d. 5th 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. Comamonas denitrificans *b. Brachymonas denitrificans* *c. Aeromonas hydrophila* *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. Eisenia foetida *b. Lumbricus terrestris* *c. Lumbricus rubellus* *d. Perionyx excavatus*

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 (OR)
B) Write short notes on endangered and threatened species

22. A) Write short notes on cryopreservation (OR)
B) Write short notes on Biodiversity Conservation

23. A) Write short notes on Bioleaching of heavy metals (OR)
B) Write short notes on Commercial biosorbents

24. A) Write short notes on activated sludge treatment (OR)
B) Write short notes on percolating filters

25. A) Write short notes on composting systems (OR)
B) Write short notes on vermicomposting

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**	

LAB IN BIOPROCESS TECHNOLOGY AND ENVIRONMENTAL BIOTECHNOLOGY

Paper	: Core Practical VII	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 40
Paper Code	: 17U6BTCP07	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 agro based 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 and estimation of alcohol from grapes	**5**
3	Immobilization of amylase by entrapment method	**5**
4	Production and estimation of citric acid from *Aspergillus* species	**5**
5	Quality analysis of milk by MBRT test	**5**
6	Enumeration of microorganisms from soil, water and air	**5**
7	Estimation of BOD of water sample	**5**
8	Determination water potability	**5**
9	Determination total suspended particles from water	**5**
10	Determination of total dissolved oxygen in water	**5**

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

NAME OF THE COURSE: **LAB IN BIOPROCESS TECHNOLOGY AND ENVIRONMENTAL BIOTECHNOLOGY**	COURSE CODE: **17U6BTCP07**	DURATION: **6Hrs**
MAX MARKS: 60		

MAJOR EXPERIMENT			
Exp: 12	Obs: 5	Res: 3	Total: **20 MARKS**
1. (i) Enumeration of microorganisms from bread sample (A) (OR)			
(ii) Estimate the amount of alcohol from the given grape sample (A) (OR)			
(iii) Estimate the amount of BOD of from the given water sample *(*A)			
MINOR EXPERIMENT			
Exp: 6	Obs: 2	Res: 2	Total: **15 MARKS**
2. (i) Determine the total suspended particles from the given water sample (B) (OR)			
(ii) Determine the total dissolved oxygen content from the given water sample (B) (OR)			
(iii) Immobilize amylase enzyme from the given crude enzyme 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

ENZYMOLOGY AND ENZYME TECHNOLOGY

Paper	: Elective II	Total Hours	: 75
Hours/Week	: 4	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: 17U6BTE02	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 (ENZYMOLOGY AND ENZYME TECHNOLOGY)

NAME OF THE COURSE: **ENZYMOLOGY AND ENZYME TECHNOLOGY**	COURSE CODE: **17U6BTE02**	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 KM value with constant Vmax?
    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. Tryspin b. Papain c. Amylase d. Protease

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

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

SBEC - IV

BIOSAFTEY, BIOETHICS & IPR

Paper	: SBEC-IV	Total Hours	: 40
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 17U6BTS04	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.	**8**
II	Biosafety Guidelines: Guidelines and regulations (Cartegana Protocol). Definition of GMOs & LMOs. Roles of Institutional Biosafety Committee, RCGM, GEAC.	**8**
III	Intellectual Property Rights: Introduction to IPR, Types of IP - Patents, Trademarks, Copyright & Related Rights, Importance of IPR – patentable and non patentables.	**8**
IV	Patents and Patent Laws: Objectives of the patent system - Basic, principles	**8**

	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.	**8**

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: **17U6BTS04**	DURATION: **3 Hrs**
MAX MARKS: **75**		

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

a. Innovator b. Brand owner c. Teacher d. Copyright holder

15. Intellectual property not refers to creations of the mind

a. Hard b. Inventions c. Literary and artistic works d. Names

16. Which one is comes under type of intellectual property (IP)?

a. Copyright b. Patent c. Trademark d. All the above

17. Mathematical algorithms are--------

a. Patenta b. Non patentable c. Both d. None of the above

18. Software is a -------

a. Patenta b. Non patentable c. Both d. None of the above

19. Patentable biotechnological inventions is ----------

a. Prote b. DNA sequences c. Both of the (a) and (b) d. None of the above

20. 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. (OR)
B) explain different types of sterilization methods.

22. A) What is institutional committe and their roles? (OR)
B) Explain RCGM and GEAC?

23. A) explain object of Intellectual property law? (OR)
B) Explain the importance of IPR?

24. A) Write a note on benefits of patent. (OR)
B) explain patentable and non-patentable biotechnological inventions?

25. A) define bioethics, explain purpose and scope of bioethics? (OR)
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.

NMEC - I BIOSAFTEY, BIOETHICS & IPR

Paper	: SBEC-IV	Total Hours	: 40
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 15U5BTN01	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.	**8**
II	Biosafety Guidelines: Guidelines and regulations (Cartegana Protocol). Definition of GMOs & LMOs. Roles of Institutional Biosafety Committee, RCGM, GEAC.	**8**
III	Intellectual Property Rights: Introduction to IPR, Types of IP - Patents, Trademarks, Copyright & Related Rights, Importance of IPR – patentable and non patentables.	**8**
IV	Patents and Patent Laws: Objectives of the patent system - Basic, principles	**8**

	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.	**8**

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: 15U5BTN01	DURATION: **3 Hrs**
MAX MARKS: **75**		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS			
21. Bio-related research activities may not involve ----------			
e. Micro organisms	f. Animal cells	g. Plant cells	h. All
22. A pathogen that is unlikely to cause any disease in humans or animals			
e. Risk group I	f. Risk group II	g. Risk group III	h. Risk group IV
23. *Korean hemorrhagic* fever is example for ----------			
e. Risk group II	f. Risk group III	g. Risk group IV	h. Risk group I
24. Physical containment is achieved by ---------			
e. One type	f. Two types	g. Three types	h. Four types
25. Which one of the following is not relevant to sterilization technique?			
e. Ethanol	f. Incinerator	g. Microscope	h. Autoclave
26. Cartagena Protocol on Biosafety to the Convention on Biological Diversity came with effect from ----------			
e. 11 September 2003	f. 12 September 2003	g. 11 September 2004	h. 12 September 2004
27. Each Institutional Biosafety Committee has a nominee for ----------			
e. DST	f. DBT	g. UGC	h. ICAR
28. How many RCGM meeting held in 2018?			
e. 7	f.8	g. 9	h. 6
29. The RCGM shall not include the following representative			
e. DBT	f.ICMR	g. UGC	h. CSIR
30. GEAC established under			
e. MoEF &	f. UGC	g. DBT	h. DST
31. Trade name is otherwise called as -------			
e. Patent	f. Model	g. Business name	h. Trademark
32----------is any information of commercial value concerning production			
e. Trade	f. Trade Secret	g. Patent	h. Industrial Design
33. IPR initially started in North Italy during the ----------			
e. Renaissance era. In	f. Renaissance era. In 1472	g. Renaissance era. In 1473	h. Renaissance era. In 1474
34. Protection of IPR not allow the following			

e. Innovator	f. Brand owner	g. Teacher	h. Copyright holder

35. Intellectual property not refers to creations of the mind

e. Hard	f. Inventions	g. Literary and artistic works	h. Names

36. Which one is comes under type of intellectual property (IP)?

e. Copyright	f. Patent	g. Trademark	h. All the above

37. Mathematical algorithms are--------

e. Patenta	f. Non patentable	g. Both	h. None of the above

38. Software is a -------

e. Patenta	f. Non patentable	g. Both	h. None of the above

39. Patentable biotechnological inventions is ----------

e. Prote	f. DNA sequences	g. Both of the (a) and (b)	h. None of the above

40. Early founders of bioethics put forth four principles which form the framework for moral reasoning

e. 4	f. 3	g. 2	h. 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.	(OR)
22. A) What is institutional committe and their roles? B) Explain RCGM and GEAC?	(OR)
23. A) explain object of Intellectual property law? B) Explain the importance of IPR?	(OR)
24. A) Write a note on benefits of patent. B) explain patentable and non-patentable biotechnological inventions?	(OR)
25. A) define bioethics, explain purpose and scope of bioethics? B) Explain perspectives and methodology of bioethics?	(OR)

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.

NMEC – I

BIOINFORMATICS

Paper	: NMEC I	Total Hours	: 40
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 17U5BTN02	External	: 75

PREAMBLE

To make students on understanding the basic concepts biological soft wares and their applicability in enhancing the need based quality of living systems

COURSE OUTCOMES

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

COs	Outcome	CPD
CO1	To understand basic knowledge of nucleic acid sequence databases	**K1, K2 & K3**
CO2	To understand the concepts of specialized databases	**K2, K3 & K4**
CO3	To understand the basic concepts of sequence analysis and sequence alignment	**K2, K3 & K4**
CO4	To understand the concepts of gene prediction methods through *insilico* approaches	**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	Bioinformatics – Biological Databases- Nucleic acid sequence databases – GenBank/NCBI, EMBL, and DDBJ. Protein sequence databases – UniprotKB and PIR, Structure databases – PDB, CATH and SCOP.	**8**
II	Specialized Databases – BLOCKS, PRINTS and Pfam, Microarrays- Microarray data analysis, Proteomic data Analysis.	**8**
III	Sequence Analysis- sequence alignment, Dot plot, pairwise Sequence Alignment- Local alignment and Global alignments- Dynamic programming algorithm for sequence alignment, Scoring matrices, gap penalties.	**8**
IV	Multiple sequence alignment- scoring methods-clustal W- Phylogenetic	**8**

	Analysis- tree construction methods- Maximum likelihood and maximum parsimony- distance methods- Database similarity search- Basic Local Alignment search tool (BLAST).	
V	Gene prediction methods – ORF finder, Restriction site analysis. Protein secondary structure prediction –Comparative Modeling -Drug Designing– - Molecular Docking	**8**

SUGGESTED READINGS:

1. Bioinformatics: Sequence, Structure and Databanks: A Practical Approach (The Practical Approach Series, 236), Des Higgins (Editor), Willie Taylor. 1st edition, October 2000, Oxford University Press. ISBN: 978-0199637904.
2. Bioinformatics: Sequence and Genome Analysis, David W. Mount. 2nd edition, June 2004, Cold spring harbor laboratory press. ISBN: 978-0879697129
3. David, H. M. 2005. Bioinformatics. Second edn. CBS Publishers, New Delhi.
4. David, R., Westhead, J., Howard, P. and Richard, M., and Twyman. Instant Notes-Bioinformatics Viva Books Private Limted, Chennai.
5. Gribskov, M., Devereux, J. 1989. Sequence analysis primer. Stockton Press.
6. Introduction to Bioinformatics, Teresa Attwood, David Parry-Smith, 1st edition, May 2001, Pearson Education. ISBN: 978-8178085074
7. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Second Edition, Andreas D. Baxevanis, B. F. Francis Ouellette. 3nd edition, October 2004, A John Wiley & Sons, Inc., Publication. ISBN: 978-0471478782.
8. Seizberg, S. L., Searls, D. B. and Kasif, S. 1998. Computational methods in Molecular biology now comprehensive Biochemistry. Elsevier.

MODEL QUESTION PAPER (BIOINFORMATICS)

NAME OF THE COURSE: **BIOINFORMATICS**	COURSE CODE: **17U5BTN02**	DURATION: **3 Hrs**
MAX MARKS: 75		

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

1. A single piece of information in a database is called ----------

a. File	b. Field	c. Record	d. Data set

2. Which of the following is a nucleotide sequence database?

a. EMBL	b. SWISPOT	c. PROSITE	d. TREMBL

3. BLAST Programme is used for ----------

a. DNA Sequence	b. Protein sequence	c. DNA barcoding	d. Sequence analysis

4. The BLAST program was developed on _____

a. 1992	b. 1995	c. 1990	1991

5. Phylogenetic analysis is a ----------

a. Dendrogram	b. Genbank	c. Data retrieval Tool	d. Data Searching tool

6. Which of the following is a part of the statistical test of sequences?

a. An optimal alignment between two chosen sequences is obtained at the end	b. Unrelated sequences of the same length are then generated through a randomization process	c. Unrelated sequences of the different length are then generated through a randomization process	d. Related sequences of the same length are then generated through a randomization process

7. Clustal W is a ----------

a. Multiple sequence alignment tool	b. Protein secondary structure prediction tool	b. Data retrieval tool	c. ORF finder

8. The procedure to align many sequences simultaneously is called ----------

a. Multiple sequence alignment	b. Pairwise alignment	c. Global alignment	d. Local alignment

9. Which one is specially made for protein data base?

a. DDBJ	b. EMBL	c. PIR	d. Genbank

10. Genbank maintained by ----------

a. DDBJ	b. EMBL	*c.* Swissport	d. NCBI

11. Submission of sequences to genbank through ----------

a. Bankit b. Sequin b. A & b c. None of the above

12. The final step involves pairwise alignment by extending from the words in both directions while counting the ---------- using the same substitution matrix

a. Dock score b. Alignment score c. Both a & b d. None of the above

13. Which of the following is not a variant of BLAST?

a. BLAST N b. BLAST P c. BLAST X d. TBLAST X

14. Phylogenetics is the study of the evolutionary history of living organisms using treelike diagrams to represent ---------- of these organisms

a. Distance matrix b. Maximum likelihood c. Pedigree d. Maximum parsimony

15. When the two domains are located in two different proteins, to preserve the same functionality, their close ---------- have to be preserved as well.

a. Solubility and Polarity b. Proximity and interaction c. Bond length and Bond energy d. 'N' and 'C' terminals

16. Which of the following is not true regarding the STRING?

a. Search Tool for the Retrieval of Interacting Genes/Proteins b. Functional associations include only the direct protein-protein interactions c. It is based on combined evidence of gene linkage, gene fusion and phylogenetic profiles d. It is a web server that predicts gene and protein functional associations

17. If the two sequences share significant similarity, it is extremely _____ that the extensive similarity between the two sequences has been acquired randomly, meaning that the two sequences must have derived from a common evolutionary origin

a. Unlikely b. Possible c. Likely d. Relevant

18. Which of the following is incorrect regarding sequence homology?

a. Two sequences can homologous relationship even if have do not have common origin b. It is an important concept in sequence analysis c. When two sequences are descended from a common evolutionary origin, they are said to have a homologous relationship d. When two sequences are descended from a common evolutionary origin, they are said to share homology

19. Which of the given statements is incorrect about Microarray (or microchip) analysis?

a. It is a new technology in which all of the genes of an organism are represented by oligonucleotide sequences spread out in an 80 x 80 array on microscope slides b. The oligonucleotide sequences cannot be synthesized directly on the slide c. The oligonucleotides are collectively hybridized to a labeled cDNA library prepared by reverse-transcribing mRNA from cells d. The amount of label binding to each oligonucleotide spot reflects the amount of mRNA in the cell

20. Other types of evidence for a relationship between two genes are also given that are not dependent in sequence similarity. These include _____

a. Genes are closely linked on the same chromosomes b. Genes are transcribed from the same DNA strand c. Gene fusions are observed between otherwise separate genes

SECTION – B (5 X 5 = 25 MARKS) ANSWER ALL THE QUESTIONS	
21. A) Write an short Biological Database B) Explain the NCBI data base	(OR)
22. A) Give an account on BLOCKS, PRINTS B) Explain the application of Pfam	(OR)
23. A) Write short note on sequence alignment B) Briefly define Scoring matrices	(OR)
24. A) Write short notes on Phylogenetic Analysis B) Write about database similarity search	(OR)
25. A) Explain ORF finder B) Explain the steps involved in Restriction site analysis	(OR)

SECTION – C (3 X 10 = 30 MARKS) ANSWER ALL THE QUESTIONS
26. Give a detailed account on Biological databases
27. Explain elaborately about the types of Biological data bases
28. Give a detailed account on BLAST
29. List out the difference between Local alignment and Global alignments
30. Give a detailed account on Molecular Docking

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

NMEC – II

CONCEPTS OF BIOTECHNOLOGY

Paper	: NMEC II	Total Hours	: 40
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: **17 U3BTN03**	External	: 75

PREAMBLE

To make non major life science students in understanding basic and applied principles of biotechnology and its technical approach in society in generating value added, reliable and reproducible products.

COURSE OUTCOMES

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

COs	Outcome	CPD
CO1	To understand the scope and application of biotechnology	**K1, K2 & K4**
CO2	Use of enzymes in generating basic recombinant DNA concepts	**K2, K3 & K4**
CO3	Use of plasmid vectors in experimenting and designing cloning Strategies	**K3, K4 & K5**
CO4	Use molecular techniques of the identification of positive recombinant clones	**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	Scope of Biotechnology: History of Biotechnology; Conventional and modern Biotechnology – Biotech industries. Biotechnology tree. Strategies for gene cloning.	**8**
II	Tools used in gene cloning – Restriction endonucleases – Types – Features. Ligases – linkers, adaptors and homopolymer tailing. Modifying enzymes	**8**
III	Vectors-properties of good vector. Constructed plasmids-pBR 322. Cosmid vectors, Animal vectors-SV40. Plant vectors – Ti derivatives	**8**
IV	Introduction of genes – vector mode – transformation and transfection. Vector less mode – Biolistics, Electroporation, Microinjection	**8**
V	Selection of recombinants, Markers – PCR, RFLP, RAPD and blotting techniques	**8**

SUGGESTED READINGS:

1. Principles of gene manipulations. Old and Primrose (1989), 3rd edition.
2. Biotechnology, Sathyanarayana U (2008), Books and Allied (p) ltd.
3. Biotechnology and genomics, Gupta PK (2004). Rastogi publications.
4. Gene cloning and DNA analysis. Brown TA. (1996). Blackwell science, Osney Mead, Oxford.
5. A text book of Biotechnology, Dubey RC (2007). S.Chand & Company Ltd, New Delhi.
6. Biotechnology, Singh BD (2004). Kalyani Publications. New Delhi.

MODEL QUESTION PAPER (CONCEPTS OF BIOTECHNOLOGY)

NAME OF THE COURSE: **CONCEPTS OF BIOTECHNOLOGY**	COURSE CODE: **17 U3BTN03**	DURATION: **3 Hrs**
MAX MARKS: 75		

SECTION – A (1 X 20 = 20 MARKS) ANSWER ALL THE QUESTIONS			
1. The following is not a branch of Biotechnology ----------			
a. Genetic engineering	b. Tissue culture	c. Physiology	d. Microbiology
2. Cell theory was proposed by_____			
a. Schleiden and Schwann	b. Robert Hooke	c. Leeuwen Hooke	d. Beetle and Tatum
3. DNA recombinant technology is also called as_____			
a. Gene manipulation	b. Totipotency	c. Splicing	d. Gene cloning
4. The PCR technique was developed by_____			
a. Karry mullis	b. Kohler	c. Milstein	d.Altman
5. Gene cloning means _____			
a. Production of mutated genes	b. Production of wild genes	c. Production of dominant genes	d. Production of large population of desired DNA fragment
6. A small circular DNA present in bacterial cells are called as ----------			
a. Enzyme	b. Ribosomes	c. Plasmids	d. Vector
7. For cloning, DNA samples are taken from ----------			
a. Same individual	b. Different individual	c. Different species	d. None of the above
8. The function of Restriction enzyme is to ----------			
a. Cut the DNA	b. Join the DNA	c. Amplify the DNA	d. None of the above
9. Who discovered the restriction enzymes?			
a. Natham & Arber and smith	b. Watson & Crick	c. Boyer & Cohen	d. Paul & Berg
10. Which organism has the highest number of vectors?			
a. Yeast	b. Mammalian cells	*c. E.coli*	d. Fungi
11. Boliver and Rodriguez constructed which vectors ----------			
a. P^{uc8}	b. Y^{ip7}	c. P^{BR322}	d. M^{13}
12. How many set of antibiotics resistance does the plasmids PBR322 carry?			
a. 1	b. 2	c.3	c. Nothing
13. Cosmids vectors are used for ----------			

a. Cloning a small fragments	b. Cloning a large fragments	c. Cloning prokaryotes	d. Cloning eukaryotes

14. Single stranded vectors are useful ----------

a. For sequencing of cloned DNA	b. For oligo nucleotide directed mutagenesis	c. For probe preparation	d. All the above

15. Chemicals used for gene transfer method ----------

a. Polyethylene	b. Dextran	c. Calcium chloride	d. All the above

16. Polymerase used for PCR is extracted from?

a. E.coli	*b. Bacillus sp*	*c. Thermos aquaticus*	*d. Saccharomyces cerevisiae*

17. At which temperature does the DNA is denatured during PCR?

a. 60ºC	b. 54ºC	c.74ºC	d.94ºC

18. Molecular markers include _____

a. RAPD	b.AFLP	c.AFLP	d. All of these

19. Western blotting is the techniques for the detection of ----------

a. Specific RNA in a sample	b. Specific DNA in a sample	c. Specific protein in a sample	d. Specific glycolipids in a sample

20. What is probe?

a. Chemically synthesized DNA	b. Purified DNA	c. Fragmented DNA duplex	d. Either purified or synthesized single single stranded DNA

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

21. A) Write history of biotechnology
B) Write a short note on biotechnology tree
22. A) Explain ligases enzymes
B) Notes on homopolymer tailing
23. A) Explain the properties of good vectors
B) Explain cosmid vectors
24. A) Write notes on bio plastics
B) Explain microinjection methods
25. A) Write notes on RFLP
B) Application on RAPD

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

26. Write the essay strategies of gene cloning
27. Explain the types and functions restriction enzymes
28. Write the essay P^{BR322} and uses of this vector
29. Write a essay on gene transfer methods
30. Explain PCR principle methodology and applications