

MANONMANIAM SUNDARANAR UNIVERSITY

TIRUNELVELI- 627 012

TAMILNADU,INDIA



M.Sc. MICROBIOLOGY

(FOR AFFILIATED COLLEGES)

CURRICULUM

(Effective from the academic year 2017-2018 onwards)

MANONMANIAM SUNDARANAR UNIVERSITY

ABHISHEKAPATTY, TIRUNELVELI- 627 012, TAMILNADU, INDIA

M.SC. MICROBIOLOGY (CBCS PATTERN)

FOR AFFILIATED COLLEGES

(EFFECTIVE FROM THE ACADEMIC YEAR 2017-2018 ONWARDS)

REGULATIONS OF SYLLABUS

1. General objectives

The prime objectives of the M.Sc. Microbiology programme is focused to impart an advanced knowledge prevailing currently among the different branches of Microbiology; to enable and instill in students an in-depth knowledge on various field applications of high utility prevailing in industries and research organizations; to imbibe and infuse the radiance of self - confidence in independent research work and ensure a fair knowledge on the current technological developments so as to enable them from employment view point in the newly emerging fields of research and industrial advancements and for the betterment of society at large.

2. Credits

The term credit is used to describe the quantum of syllabus for various programmes in term of study. It indicates differential weightage given according to the contents and duration of the courses in the curriculum design. The total number of credits for a master's programme is 104.

3. Core and elective courses

Every student admitted to PG course shall undertake 24 courses, of which 13 courses will be core theory papers, 2 courses will be elective papers, 1 course will be project and 8 practical courses.

4. Course regulation and syllabus course objectives

The course objectives for M.Sc. Microbiology are as follows:

- a. To provide the students a rock solid foundation with an in-depth knowledge and scientific applications of microbiology in variegated fields.
- b. To generate a level of confidence, instill an analytical mind, create an aptitude for creativity and critical thinking towards an independent research work and leadership quality.
- c. To provide a platform for intellectual curiosity towards scientific development in the field of microbial technology.
- d. To enable in them the levels of self-reliance in the emerging fields of industrial development through self-sustenance.
- e. Provide a foundation for an interdisciplinary work which should support the students seeking entry to every industry.
- f. To fulfill the demand of the students, basic subjects in botany and zoology have been included as open elective along with basic practicals (Refer the Table given below) in order to pave way to write NET / SLST / SLET and other competitive exams.
- g. Provide a base line exposure to multi-scientific fields of Microbiology / Biotechnology / Immunology / Genetics / Molecular Biology / Environmental Sciences / Physiology / Clinical Sciences on par with Zoology and Botany subjects so that they can handle students at secondary and higher secondary levels at schools / colleges with an advanced knowledge on lessons incorporated in school / college texts.

TABLE: LIST OF PAPERS OFFERED FOR OPEN ELECTIVE

NO	SEMESTER I	SEMESTER II
	ANNEXURE - I [#]	ANNEXURE - II [#]
1	Plant Diversity I: Algae, Fungi and Bryophytes	Plant Diversity II: Pteridophytes, Gymnosperms and Palaebotany
2	Anatomy, embryology and morphogenesis	Plant physiology and ecology
3	Invertebrata	Chordata
4	Environmental biology and Biodiversity	Biophysics and Biostatistics
5	Apiculture	Aquaculture
6	Biochemical techniques and Instrumentation	Biodegradation and remediation

List of practicals for every subject given in the Annexure I & II are also attached behind the elective theory syllabus, they should also be done along with the experiments connected with the core papers, based on the selection of the elective paper by the college.

5. Eligibility for admission to the course and examination

Candidates shall be admitted to the course provided if he / she has obtained a bachelor's degree in science in Microbiology / Biotechnology / Advanced Zoology and Animal Biotechnology / Plant science and Biotechnology / Zoology / Botany / Biochemistry / Biology / Life Science / Nutrition and Dietetics / B.S.M.S. / B.A.M.S. / B.U.M.S. / B.Sc., in MLT / B.E or B.Tech in Biotechnology / Bioengineering / Bio medical sciences / B.Sc., in Nursing / Genetics / Agriculture / Industrial Microbiology / Immunology / Molecular biology / Environmental Science / Virology / Bioinformatics or any other degree that may be considered as equivalent top by the Manonmaniam Sundaranar University.

6. Qualification norms for the appointment of Assistant Professor

Candidates fulfilling the following conditions shall be appointed as Asst. Professor.

- i) A M.Sc., / M.Phil degree in Microbiology / Applied Microbiology discipline (55% minimum) with Ph.D. or UGC-NET/ SLST / SLET.

7. Medium of instruction and examination

The medium of instruction as well as examination will be in English

Theory examination

The external evaluation will be based on the examination to be conducted by the university at the end of each semester.

Practical examination

Practical examinations will be conducted at the end of every semester.

8. Evaluation

A. Each paper carries an internal component

B. There is a pass minimum of 50% for P.G. external and overall components

Theory: External : internal Assessment = 75:25

Practical: External : Internal Assessment = 50:50

C. Internal Assessment

Regarding the internal assessment, 25 marks are allocated in the following manner

COMPONENTS	MARKS
The average of the best two tests from the 3 compulsory tests	15 Marks
Assignment	05 Marks
Seminar	05 Marks
Total	25 Marks

Note: Each test will be of one hour duration

D. Internal marks for practical shall be allotted in the following manner

COMPONENTS	MARKS
Experimental works and other lab oriented and knowledge enrichment activities	20 Marks
Record	10 Marks
Model test	20 Marks
Total	50 Marks

E. Project work

COMPONENTS	MARKS
Internal	25 Marks
Dissertation	25 Marks
Presentation	25 Marks
Viva-voce	25 Marks
Total	100 Marks

Note:

- i) Student should carry out **INDIVIDUAL PROJECTS** only
- ii) Project shall be allotted at the beginning of the IV semester.
- iii) In house projects are encouraged.
- iv) Students may be allowed to carry out the project work in other research institutes.
- v) Faculty members of the respective colleges must serve as guides
- vi) Co- guides from the other institutions may be allowed.
- vii) Project report evaluation will be done and Viva-voce will be conducted by both the external examiner and the guide at the end of the **FOURTH SEMESTER** itself.
- viii) Dissertation in **THREE** copies have to be submitted 15 days before the actual schedule of the exam.
- ix) **Evaluation of dissertation** has to be done by the external examiner appointed by the University for **50 Marks**.

G. The performance of the students are indicated by the SEVEN POINTS SCALE GRADING SYSTEM as per the UGC norms given below

GRADE GRADE POINT PERCENTAGE OF PERFORMANCE MARKS

O	9.5 and Above	95-100	Outstanding
E	8.5 and Above	85-94	Excellent
D	7.5 and Above	75-84	Distinction
A	7.0 and Above	70-74	Very Good
B	6.0 and Above	60-69	Good
C	5.0 and Above	50-59	Average
RA	0	Upto 49	Re-Appear

H. The overall performance level of the candidates will be assessed by the following formulae:

$$\text{Cumulative weighted average of marks} = \frac{\sum(\text{marks} \times \text{credits})}{\sum \text{credits}}$$

$$\text{Cumulative weighted average grade points} = \frac{\sum(\text{Grade points} \times \text{Credits})}{\sum \text{Credits}}$$

H. Industrial Visit

Academic visits to institutions and industries related to the courses during the semesters of study will form part of the curriculum to strengthen the understanding of concepts and applications taught theoretically and practically. This kind of visits will be a boon to collect specimens and samples, to understand the scope and avenues of different subjects studied by students and the expectations of the organisation, who are employing them after the completion of the degree. Based on the needs, students could develop the required skills. Staff accompanying the students should be given non-remunerative OD for such visits.

9. The question paper pattern for all theory papers shall be as follows

SECTION	TYPE OF QUESTIONS	MARKS
Part –A	Multiple choice question (Two question from each unit) 5x2	1x10 = 10 Marks
Part – B	Internal choice questions (one question from each unit) 5x1	5x5 = 25 Marks
Part – C	Internal choice questions (one question from each unit) 5x1	8x5 = 40 Marks
	Total	75 Marks

10. The question paper pattern for all practical papers shall be as follows

Practical time: 9 hours

Max. Marks: 50

NO	COMPONENTS	MARKS
1	Major experiment	15 Marks
2	Minor experiment	10 Marks
3	Experimental procedure	05 Marks
4	Identification of spotters	10 Marks
5	Record	05 Marks
6	Viva-voce	05 Marks
	Total	50 Marks

MANONMANIAM SUNDARANAR UNIVERSITY

Tirunelveli – 627012, INDIA

M.Sc., Microbiology (Colleges)

SEMESTER SYSTEM WITH CREDITS (CBCS PATTERN)

SYLLABUS

(SCHEME OF EXAMINATION)

(EFFECTIVE FROM THE ACADEMIC YEAR 2017-2018 ONWARDS AND THEREAFTER)

SEM	SUB NO	SUBJECT STATUS	SUBJECT TITLE	CONTACT Hrs/week	L Hrs/week	T Hrs/week	P Hrs/week	C credits
I	1	Core	.General Microbiology & Diversity	4	1	3	0	4
	2	Core	.Biochemistry	4	1	3	0	4
	3	Core	.Physiology &Metabolism	4	1	3	0	4
	1	Open Elective	Open Elective 1: Choose any one from Annexure I	3	1	2	0	3
	1	Practical	. Practical – I	10	0	0	10	5
	2	Practical	. Practical – II	10	0	0	10	5
II	4	Core	.Molecular Biology	4	1	3	0	4
	5	Core	. Immunology	4	1	3	0	4
	6	Core	. Virology	4	1	3	0	4
	6	Open Elective	Open Elective 2: Choose any one from Annexure II	3	1	2	0	3
	2	Practical	. Practical – III	10	0	0	10	5
	3	Practical	. Practical – III	10	0	0	10	5
III	7	Core	.Bioinformatics and Biostatistics	4	1	3	0	4
	8	Core	.Medical &Pharmaceutical Microbiology	4	1	3	0	4
	9	Core	.Environmental & Agricultural Microbiology	4	1	3	0	4
	10	Core	. Research Methodology	4	1	3	0	4
	5	Practical	. Practical – V	10	0	0	10	5
	6	Practical	. Practical – IV	10	0	0	10	5
IV	11	Core	.Food Microbiology	4	1	3	0	4
	12	Core	.Fermentation &Industrial Microbiology	4	1	3	0	4
	13	Core	.Biotechnology	4	1	3	0	4
	1	Project(Dissertation)	Project	12	0	0	12	6
	7	Practical	. Practical – VII	10	0	0	10	5
	8	Practical	. Practical – VIII	10	0	0	10	5

Based on the open elective paper selected (Table - 1), the relevant practicals listed following the open elective theory papers should be merged with concerned semester practicals at last.

First Year I Semester 1 Core - Credits 4
Theory

GENERAL MICROBIOLOGY AND DIVERSITY

SUB CODE:

L T P C

4 0 0 4

Unit: I

Evolution of Microorganisms & Microbiology: Members of the microbial world, Microbial evolution, Microbiology & its origin and microbiology today - Scope, history & development of Microbiology –Characterization, Classification (Haeckel, Whittaker and Carl Woese) and Identification of Microorganisms – Comparison of bacteria, archaea&eukarya – Introduction to taxonomy : phenotypic classification, phylogenetic classification, genotypic classification, taxonomic ranks – Techniques for determining microbial taxonomy & phylogeny: Classical & molecular characteristics - Genetic relationship - DNA homology -16S r RNA sequencing - Phylogenetic tree - Bergey's manual of systematic bacteriology.

(14 L)

Unit: II

Microscopy – Its principles and applications: Bright and dark field, phase contrast, fluorescence microscopy, TEM and SEM - Staining methods :Gram's, acid-fast, capsule,flagella spore, metachromatic granules, nuclear,silverimpregnation&fungal staining.

(12 L)

Unit: III

Outline of microbial control methods - Methods of sterilization: Physical control methods: heat, filtration and radiation, chemical control agents: phenolics, alcohol, halogens, heavy metals, quaternary ammonium compounds, aldehydes and sterilizing gases - biological control of microorganisms - Indicator microorganisms for sterilization methods - Cultivation of microorganisms - Culture media: chemical and physical, functional types: supportive media (Transport), enriched media, selective media and differential media. Isolation of pure cultures: streak, spread and pour plate methods - Methods of preservation and maintenance of cultures – principle and applications of lyophilizer.

(14 L)

Unit: IV

Fungi: Mold – General characters, morphology, nutrition and metabolism – reproduction – Classification of Fungi (Characters of selected groups) – Oomycetes- Zygomycetes – Ascomycetes – Basidiomycetes – Deuteromycetes. Lichens: General characters and economic importance.

(10 L)

Unit: V

Algae: Distribution, general characters, thallus and its structure, nutrition and reproduction – Characters of selected groups – Blue green algae, Pyrrophyta, Euglenophyta, Chrysophyta, Phaeophyta and Rhodophyta. Protozoa: General characters, locomotion, nutrition, and reproduction – Characters of Sarcodina (*Entamoeba histolytica*) and Sporozoa (*Plasmodium* sp)

(10 L)

TEXTBOOKS RECOMMENDED:

1. Bernard D. Davis., Renato Dulbecco., Herman N. Elsen and Harold S. Ginsberg. (1990). Microbiology (4th edition). J.B. Lippincott Company, New York.
2. Prescott L.M., Harley J.P. and Klein D.A. (2008). Microbiology (7th edition). McGraw Hill, New York.
3. Larry McKane and judykandel (1996). Microbiology - Essentials and Applications. (2nd edition). McGraw Hill, New York.
4. Madigan M.T., Martinko, J. IVI and parker J. Brock T.D. (1997). Biology of microorganisms. (8th edition. Prentice hall international Inc, London.
5. Nester, E.W., Roberts, C.V., and Nester, M.Y. (1995). Microbiology. A Human perspective. IWOA, USA.
6. Salle, A.J. (1996). Fundamental Principles of Bacteriology. (7th edition). Tata McGraw-Hill Publishing Company Ltd., New Delhi.
7. Pelczar Jr., M.J., Chan E.C.S. and Kreig, N.R. (1993). Microbiology. McGraw Hill Inc., New York.
8. Stainer, R.Y., Ingraham, J.L., Wheelis, M.L. and Painter, P.R. (1986). General Microbiology. MacMillan Education Ltd., London.
9. Starr, M.P., Stolp, H., Truper, H.C., Balows, A. and Schegel, H.C. (1991). The prokaryotes. A Handbook of Habitats, Isolation and Identification of Bacteria. Springer Verlag.
10. Tortora, Funke, Case Addison (2001). Microbiology – An Introduction – 7th edition, Wesley Longman Inc.
11. Dubey, R.C. and Maheshwari, O.K., (2002). Practical Microbiology. S. Chand and Co Ltd., New Delhi.
12. John L. Ingraham and Catherine A. Ingrahani (2000). Introduction to Microbiology. Books / Cole Thomas Learning, New York.
13. Talaro, K.P. and Talaro, A (1999). Foundations in Microbiology. WCP McGraw – Hill, New York.
14. Marimuthu, R. (2008). Microscopy and Micro techniques, MJP Publishers, Chennai.

REFERENCES:

1. Holt, J.S. Kreig, N.R., Sneath, P.H.A. and Williams, S.T. (1994). Bergey's Manual of Determinative Bacteriology. (9th edition) – Williams & Wilkins, Baltimore.
2. Brige E.A. (1992). Modern Microbiology – Wm C. Brown Publishers, Dubuque, U.S.A.
3. Goodfellow M. and O'Dennell A.C. (1994). Chemical methods in prokaryotic Systematics – John Wiley & Sons, New York.
4. Murray R.K., Granner M.D., Mayes P.A. and Rodewell V.W. (1990). Biochemistry – Prentice Hall International Inc., London.
5. Bryant D.A. (1994). The molecular Biology of Cyanobacteria. Kluwer Academic Publishers, London.
6. Gerhardt, P., Murray R. Ce., Wood, W.A. and Kreig, N.R. (ed) (1984). Methods for General and Molecular Bacteriology – American Society for Microbiology, Wahnington D.C.
7. Neidhardt, F.C. (ed) (1987). *Escherichia coli* and *Salmonella typhimurium* – Cellular and Molecular Biology (Vol.I). American Society for Microbiology, Washington D.C.
8. Hall, D.C. and Rao, K.K. (1995). Photosynthesis – Cambridge University Press.
9. Zubey C.L. Parson W.W. and vance D.E. (1994). Principles of Biochemistry – Wm.C. Brown Publishers, Oxford, England.
10. Mathews C.K. and Holde K.E.V. (1996). Biochemistry. The Benjamin / Cummings Publishing Company, Inc., New York.
11. Stryer L. (1995). Biochemistry. W.H. Freeman and Company, New York.

First Year I Semester 2 Core - Credits 4
Theory

BIOCHEMISTRY

SUB CODE:

L T P C

4 0 0 4

Unit: I

Carbohydrates: Monosaccharide and their relationship – Structure of Sugars: stereoisomerism and optical isomer of sugars. Reactions of aldehyde and ketone groups, ring structure, tautomeric forms, mutarotation and reactions of sugars in OH groups – Disaccharides – structure, occurrence and biological importance: Maltose, Sucrose, Lactose & Inversion of sucrose. Structural polysaccharides: Homopolysaccharides and Heteropolysaccharides and Mucopolysaccharides – Cellulose, Chitin, Inulin, Glycogen, Hyaluronic acid, Chondroitin sulfates, Heparin, Dermatan sulfate and Keratan sulfate. Blood group substances.

(14 L)

Unit: II

Lipids: Definition, detailed classification of lipids – Components of lipids: Fatty acids and Glycerals – Types of Fatty acids: Essential and Non Essential – Triglycerols – Properties, types and their functions: Phospholipids, Glycolipids, Lipoproteins and Steroids.

(10 L)

Unit: III

Elemental composition of protein, building blocks. Amino acids: classification based on their nature & requirements – selenocysteine – physical and chemical properties of amino acid - Peptide bond - classification, structure & properties of proteins: Functional, Solubility & Nutritional. Enzymes: Types based on their action - Mechanism of enzyme action – factors influencing enzyme action – Michaelis-Menton Hypothesis. A brief view over co-enzymes and Isoenzyme.

(14 L)

Unit: IV

Nucleic Acids - brief history - nucleotides: Components, Types, Tautomeric Forms, Nomenclature & analogs. Different forms, structure and functions of DNA & RNA. Chemicals & buffers used in Genetic material studies.

(10 L)

Unit: V

Clinical Biochemistry Laboratory – Collection of Blood: Anticoagulants, Hemolysis & Preservation of Blood Specimens. Types of laboratory tests – Collection of urine – cerebrospinal fluid (CSF) – Quality control methods – Autoanalysis in clinical chemistry – Analysis in clinical biochemistry laboratory and reference values.

(12 L)

TEXTBOOKS RECOMMENDED:

1. Stryer, L. (Ed) (1995). Biochemistry W.H. Freeman and Company, New York.
2. Donald Voet and Judith voet. (1990). Biochemistry. John Wiley and Sons, New York.
3. Henry, R., Mahler and Eugene – H. Cerdesz (1966). Biological Chemistry. Harper Internationsl Edition, New York.
4. Hubert Stryer (1995). Biochemistry – Freeman and Company, New York.
5. Dawn B. Markus (1994). Biochemistry. Harwad – Publishing, New York.
6. William. J. Marshall and Stephan K. Bangert. (1995). Clinical Biochemistry – Metabolic and Clinical Aspects – Churchill Livingston, New York.
7. Harper’s Biochemistry, prentice – Hall International, INC Singapore.
8. Zubey C.L., Parson, W.W. and Vans, D.E. (1994). Principles of Biochemistry, Wm C. Brown Publ., England.
9. Talaro. K.P. and Talaro, A. (1999). Foundations of Microbiology. WCP McGraw – Hill, New York.
10. Lehninger, Nelson and Cox (2002). Principles of Biochemistry CBS Publishing and Distributors.
11. Caldwell, D.R. (1995). Microbial Physiology and Metabolism, Wm. C. Brown Publishers, USA.
12. Lansing M. Prescott, John P. Harley and Donald A. Klein (2003). Microbiology (5th edition). McGraw – Hill Company, New York
13. Larry McKane and Judy Kandel (1996). Microbiology – Essentials and Applications. (2nd edition). McGraw – Hill Inc, New York
14. Moat, A.G and Foster J.W. (1998). Microbial Physiology (2nd edition). Jihn Wiley and Sons, New York.
15. Pelczar Jr., M.J., Chan E.C.S. and Kreig, N.R. (1993). Microbiology. McGraw Hill Inc., New York.
16. Salle, A.J. (1996). Fundamental Principles of Bacteriology (7th edition). Tata McGraw Hill Publishing Company Limited, New Delhi.
17. White, D. (1995). The Physiology and Biochemistry of prokaryotes. Oxford University Press. Oxford, New York.
18. Madigan M.T., Martinko, J. IVI and parker J. Brock T.D. (1997). Biology of microorganisms. (8th edition. Prentice hall international Inc, London.
19. Nester, E.W., Roberts, C.V., and Nester, M.Y. (1995). Microbiology. A Human perspective. IWOA, USA.
20. Veerakumari L. (2006). Bioinstrumentation. MJP Publishers, Chennai.
21. MeenaKumari. S. (2006). Microbial Physiology. MJP Publishers, Chennai.

22. Christopher K. Mathews and Van Holde, K.E. (1996). Biochemistry (2nd edition). The Benjamin / Cummings Publishing Company.
23. David E. Metzler and Coral M. Metzler (2001). Biochemistry – The chemical reactions of living cell – Vol 1 and 2 (2nd edition). Harcourt / Academic Press, New York.
24. Donald Voet and Judith voet. (1995). Biochemistry. (2nd edition). John Wiley and Sons Inc., New York.
25. Freifelder D. (1996). Molecular Biology. (2nd edition). Narosa Publishing House, New Delhi.
26. Geofferey, L. and Zubey, C.L. (1998). Biochemistry (4th edition). Wm. C. Brown Publishers.
27. Jeremy M. Berg, John L. Tymoczko and LubertStryer (2002). Biochemistry (5th edition). W.H. Freeman and Company, New York.
28. LubertStryer (1995). Biochemistry (4th edition). W.H. Freeman and Company, New York.
29. Reginald, h., garret and Charles M. Grishm. (199*8). Biochemistry (2nd edition). Saunders College Publishing.
30. Thomas S. Devlin. (2002). Textbook mof Biochemistry with Clinical Correlations (5th edition). John Willey and Sons Inc. Publication, New York.
31. Trudy Mckee and James R.Mc. Kee (1999). Biochemistry – An Introduction (2nd edition). WCB McGraw – Hill, U.S.A.

First Year

I Semester

3 Core - Theory

Credits 4

PHYSIOLOGY AND METABOLISM

SUB CODE:

L T P C

4 0 0 4

Unit: I

Extracellular components: Capsule, slime layer, sheath, flagella and pili – Structure & Functions. Cell wall & Cell membrane: Archae bacteria, Gram positive & Gram negative – Structure & Functions. Intracellular membranes – Structure & functions. Biosynthesis of PG layer. Cytoplasm and its inclusions. Genetic materials: nucleoid and plasmids.

(12L)

Unit: II

Major nutritional types - Nutrient Transport: Simple, passive & facilitated diffusion, Active transport: symport&antiport, group translocation & iron transport - Introduction to metabolism - metabolic pathways like glycolysis, TCA cycle, EMP, ED & glyoxylate cycle. Respiration: Aerobic - ETS and it's components – oxidative & substrate level phosphorylation - Chemiosmosis theory.

(13L)

Unit: III

Anaerobic types of respiration – Nitrate, Sulphate respiration & diversity of anaerobic final electron acceptors. Fermentation: Alcoholic, lactic acid, propionic, mixed acid, butanediol, butyric acid, amino acid and methanogenesis - Pasteur

effect. Bioluminescence.

(12L)

Unit: IV

Photophosphorylation: oxygenic and anoxygenic – Cyclic and acyclic ETS, Photosynthetic and accessory pigments. Photosystem of purple sulphur, purple non-sulphur and green sulphur bacteria. Halobacterial photosynthesis – bacterial rhodopsin.

Nitrogen fixation: Symbiotic, asymbiotic and associative. Nitrogenase - mechanism of nitrogen fixation, heterocyst and *Nif* genes. (12L)

Unit: V

Bacterial growth: Binary fission, Growth curve, Auxenic, synchronous, asynchronous culture. Batch culture, fed batch & continuous culture: chemostat and turbidostat. Factors affecting growth: Physical, chemical and biological. Spore: endo and exospores. Endospore: structure, factors influencing sporulation, process of sporulation and a bird's eye view on spore genes.

(11L)

TEXTBOOKS RECOMMENDED:

1. Talaro. K.P. and Talaro, A. (1999). Foundations of Microbiology. WCP McGraw – Hill, New York.
2. Caldwell, D.R. (1995). Microbial Physiology and Metabolism, Wm. C. Brown Publishers, U.S.A.
3. Lansing M. Prescott, John P. Harley and Donald A. Klein (2003). Microbiology (5th edition). McGraw – Hill Company, New York
4. Larry McKane and Judy Kandel (1996). Microbiology – Essentials and Applications. (2nd edition). McGraw – Hill Inc, New York
5. Moat, A.G and Foster J.W. (1998). Microbial Physiology (2nd edition). Jhn Wiley and Sons, New York.
6. Pelczar Jr., M.J., Chan E.C.S. and Kreig, N.R. (1993). Microbiology. McGraw Hill Inc., New York.
7. Salle, A.J. (1996). Fundamental Principles of Bacteriology (7th edition). Tata McGraw Hill Publishing Company Limited, New Delhi.
8. White, D. (1995). The Physiology and Biochemistry of prokaryotes. Oxford University Press. Oxford, New York.
9. Madigan M.T., Martinko, J. IVI and parker J. Brock T.D. (1997). Biology of microorganisms. (8th edition. Prentice hall international Inc, London.
10. Nester, E.W., Roberts, C.V., and Nester, M.Y. (1995). Microbiology. A Human perspective. IWOA, USA.
11. Mariappan C. (2010). A textbook of general microbial physiology, biochemistry and metabolism. Pooja Publishers, India.
12. Meena Kumari. S. (2006). Microbial Physiology. MJP Publishers, Chennai.
13. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer (2002). Biochemistry (5th edition). W.H. Freeman and Company, New York.

2017-18/MSU/46thSCAA/Affiliated coll./PG/M.Sc.(Microbiology)sem-1/Elective/Ppr-1

First Year

I Semester

1 Open Elective - Credits 3
Theory

CHOOSE ANY ONE FROM ANNEXRE I

SUB CODE:

NO SEMESTER I		
	ANNEXURE – I[#]	Subject Codes
1	Plant Diversity I: Algae, Fungi and Bryophytes	
2	Anatomy, embryology and morphogenesis	
3	Invertebrata	
4	Environmental biology and Biodiversity	
5	Apiculture	
6	Biochemical techniques and Instrumentation	

List of practicals for every subject given in the Annexure I are also attached behind the elective theory syllabus, they should also be done along with the experiments connected with the core papers, based on the selection of the elective paper by the college.

2017-18/MSU/46thSCAA/Affiliated coll./PG/M.Sc.(Microbiology)sem-1/Practical/Ppr-1

First Year

I Semester

Practical – I

Credits 5

PRACTICAL - I

SUB CODE:

L T P C

0 0 5 5

1. Laboratory precautions
2. Washing and cleaning of glasswares
3. Biological safety cabinets
4. Light microscopy
5. Wet mount to show different types of microbes
6. Hanging drop technique
7. Sterilization - principles and methods
 - a. Moist heat
 - b. Dry heat
 - c. Filtration
8. Fumigation
9. Smear preparation
10. Counting cells using Haemocytometer
11. Simple staining
12. Negative staining
13. Gram's staining
14. Acid-fast staining (Ziehl-Neelson method)
15. Spore staining (Schaffer-Fulton method)
16. Capsule staining
17. Preparation of liquid, solid and semi-solid media
18. Preparation of agar deeps, agar slants and agar plates

19. Preparation of basal, enriched, selective and enrichment media
20. Serial dilution technique
21. Plating techniques – pour plate and spread plate
22. Enumeration of bacteria – Soil and water samples
23. Cultural characteristics of microorganisms
24. Culture transfer techniques
25. Techniques of isolation of pure cultures – Streak plate method
26. Morphology of molds – Lactophenol cotton blue staining
27. Fungal slide culture techniques

LABORATORY MANUALS RECOMMENDED:

1. Cappuccino.J.C:7 and Sherman. N. (1996). Microbiology – Laboratory Manual. Benjamin Cummins, New York
2. Kannan. N. (1996). Laboratory manual in General Microbiology. Palan Paramount Publication, Palani.
3. Gunasekharan. P. (1996). Laboratory manual in Microbiology, New Age International Ltd., Publishers, New Delhi.
4. Sundararaj, T. (2005). Microbiology – laboratory manual. (1st edition). Pubinj. Sunciararaj. T, Chennai
5. Jayaraman, J. (1985). Laboratory manual in Biochemistry. Wiley Eastern Ltd, New Delhi.
6. Plummer, D.T. (1998). An Introduction to practical Biochemistry. Tata McGraw Hill, New Delhi.
7. Palanivelu P. (2001). Analytical Biochemistry and Separation techniques – A Laboratory Manual.
8. Benson (2002). Microbiological applications – Laboratory Manual in General Microbiology. International edition. McGraw Hill Higher education.
9. Collins, C.R. and Lyne P.M. (1976). Microbiological methods (4th edition). Butterwoths, London.
10. Dubey, R.C. and Maheshwari, O.K., (2002). Practical Microbiology. S. Chand and Co Ltd., New Delhi.
11. Baron, E.J. and Finegold, S.M. (1995). Diagnostic Microbiology. Blackwell Scientific Press.
12. Davis, L., Dipner, M.O and Battey, J.F. (1986). Basic methods in Molecular Biology .Elseiver, Amsterdam
13. S.Rajan. (2012): Experimental Procedures in Life Sciences. Anjanaa Book House, Chennai 600107.

2017-18/MSU/46thSCAA/Affiliated coll./PG/M.Sc.(Microbiology)sem-1/Practical/Ppr-2

First Year

I Semester

Practical - II #

Credits 5

PRACTICAL – II

SUB CODE:

L T P C

0 0 5 5

1. Cultivation of anaerobic microorganisms – Pyrogallol method & anaerobic jar.
2. Extracellular enzymatic activities of microorganisms (Utilization of gelatin, starch casein and lipid).
3. Carbohydrate fermentation (Any one carbohydrate source)
4. Triple sugar iron test
5. IMVIC test
6. H₂S test
7. Urease test
8. Nitrate reduction test
9. Catalase test
10. Oxidase test
11. Growth curve (turbidity method)
12. Total Erythrocyte Count
13. Total Leucocyte Count
14. Total Platelet Count
15. Haemoglobin estimation
16. Erythrocyte Sedimentation Rate (ESR)
17. Serum Cholesterol analysis (DEMO)
18. Estimation of urine albumin
19. Estimation of urine bile salts
20. Estimation of urine sugar
21. Reference values of biochemical tests

22. # List of practicals for every subject given in the Annexure I are also attached behind the elective theory syllabus, they should also be done along with the experiments connected with the core papers, based on the selection of the elective paper by the college.

LABORATORY MANUALS RECOMMENDED:

1. Cappuccino.J.C:7 and Sherman. N. (1996). Microbiology – Laboratory Manual. Benjamin Cummins, New York
2. Kannan. N. (1996). Laboratory manual in General Microbiology. Palan Paramount Publication, Palani.
3. Gunasekharan. P. (1996). Laboratory manual in Microbiology, New Age International Ltd., Publishers, New Delhi.
4. Sundararaj, T. (2005). Microbiology – laboratory manual. (1st edition). Pubinj. Sunciararaj. T, Chennai
5. Jayaraman, J. (1985). Laboratory manual in Biochemistry. Wiley Eastern Ltd, New Delhi.
6. Plummer, D.T. (1998). An Introduction to practical Biochemistry. Tata McGraw Hill, New Delhi.
7. Palanivelu P. (2001). Analytical Biochemistry and Separation techniques – A Laboratory Manual.
8. Benson (2002). Microbiological applications – Laboratory Manual in General Microbiology. International edition. McGraw Hill Higher education.
9. Collins, C.R. and Lyne P.M. (1976). Microbiological methods (4th edition). Butterwoths, London.
10. Dubey, R.C. and Maheshwari, O.K., (2002). Practical Microbiology. S. Chand and Co Ltd., New Delhi.
11. Baron, E.J. and Finegold, S.M. (1995). Diagnostic Microbiology. Blackwell Scientific Press.
12. Davis, L., Dipner, M.O and Battey, J.F. (1986). Basic methods in Molecular Biology .Elseiver, Amsterdam
13. S.Rajan. (2012): Experimental Procedures in Life Sciences. Anjanaa Book House, Chennai 600107.

MOLECULAR BIOLOGY & GENETICS

SUB CODE:

L T P C

4 0 0 4

Unit - I: DNA replication and repair

Identification of genetic material (Griffith, Avery and Hershey and Chase experiments). DNA replication - Meselson – Stahl experiment , Molecular mechanisms of DNA Replication – bidirectional and rolling circle replication. Differences in prokaryotic and eukaryotic replication. Plasmids – types, structure and replication. DNA repair – mechanism of excision repair, SOS repair, mismatch repair and photoreactivation.

(14L)

Unit – II: Transcription and translation

Process of transcription – initiation, elongation – termination. Synthesis of mRNA in prokaryotes and eukaryotes. Synthesis of rRNA and tRNA. RNA processing – capping and polyadenylation. Genetic code, process of translation – initiation, elongation and termination. Signal sequences and protein transport.

(12L)

Unit – III: Concept of Gene & Gene regulation

Organization of Gene in Prokaryotes and Eukaryotes - Introduction – Operon concept, lac and trp operons, promoters and repressors. Regulation of gene expression – Transcriptional control – promoters, terminators, attenuators and antiterminators; Induction and repression; the lac operon – catabolite repression; Biosynthesis: trp operon – upstream activator sequences and enhancers, two component regulatory systems. Translational control – ribosome binding, codon usage, antisense RNA; post-transcriptional gene silencing – *RNAi*.

(14L)

Unit - IV: Gene transfer mechanisms

Transformation – competence cells, regulation, general process; Transduction – general and specialized; Conjugation – *Hfr*, triparental mating, self transmissible and mobilizable plasmids, pili.

(10L)

Unit – V: Transposable elements

Introduction - Discovery insertion sequences, complex and compound transposons – T₁₀, T₅, and retroposon – Nomenclature- Insertion sequences – Mechanism – Transposons of *E.coli*, Bacteriophage and Yeast.

(10L)

TEXTBOOKS RECOMMENDED:

1. Watson, J.D., Hopkins, N.H., Roberts J.W., Steitz J.A and Weiner, A.A.M. (1987). *Molecular Biology of the gene*. The Benjamin/Cummings Publishing Company.
2. Lewin, B. (2007). *Genes IX* Oxford University press, UK.
3. Lodish, H., Baltimore, D., Berk, A., Zipursky, S.L., Matsudaira, P., and Darnell, J. (1995). *Molecular cell Biology*. Scientific American Books.
4. Maloy, S.R., Cronan, Jr. J.E. and Freifelder, D. (1994). *Microbial Genetics*. Jones and Bartlett Publishers.
5. Freifelder, D. (1991). *Molecular Biology*. Narosa Publishing House.
6. Talaro, K.P. and Talaro, A (1999). *Foundations in Microbiology*. WCP McGraw – Hill, NewYork.
7. Jeyanthi, G.P. (2008). *Molecular Biology*. MJP Publishers, Chennai.

REFERENCES:

1. Friedberg EC, Walker GC, Siede W. (2005). *DNA repair and mutagenesis*. ASM press
2. James D. Watson, Tania A. Baker, Stephen P. Bell, and Alexander Gann, *Molecular Biology of the Gene*, Fifth Edition
3. Rowland H. Davis, *The Microbial Models of Molecular Biology: From Genes to Genomes*.
4. Antony JF, Griffiths, Gilbert WM, Lewontin RC and Miller JH (2002).
5. *Modern Genetic Analysis, Integrating Genes and Genomes*, 2nd edition, WH
6. Blackburn GM, Gait MJ. (1996). *Nucleic acids in chemistry and biology*. Oxford University press.
7. Malacinski GM and Freifelder D (1998) *Essentials of Molecular Biology*, 3rd edition, John and Bartlett Publishers.
8. Lewin B. (2000). *Genes VII*. Oxford University press
9. Maloy SR, Cronan Jr. JE, Freifelder D (1994). *Microbial genetics*. Jones and Bartlett publishers.
10. Singer M, Berg P. (1991). *Genes and Genomes*. University Science Books.
11. Stryer L. (2002). *Biochemistry*. 5th edition, W.H.Freeman and company.
12. Watson JD, Hopkins NH, Roberts JW, Steitz JA, Weiner AM. (1998).
13. *Molecular biology of the gene*, 4th edition, Benjamin/Cummings publishing company.
14. Eckstein F., and Lilley, D.M. (1992). *Nucleic Acids and Molecular Biology – Springer – Verlag*
15. Blackburn, C. M. and Gait M.J. (1996). *Nucleic acids in HChemistry and biology – Oxford University Press*.
16. Stryer L. (1995). *Biochemistry*, W.H. Freemand and Company.
17. Eckstein F, Lilley DM. (1996). *Catalytic RNA – Springer – Verlag*.
18. Frieledger EC, Walker GC, Siede W. (1995). *DNA repair and mutagenesis*, ASM Press
19. Gardner EJ, Simmons, MJ, Snustad DP (1991). *Principles of Genetics*. John Wiley and Sons, New York.
20. Singer M, Berg P. (1991). *Genes and Genomes*. University Science Books.

IMMUNOLOGY

SUB CODE:

L T P C

4 0 0 4

Unit: I

History and development of immunology - Phylogeny and ontogeny of immune system. Immunity: Innate & Acquired. Infection. Pathogenicity. Virulence factors. Resistance. An over view on the cells of immune system. Phagocytosis. Inflammation. Organs & tissues of immune system. Clonal selection theory. Immune response: HIR & CMI. Cytokines.

(14 L)

Unit: II

Antigens and antibody – structure, types and functions. Antibody diversity: isotypes, allotypes and idiotypes. Biology of T & B cell. Major Histocompatibility Complex (MHC). Human leucocyte antigen (HLA). Complement pathways: classical, alternative & lectin.

(13 L)

Unit: III

Clinical immunology: serotyping. Agglutination. Precipitation. Complement fixation. Immunoblotting (western blotting). Immunofluorescence. Immunodiffusion: SRID, ODD, RIEP & Immnoelectrophoresis. Flow cytometry. Radioimmune assay.

(13 L)

Unit: IV

Applied Immunology - Hypersensitivity - immediate & delayed type. Autoimmunity. Transplantation immunology. Tumor immunology. Immunological tolerance. Immunosuppression. Immuno deficiency diseases.

(10 L)

Unit: V

Monoclonal antibody: production & applications. Vaccination: types, principle & applications. Current basic immunization schedule. (10 L)

TEXTBOOKS RECOMMENDED:

1. Donald M. Weir and John Steward (1993). Immunology (7th editoin). ELBS, London.
2. Hue Davis (1997). Introductory Immunology (1st edition). Chapman and Hall Publisher, London.
3. Ivan M. Roit (1998). Essential Immunology – Blackwell Scientific Publishers, London.
4. Paul (1998). Fundamental Immunology, (2nd edition). Raver Press, New Yoek.
5. Peter J. Delves and Ivan M. Roit (Eds) (1998). Encyclopedia of immunology – (2nd edition). Academic Press.
6. Ridklad, M. Aydl (1995). Immunology, (2nd edition), Baltimore, Hong Kong, NMS Publication.
7. Roit, J.M., Brostaff, J.J and male, D.K. (1996). Imunology (4th edition). C.V. Mosby Publisher, St. Loius.
8. Stewart Sell (2001). Immunology, immunopathology and immunity. (6th edition). ASM Press, USA.
9. Ajanathanarayanan, R. and Panicxker, J. (2000). Textbook of Microbiology, orient Longmans.
10. Rajan, S. (2007). Medical microbiology, MJP Publishers, Chennai.
11. Fathimunisa Begum (2008). Monoclonal antibodies: The hopeful drugs. MJP Publishers, Chennai.
12. Kannan, I. (2007). Immunology. MJP Publishers, Chennai.

REFERENCES:

1. Stefan, H. and Kaufmann, E. (2002). Immunology of infectious diseases. ASM Press, USA.
2. Abbas, A.K., Lichtman, A.H. and Pober, J.S. (1994). Cellular and Molecular Immunology. (2nd edition). WB Saunders, USA.
3. Humphrey, J.H, and Wite, R.G. (1995). Immunology for students of Medicine, (5th edition) ELBS, London.
4. Weir, D.M. (1995). Experimental Techniques in Immunology. Blackwell Scientific Publishers, London.

First Year

II Semester

6 Core – Theory

Credits 4

VIROLOGY

SUB CODE:

L T P C

4 0 0 4

Unit: I

Brief outline of virology: Discovery of virus; early development of virology – nomenclature – classification and taxonomy of viruses - based on host, nucleic acids and structure; Evolution of Viruses. (10L)

Unit: II

Bacterial viruses: ØX 174; T₄; M₁₃; Lambda and Mu; P₁ phages. Structural organization – lifecycle : lytic and lysogenic - transcription - DNA replication and phage production - genetics of each phage. (10L)

Unit: III

Plant viruses: TMV - general characters – morphology – structure – replication - RNA as the initiator of infection; Cauliflower Mosaic Virus - a brief account. Transmission of plant viruses - transmission by vectors - transmission without vectors. Common viral diseases of crop plants - names of diseases, pathogens and symptoms only -paddy, cotton, tomato and sugar cane. (15L)

Unit: IV

Animal viruses: General characters, chemical and physical nature, life cycle, epidemiology, pathogenicity, disease caused and immunologic response of the following viruses: Myxo virus: Orthomyxo virus, Paramyxo virus; Herpes virus - HSV₁&HSV₂; Adenovirus and Adeno Associated Viruses; Tumour viruses of human. (15L)

Unit: V

Other viral types: Brief account of Cyanophages – mycophycophages – Insect viruses. Viroids, prions, satellite RNAs and virusoids. Antiviral agents and vaccines – different types. (10L)

REFERENCES:

1. Conrat HF, Kimball PC and Levy JA. (1988). Virology. II edition. Prentice Hall, Englewood Cliff, New Jersey.
2. Dimmock NJ, Primrose SB. (1994) Introduction to Modern Virology IV edition. Blackwell Scientific Publications, Oxford
3. Flint SJ, Enquist LW, King RM, Racaniell VR and Shalka AM (2000). Principles of Virology - Molecular Biology, pathogenesis and control, ASM Press, Washington DC.
4. Khan J.A, J.Dijkstra. Plant viruses as molecular pathogens. 2000. CBS publishers and Distributors. New Delhi
5. Maloy SR, Cronan Jr. JE, Freifelder D. (1994). Microbial genetics. Jones and Bartlett publishers.
6. Robert G. Welstar and Allan Garnoll. Encyclopaedia of Virology (1994). Vol I, II & III Academic Press inc. San Diego, CA 92101. Ed.
7. Timbury MC. (1994) Medical Virology X edition. Churchill Livingston.
8. Topley & Wilson's. (1990) Principles of Bacteriology, Virology and Immunity VIII edition Vol. IV Virology, Edward Arnold, London.
9. Alan, J. Cann. (1997). Principles of Molecular Virology. (2nd edition). Academic Press, California.
10. Ann GludiciFettner (1990). The science of viruses. Quill William Marrow, New York.
11. Conrat H.F. Kimball P.C. and levy J.A. (1998). Virology (2nd edition). Prentice Hall, EngleCliff, New Jersey.
12. Dimmock, N.J. and Primrose, S.B. (1994). Introduction to modern Virology. (4th edition). Blackwell Scientific Publications, Oxford.
13. Racaniello, V.R. and Skalka, A.M. (2000). Principles of Virology, Molecular biology, pathogenesis and Control, ASM Press, Washington DC.
14. Maloy, S.R., Cronan, Jr. J.E. and Freifelder, D. (1994). Microbial Genetics. Jones and Bartlett Publishers.
15. Nicklin, J. Greame-Cook and Killington, R. (2003). Instant notes in Microbiology. (2nd edition). Viva Books Private Limited, New Delhi.
16. Robert. I. Krasner. (2002). The Microbial Challenge: Human Microbe Interactions. ASM Press, Washington.
17. Roger Hull (2002). Mathew's Plant Virology. (4th edition). Academic press. A Harcourt Science and Technology company, New York.
18. Tom parker, Leslie M. and Collie H. (1990). Topley and Wilson's principles of Bacteriology, Virology and Immunity (8th edition).
19. Bernard D. Davis., Renato Dulbecco., Herman N. Elsen and Harold S. Ginsberg. (1990). Microbiology (4th edition). J.B. Lippincott Company, New York.

20. Prescott L.M., Harley J.P. and Klein D.A. (2008). Microbiology (7th edition). McGraw Hill, New York.
21. Larry McKane and Judy Kandel (1996). Microbiology essentials and applications. (2nd edition). McGraw Hill, New York.
22. Madigan M.T., Martinko, J. and Parker J. Brock T.D. (1997). Biology of microorganisms. (8th edition. Prentice hall international Inc, London.
23. Nester, E.W., Roberts, C.V., and Nester, M.Y. (1995). Microbiology. A Human perspective. IWOA, USA.
24. P.Saravanan. (2006). Virology, MJP Publishers, Chennai.
25. Luria, S.E. and Darnel, J.E. Jr., Baltimore, D. and Campbell, A. (1978). General Virology, (3rd edition). John Wiley and Sons, New York.
26. Dimmock- Virology
27. Rhodes and Van Royen – Text book of Virology
28. Biswas and Biswas – An Introduction to Viruses
29. Ananth Rai – Animal viruses.
30. Green wood – Textbook of Virology.

First Year

II Semester

2 Open Elective - Credits 3

Theory

CHOOSE ANY ONE FROM ANNEXRE II

SUB CODE:

NO	SEMESTER II ANNEXURE – II [#]	Subject Codes
1	Plant Diversity II: Pteridophytes, Gymnosperms and Palaebotany	
2	Plant physiology and ecology	
3	Chordata	
4	Biophysics and Biostatistics	
5	Aquaculture	
6	Biodegradation and remediation	

List of practicals for every subject given in the Annexure II are also attached behind the elective theory syllabus, they should also be done along with the experiments connected with the core papers, based on the selection of the elective paper by the college.

PRACTICAL – III

SUB CODE:

L T P C

0 0 5 5

1. Isolation of chromosomal DNA
2. Isolation of bacterial plasmids
3. Induced mutagenesis – UV and NTG
4. Spontaneous mutation
5. Agarose gel electrophoresis – plasmid and DNA samples
6. PAGE – Demonstration
7. PCR
8. Collection of venous blood from human and separation and preservation of serum / plasma
9. Blood grouping
10. Latex agglutination tests: CRP, RA, ASO and VDRL
11. Widal (Qualitative and Quantitative)
12. Precipitation reactions – SRID, DID, Rocket electrophoresis and immune electrophoresis and staining of precipitin lines (DEMO).
13. ELISA technique – (DEMO)
14. Skin test – Mantoux test - (DEMO)
15. Western Blot - (DEMO)

LABORATORY MANUALS RECOMMENDED:

1. Cappuccino.J.C:7 and Sherman. N. (196). Microbiology – Laboratory Manual. Benjamin Cummins, New York
2. Kannan. N. (1996). Laboratory manual in General Microbiology. Palan Paramount Publication, Palani.
3. Gunasekharan. P. (1996). Laboratory manual in Microbiology, New Age International Ltd., Publishers, New Delhi.
4. Sundararaj, T. (2005). Microbiology – laboratory manual. (1st edition). Pubinj. Sundararaj. T, Chennai
5. Jayaraman, J. (1985). Laboratory manual in Biochemistry. Wiley Eastern Ltd, New Delhi.
6. Plummer, D.T. (1998). An Introduction to practical Biochemistry. Tata McGraw Hill, New Delhi.
7. Palanivelu P. (2001). Analytical Biochemistry and Separation techniques – A Laboratory Manual.
8. Benson (2002). Microbiological applications – Laboratory Manual in General Microbiology. International edition. McGraw Hill Higher education.
9. Collins, C.R. and Lyne P.M. (1976). Microbiological methods (4tyh edition). Butterwoths, London.
10. Dubey, R.C. and Maheshwari, O.K., (2002). Practical Microbiology. S. Chand and Co Ltd., New Delhi.
11. Baron, E.J. and Finegold, S.M. (1995). Diagnostic Microbiology. Blackwell Scientific Press.
12. Davis, L., Dipner, M.O and Battey, J.F. (1986). Basic methods in Molecular Biology. Elseiver, Amsterdam

2017-18/MSU/46thSCAA/Affiliated coll./PG/M.Sc.(Microbiology)sem-1/Practical/Ppr-4

First Year

II Semester

Practical - IV

Credits 5

PRACTICAL – IV[#]

SUB CODE:

L T P C

0 0 5 5

1. Cultivation of virus – Embryonated egg method (DEMO)
2. Isolation of bacteriophage from sewage.
3. Phage titration
4. Preparation of virus stocks and determination of mouse (DEMO)
5. Study of virus infected plant specimens -(DEMO).
6. # List of practicals for every subject given in the Annexure II are also attached behind the elective theory syllabus, they should also be done along with the experiments connected with the core papers, based on the selection of the elective paper by the college.

LABORATORY MANUALS RECOMMENDED:

1. Cappuccino.J.C:7 and Sherman. N. (196). Microbiology – Laboratory Manual. Benjamin Cummins, New York
2. Kannan. N. (1996). Laboratory manual in General Microbiology. Palan Paramount Publication, Palani.
3. Gunasekharan. P. (1996). Laboratory manual in Microbiology, New Age International Ltd., Publishers, New Delhi.
4. Sundararaj, T. (2005). Microbiology – laboratory manual. (1st edition). Pubinj. Sundararaj. T, Chennai
5. Jayaraman, J. (1985). Laboratory manual in Biochemistry. Wiley Eastern Ltd, New Delhi.
6. Plummer, D.T. (1998). An Introduction to practical Biochemistry. Tata McGraw Hill, New Delhi.
7. Palanivelu P. (2001). Analytical Biochemistry and Separation techniques – A Laboratory Manual.
8. Benson (2002). Microbiological applications – Laboratory Manual in General Microbiology. International edition. McGraw Hill Higher education.
9. Collins, C.R. and Lyne P.M. (1976). Microbiological methods (4tyh edition). Butterwoths, London.

10. Dubey, R.C. and Maheshwari, O.K., (2002). Practical Microbiology. S. Chand and Co Ltd., New Delhi.
11. Baron, E.J. and Finegold, S.M. (1995). Diagnostic Microbiology. Blackwell Scientific Press.
12. Davis, L., Dipner, M.O and Battey, J.F. (1986). Basic methods in Molecular Biology. Elsevier, Amsterdam

ANNEXURE 1

First Year **I Semester** **1 Open Elective -**
Theory **Credits 3**

AI -1 : ALGAE, FUNGI AND BRYOPHYTES

SUB CODE:

L T P C

3 0 0 3

Unit: I

General trends and criteria for Algal classification (Fritch 1977). Salient features of major classes: Chlorophyceae, Xanthophyceae, Chrysophyceae, Bacillariophyceae, Cryptophyceae, Dinophyceae, Chloromonadineae, Euglenineae, Phaeophyceae, Rhodophyceae, Myxophyceae. Ultrastructure of Prokaryotic and Eukaryotic algal cells and their components– cell wall, protoplasm, flagella, eye spots, chloroplast, pyrenoid, nucleus, pigments and reserve foods. Economic importance of algae – Food and feed – Single cell protein – Industrial products (Agar-Agar, Carrageenan, Iodine, Vitamins) – In Medicine and Diatomaceous earth. (14L)

Unit: II

Range of thallus structure, origin and evolution of sex in algae, phylogeny and interrelationships of algae. Lifecycle patterns in algae and alternation of generations, Fossil algae. Ecology of algae: Freshwater algae, marine algae, soil algae, symbiotic algae and parasitic algae. Algae as pollution indicators, algal blooms, algicides culture and cultivation of fresh water and marine algae – Knop's solution. (14L)

Unit: III

General features, occurrence and distribution. Mode of nutrition in fungi, culture, Classification of fungi (Alexopoulos 1979), general characters of major classes: Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Thallus organization, cell structure and fruit bodies. Phylogeny and interrelationships of major groups of fungi. Economic importance of fungi, in medicine and in industries. (12L)

Unit: IV

Homothallism and Heterothallism in fungi. Homokaryon and Heterokaryon, Hormonal control in sex organ development in fungi. Physiological specialization and physiological races in fungi. Reproduction, life cycle types, parasexual cycles, reduction in sexuality in fungi. Spore dispersal mechanisms and fungal genetics, Fossil fungi. **LICHENS**: General features, classification (Miller), Distribution, thallus organization, vegetative and sexual reproduction, lichens as indicators of pollution and economic importance. (10L)

Unit: V

General features, distribution, classification (Watson, 1955) of bryophytes, General characters of major groups. Marchantiales, Jungermaniales, Anthocerotales, Sphagnales, Funariales and Polytrichales. Range of vegetative structure, Evolution of gametophytes and sporophytes. Reproduction – Vegetative and sexual, spore dispersal mechanisms in bryophytes, spore germination patterns in bryophytes. Ecological and economic importance of bryophytes. Fossil bryophytes. (10L)

REFERENCES:

ALGAE

1. O.P.Sharma (2007). Text book of Algae. Tata McGraw-Hill publishing company Ltd, Delhi
2. James Graham – Lee W. Wilcox - Linda E. Graham (2008). Algae (2nd edition)
3. Vashishta, B. R. *et al.* (2008). Botany for Degree Students – Algae. S. Chand and Co.Ltd.,New Delhi.
4. Kumar, H. D. (1989). Introductory Phycology. East-West Press, Madras.
5. Round, F. E. (1981). The Ecology of Algae. CambridgeUniversity Press, London.
6. A V S SSambamurty (2005). A Textbook of Algae. I K International
7. S K Singh and Seema Srivastava (2008) A Textbook of Algae. Campus Books, ISBN: 8180301445

FUNGI

1. R.M. Johri, Snehlata and KavitaTyagi, (2011). A Textbook of Fungi ISBN: 9380642000
2. Rajni Gupta, APH, (2004). A Text Book of Fungi ISBN: 8176487368
3. C.S. Chandoliya (2009). Fungi: Biological Diversity ISBN: 8178844923 Cyber Tech Pub
4. H.C.I. Gwynne – Vaughan and B. Barnes (2004). Fungi: Their Structure and Development Biotech Books
5. H C Dube (2007). Fungi, Bacteria and VirusesAgrobios, ISBN: 8177543148
6. John Webster and Roland Weber (2007). Introduction to Fungi
7. Alexopoulos, C. J. and Mims, C. W. (1979). Introductory Mycology. Wiley Eastern Ltd., New York.
8. Bold, H. C. *et al.* (1980). Morphology of Plants and Fungi. Harper and Row Publishing Inc., New York.
9. Mehrotra, R. S and Aneja, K. R. (1990). An Introduction of Mycology. Wiley Eastern Ltd., New Delhi.
10. Hale, M. E. Jr. (1983). Biology of Lichens. Edward Arnold, Maryland.

BRYOPHYTES

1. Parihar, N. S (1972). An Introduction to Embryophyta-I: Bryophyta. CentralBook Depot, Allahabad.
2. Watson, E. V. (1971). The Structure and Life of Bryophytes. B.I. Publns, New Delhi.
3. Vashishta, B. R. *et al.* (2008). Botany for Degree Students: Bryophyta. S. Chand and Co. Ltd., New Delhi.

First Year I Semester 1 Open Elective –
Practical # Credits 5

PRACTICAL II (AI-1)

SUB CODE:

L T P C

0 0 5 5

PLANT DIVERSITY – I (ALGAE, FUNGI, LICHENS AND BRYOPHYTES)

1. Microscopic slide preparation of types prescribed in the syllabus.
2. Identifying the microscopic slides relevant to the syllabus.
3. Identifying types from algae mixtures. (*Gloeocapsa*, *Spirulina*, *Anabaena*, *Volvox*, *Navicula*(Diatoms), & Lichens)
4. Study of pathological specimens included in the syllabus.

List of practicals for the above subject should also be done along with the experiments connected with the core papers, if it is selected by a college as a open elective.

2017-18/MSU/46thSCAA/Affiliated coll./PG/M.Sc.(Microbiology)sem-1/Elective/Ppr-1

First Year I Semester 1 Open Elective - Theory Credits 3

AI -2 : ANATOMY, EMBRYOLOGY AND MORPHOGENESIS

SUB CODE:

L T P C

3 0 0 3

Unit: I

General account and theories of organization of apical meristems of shoot apex and root apex, quiescent centre. Structural diversity and phylogenetic trends of specialization of xylem and phloem. Cambium – origin – cellular structure, cell division, storied and nonstoried types. Cambium in budding and grafting – wound healing role. Trichomes, periderm and lenticels. (13L)

Unit: II

Anatomical characteristics and vascular differentiation in primary and secondary structure of root and stem in Dicot and Monocot. Origin of lateral roots – Root stem transition – Anatomy of Dicot and Monocot leaves. Leaf abscission, stomatal types, nodal anatomy, petiole anatomy, vascularisation of flower and seedling. (12L)

Unit: III

Microsporangium –Microsporogenesis, Microspores – arrangement – morphology – ultrastructure –Microgametogenesis– Pollen – Stigma – Incompatibility– Methods to overcome incompatibility –Megasporangium– Megagametogenesis – Female gametophyte –Monosporic–Bisporic and Tetrasporic– Nutrition of embryo sac and fertilization (13L)

Unit: IV

Endosperm – Types – Endosperm haustoria– Cytology and physiology of endosperms, functions of endosperms – Embryo development in Dicot and Monocot, Nutrition of embryo–Polyembryony– Causes, Apomixis– Causes, Apospory– Their role in plant improvement programmes and seed development.

(10L)

Unit: V

Definition – Morphogenesis and its relation to morphology – Turing's diffusion reaction theory – Morphogenetic factors – growth regulators – genetic and environment – polarity. Molecular basis of morphogenesis – Cytosol and cytoskeleton, microtubules and microfilaments – Cellular level morphogenesis – Nuclear transplantation experiments with *Acetabularia*–Sach's and Error's laws – Asymmetric divisions and their significance. Morphogenesis at tissue level – Differentiation, dedifferentiation and redifferentiation of vascular tissue *in vivo*, *in vitro* and in wounds. Plant galls and their importance in morphogenesis.

(12L)

REFERENCES:

1. Cutter, E. G. (1978). Plant Anatomy. Edward Arnold Publishers Ltd., London.
2. Easu, K. (1953). Plant Anatomy. John Wiley & Sons Inc., New York.
3. Metcalfe and Chalk (1950). Anatomy of the Dicotyledons and Monocotyledons. Vol. I and II. Clarendon Press, Oxford, UK.
4. Pandey, B. P. (1989). Plant Anatomy. S. Chand and Co. Ltd., New Delhi.
5. Singh, V., Pande, P. C. and Jain, D. K. (1987). Anatomy of Seed Plants. Rastogi Publications, Meerut.
6. Agarwal, S. B. (1990). Embryology of Angiosperms - a fundamental approach. SahityaBhawan, Agra.
7. Bhojwani, S. S. and Bhatnagar, S. P. (1981). Embryology of Angiosperms. VikasPublishing House Pvt. Ltd., New Delhi.
8. Raghavan, V. (1976). Experimental Embryogenesis in Vascular Plants. AcademicPress, London.
9. Bonner, J. T. (1965). Morphogenesis. Oxford & IBH Publications, Bombay.
10. Burgess, J. (1985). An Introduction to Plant Cell Development. CambridgeUniversity Press, London.
11. Murphy, T. M. and Thompson, W. F. (1988). Molecular Plant Development. Prentice Hall of India Pvt. Ltd., New Jersey.

First Year I Semester 1 Open Elective -
Practical # Credits 5

PRACTICAL II (AI-2)

SUB CODE:

L T P C

0 0 5 5

Embryology & Morphogenesis

1. Slides showing developmental stages of anther, embryosac, endosperm and embryo.
2. Study of different types of pollen grains.
3. Dissection of endosperm haustoria - *Cassia*, *Cucumis*, *Peltophorum*
4. Dissection of Embryo - *Abelmoschus*, *Cyamopsis*, *Tridax*

List of practicals for the above subject should also be done along with the experiments connected with the core papers, if it is selected by a college as an open elective.

First Year I Semester 1 Open Elective - Theory Credits 3

AI -3 : INVERTEBRATA

SUB CODE:

L T P C

3 0 0 3

Unit: I

Introduction to principles of Taxonomy; Phylum **Protozoa**: General characters and classification upto class level, giving examples. Detailed Study: Paramecium. General Topics: 1. Protozoan parasites 2. Plasmodium 3. Entamoeba - life history, pathogenesis and control measures. (12L)

Unit: II

Phylum Porifera: Detailed Study: Ascon sponge. General Topic: Canal system in sponges. **Phylum: Coelenterata**: General characters and classification upto class level giving examples. Detailed Study: Obelia. General Topics : Polymorphism in Hydrozoa, Corals & Coral reef. (12L)

Unit: III

Phylum Platyhelminthes: General characters and classification upto class level with examples. Detailed study: Taeniasolium. General Topic: Parasitic adaptation in Platyhelminths, **Phylum Nematoda**: Detailed Study: Ascaris. General Topics: Nematode parasites : Life history, Pathogenicity and Control measures of Ancylostoma, Enterobius, Wuchereria and Dracanculus; Parasitic adaptations in nematodes. (13L)

Unit: IV

Phylum Annelida: General characters and classification upto class level with examples. Detailed Study: Nereis. General Topic: Adaptive Radiation in

Annelida. **Phylum Arthropoda:** General characters and classification upto class level with examples. Detailed Study: Prawn. General Topics: Crustacean Larvae, Beneficial and harmful insects. (12L)

Unit: V

Phylum Mollusca: General characters and classification upto class level with examples. Detailed Study: Pila. General Topics: Adaptive radiation in Gastropoda; Economic importance of Mollusca.

Phylum Echinodermata: General characters and classification upto class level with examples. Detailed Study: Star fish. General Topic: Larval forms of Echinoderms. (11L)

REFERENCES:

1. Ekambaranatha Iyar and T.N.Ananthakrishnan. 1992. A Manual of Zoology, Vol.I(Invertebrata). Parts I & II. Viswanathan & Co.
2. Barrington, E.J.W.1979. Invertebrates. Structure and Function 2nd edn. ELBS and Nelson.
3. Jordon, E.L. and P.S.Verma. 1995 Invertebrate Zoology. 12th edn. Sultan Chand & Co.
4. Barnes, R.D. Invertebrates. W.B.Saunders.
5. Kotpal, R.L., (All Series) Protozoa, Porifera, Coelenterata, Annelida, Arthropoda, Mollusca & Echinodermata - Rastogi Publications.

2017-18/MSU/46thSCAA/Affiliated coll./PG/M.Sc.(Microbiology)sem-1/Elective/Ppr-1

**First Year I Semester 1 Open Elective –
Practical[#] Credits 5**

PRACTICALII (AI -3)

SUB CODE:

L T P C

0 0 5 5

1. Identification and study of selected Protozoans and Helminthes of medical importance.
2. Identification and study of section of certain animals from Coelenterata, Aschelminthes and Annelida to understand the evolution of different types of coelom.
3. Identification and study of larval from all major phyla of Invertebrates.
4. Identification and study of Invertebrate fossils (slidesand specimens)

List of practicals for the above subject should also be done along with the experiments connected with the core papers, if it is selected by a college as a open elective.

2017-18/MSU/46thSCAA/Affiliated coll./PG/M.Sc.(Microbiology)sem-1/Elective/Ppr-1

First Year I Semester 1 Open Elective -
Practical Credits 3

AI - 4: ENVIRONMENTAL BIOLOGY & BIODIVERSITY

SUB CODE:

L T P C

3 0 0 3

Unit: I

Ecology and Environmental Science – Definition - Scope – Branches – Abiotic factors – Water – Soil – Temperature – Light. Biotic factors – Animal relationship – Symbiosis – Commensalisms – Mutualism –Antagonism – Antibiosis – Parasitism – Predation – Competition (12L)

Unit: II

Ecosystem –Definition Structure – Pond ecosystem – Primary production – Secondary production –Food chain – Food web – Trophic levels – Energy flow – Pyramid of biomass – Pyramid of energy – Biogeochemical cycle – Nitrogen and phosphorus. Community Ecology: Characteristics, Ecological succession. (12L)

Unit: III

Population Ecology – Definition – Density – Estimation –Natality – Mortality – Age distribution - Age pyramids – Population growth – Population equilibrium – Pollution – Types – Sources – Effects- Air – Water – Land – Noise – Thermal – Pesticide – Radioactive – Green house effect - Ozone and its importance –

Global warming – Acid rain – Bio accumulation – Bio magnification, Biological control. (14L)

Unit: IV

Biodiversity : Concept, types and components, Global “biodiversity hotspots”. IUCN species categories – rare, endangered and threatened; Animal extinction – causes. Wild life conservation and management – Remote sensing techniques; (12L)

Unit: V

Diversity of Invertebrate: A brief account of Diversity among Invertebrates and Chordates. Animal Biodiversity Policy and Management in India: National Biodiversity Act of India. Biodiversity Register. (10L)

REFERENCES:

1. Clarke, G.L. 1954 – Elements of Ecology, John Wiley & Sons. N.Y.
 2. Kendeigh, S.C., 1961 – Animal Ecology, Prentice Hall.
 3. Odum, E.P., 1971 – Fundamentals of Ecology., W.B. Saunders Company, Philadelphia.
 4. Rastogi, V.B. and M.S. Jayaraj, 1989 – Animal Ecology and distribution of animals, KedarnathRamnath.
 5. Sharma, P.D., 1990 – Ecology and Environment, Rastogi Publications, Meerut.
 6. Southwick, C.H., 1976 – Ecology and Quality of Environment D. Van Nostrand Co.
 7. Verma, P.S. and V.K. Agarwal, 1996 – Principles of Ecology, S.Chand& Co., New Delhi.
 8. S.S. Purohit, D.H. Shanmi and A.K.Agarwal, 2004 – Environmental Sciences : A New Approach, Agrobix, Jodhpur.
 9. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad.
 - 10Krishnamurthy, K.V. 2003, Introduction to Biodiversity. Oxford and IBH.
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2017-18/MSU/46thSCAA/Affiliated coll./PG/M.Sc.(Microbiology)sem-1/Elective/Ppr-1

First Year

I Semester

**1 Open Elective -
Practical**

Credits 6

PRACTICAL II (AI : 4)

SUB CODE:

L T P C

0 0 5 5

ENVIRONMENTAL BIOLOGY AND BIODIVERSITY

1. Estimation of dissolved oxygen
2. Estimation of salinity
3. Mounting and identification of plankton (fresh water / marine)
5. Visit to a local polluted area – Solid waste / sewage treatment plant.

List of practicals for the above subject should also be done along with the experiments connected with the core papers, if it is selected by a college as a open elective.

2017-18/MSU/46thSCAA/Affiliated coll./PG/M.Sc.(Microbiology)sem-1/Elective/Ppr-1

First Year I Semester 1 Open Elective - Theory Credits 3

AI -5 : APICULTURE

SUB CODE:

L T P C

3 0 0 3

Unit: I

Honeybee – Systematic position – Species of Honey bees – Life history of Honey bee – behaviour – swarming – Pheromone. (10L)

Unit: II

Bee colony – Castes – natural colonies and their yield – Types of bee hives – Structure – location, care and management. (10L)

Unit: III

Apiary – Care and Management – Artificial bee hives – types – construction of space frames – Selection of sites – Handling – Maintenance – Instruments employed in Apiary – Extraction instruments. (12L)

Unit: IV

Honey – Composition – uses – Bee wax and its uses – yield in national and international market – Diseases of honey bees and their control methods. (12L)

Unit: V

Apiculture as Self - employment venture – Preparing proposals for financial assistance and funding agencies – Economics of bee culture. (14L)

REFERENCES:

1. Cherian, R. & K.R. Ramanathan, 1992 – Bee keeping in India
2. Mishra, R.C., 1985 – Honey bees and their management in India, ICAR
3. Singh, S. 1982 – Bee Keeping – ICAR
4. Sharma, P. and Singh L. 1987 – Hand book of bee keeping, Controller Printing and Stationery, Chandigar.
5. Rare, S. 1998 – Introduction to bee keeping, Vikas Publishing house.
6. Shukula,G.S. and Upadhyay V.B. (1997) Economic Zoology, RastogiPublications,Meerut.



First Year

I Semester

1 Open Elective -
Practical

Credits 5

PRACTICAL II (AI : 5)

SUB CODE:

L T P C

0 0 5 5

APICULTURE

-
1. Bees diversity based on their functions.
 2. Hive preparation model.
 3. Physical & chemical parameters of honey.
 4. Field visit - apiary.

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List of practicals for the above subject should also be done along with the experiments connected with the core papers, if it is selected by a college as a open elective.

First Year I Semester 1 Open Elective - Credits 3
Theory

AI - 6: BIOCHEMICAL TECHNIQUES AND INSTRUMENTATION

SUB CODE:

L T P C

3 0 0 3

Unit: I

pH meter – titration curve and measurement – principles, laws of absorbtion and radiation, visible, ultraviolet, infrared and mass spectrophotometry – Absorption spectrum, flame photometry – principles of colorimetry, turbidometry and viscometry. (12 L)

Unit: II

Principles of centrifugation – centrifugation techniques - preparative and analytical methods, density gradient centrifugation – types of rotors – Safety aspects in use of centrifuge. (10 L)

Unit: III

General principles and application of chromatography: Partition (Paper, Thin layer & Gas chromatography), Adsorption (column Chromatography), Ion exchange, Gel filtration, Affinity & High performance liquid chromatography. (13 L)

Unit: IV

Electrophoresis – horizontal and vertical – moving boundary, zone (paper and gel) electrophoresis – immune electrophoresis – Rocket immuno electrophoresis – iso electric focusing – Application of electrophoresis: AGE, PAGE. An overview on the analysis of bands: direct photometric scanning, staining methods, radiolabelling, autoradiography, enzyme assay, immunological methods, blotting & detection. (13 L)

Unit: V

Advanced instrumentation – IR spectroscopy, Raman spectroscopy, X ray Spectroscopy, NMR & AAS – principles, component structure and applications. A overview on radio isotopic technique. Detection and measurement of Radioactivity – Safety aspects of radio isotopic technique (12 L)

TEXTBOOKS RECOMMENDED:

1. Jayaramam . J. (1985) Laboratory Manual in Biochemistry. Wiley Eastern Ltd., New Delhi.
2. Plummer, D.T. (1998). An Introduction to practical Biochemistry. Tata McGraw Hill, New Delhi.
3. Palanivelu P. (2001). Analytical Biochemistry and Separation techniques – A Laboratory Manual.
4. Keith Wilson and Walker. J. (2003). Practical Biochemistry – Cambridge University Press.
5. Veerakumari L. (2006). Bioinstrumentation. MJP Publishers, Chennai.

First Year I Semester 1 Open Elective –
Practical[#] Credits 5

PRACTICAL II (AI -6)

SUB CODE:

L T P C

0 0 5 5

BIOCHEMICAL TECHNIQUES AND INSTRUMENTATION

28. Verification of Beer- Lambert law (Colorimetry and Spectrophotometry)
29. Preparation of standard graph (protein, DNA, RNA and Carbohydrates)
30. Separation of aminoacids by paper chromatography
31. Visits : Institutional, research, Industrial, fields etc.,

List of practicals for the above subject should also be done along with the experiments connected with the core papers, if it is selected by a college as a open elective.

First Year II Semester 1 Open Elective - Theory Credits 3

AII - 1:PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY

SUB CODE:

L T P C

3 0 0 3

Unit I

General features and origin of Pteridophytes. Classification of Pteridophytes (Smith 1971). Range of morphology, structure, reproduction and evolution of gametophytes and sporophytes of the following orders: Rhyniales, Psilotales, Lycopodiales, Selaginellales, Isoetales, Calamitales and Equisetales. (12 L)

Unit II

Range of morphology, structure, reproduction and evolution of gametophytes and sporophytes of the following orders: Ophioglossales, Marattiales, Osmundales, Filicales and Salviniiales. Stellar evolution in pteridophytes, Heterospory and origin of seed habit. Structure, development and evolution of sorus in Filicales. Phyletic slide, spore germination patterns. Economic importance of Pteridophytes. (14L)

Unit III

A general account of the characteristic features of Gymnosperms. Origin of Gymnosperms. Classification of Gymnosperms (Sporne, 1965). General structure and interrelationships of Pteridospermales, Bennetitiales, Pentoxylales and Cordaitales. (12L)

Unit IV

A general account on the distribution, morphology, anatomy, reproduction and phylogeny of Cycadales, Coniferales, Ginkgoales, Ephedrales, Welwitschiales and Gnetales. Economic importance of Gymnosperms. (10L)

Unit V

Concepts of Paleobotany, A general account on Geological Time Scale. Techniques for Paleo botanical study. Fossil types: Compressions, incrustation, casts, molds, petrifications, coalballs and compactions. Age determination and methods of study of fossils. Systematic and Nomenclature of fossil plants. Study of morphology and anatomy of the vegetative and reproductive structure in the following fossil forms: Rhynia, Lepidodendron, Sphenophyllum, Lyginopteris, Pentoxylon and Cordaites. Paloclimates and fossil plants. Role of fossil in oil exploration and coal excavation, Paleopalynology. (12L)

REFERENCES:

1. Eames, A. J. (1936). *Morphology of Vascular Plants – Lower Groups*. Tata McGraw Hill, New Delhi.
2. Rashid, A. (1986). *An Introduction to Pteridophyta*. Vani Educational Books, New Delhi.
3. Sharma, O. P. (1990). *Text Book of Pteridophyta*. Macmillan India Ltd., India.
4. Smith, G. M. (1971). *Cryptogamic Botany*. Vol. II. Bryophytes and Pteridophytes. Tata McGraw Hill, New Delhi.
5. Sporne, K. R. (1972). *The Morphology of Pteridophytes*. B. I. Publications, Madras.
6. Sundararajan, S. (2007). *Introduction to Pteridophyta*. New Age International Publishers, New Delhi.
7. Chamberlain, C. J. (1957). *Gymnosperms Structure and Evolution*. University Chicago Press, New York.
8. Foster, A. S. and Gifford, E. M. (1965). *Morphology and Evolution of Vascular Plants*. W. H. Freeman & Co.
9. Sporne, K. R. (1974). *The Morphology of Gymnosperm*. B.I. Publications, New Delhi.
10. Nikias, K. J. (1981). *Paleobotany, Paleoecology and Evolution*. Praeger Publishers, USA.
11. Seward, A. C. (1919). *Fossil Plants*. Vol. I, II, III and IV. Cambridge University Press, London.
12. Shukla, A. C. and Mishra, S. P. (1982). *Essentials of Paleobotany*. 2nd ed. Vikas Publishing House Pvt. Ltd., New Delhi.

2017-18/MSU/46thSCAA/Affiliated
1/Elective/Ppr-2

coll./PG/M.Sc.(Microbiology)sem-

First Year

II Semester

1 Open Elective –
Practical[#]

Credits 5

PRACTICAL IV (AII -1)

SUB CODE:

L T P C

0 0 5 5

PLANT DIVERSITY II – PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY

1. Making suitable micro preparations of types prescribed in Pteridophytes and Gymnosperms.
2. Observing and identifying the fossil slides included in the syllabus
3. Study of the morphology and anatomy of the vegetative and reproductive parts of the Pteridophytes - *Nephrolepis* and *Azolla*.
4. Study of the morphology and anatomy of vegetative and reproductive parts of the Gymnosperms *Ginkgo* and *Ephedra*

List of practicals for the above subject should also be done along with the experiments connected with the core papers, if it is selected by a college as an open elective.

2017-18/MSU/46thSCAA/Affiliated coll./PG/M.Sc.(Microbiology)sem-1/Elective/Ppr-2

First Year II Semester 1 Open Elective - Credits 4
Theory

AII – 2: PLANT PHYSIOLOGY

SUB CODE:

L T P C

3 0 0 3

Unit I

Water relation: significance, - osmotic and non-osmotic uptake of water. Ascent of sap-cohesion theory: root pressure, transpiration, physiology of stomatal Action, Translocation of solutes and assimilates. Mass flow, - Membrane permeability mineral uptake: Passive and active. Role of major and Minor elements, mineral deficiency symptoms. (12 L)

Unit II

Photosynthesis: Absorption spectrum, Action spectrum, role of pigments enhancement effect, photosystems I & II Photosynthetic electron transport, Photophosphorylation, Carbon Assimilation: Calvin cycle Hatch & Salck pathway, CAM pathway- Respiration: respiratory substrates. Aerobic and anaerobic. Glycolysis. Krebs's Cycle and oxidative phosphorylation, energetics of respiration. (12L)

Unit III

Plant Growth: regulatory substances; auxins, kinins, gibberellins, abscissic acid and their function. Role of hormones in flowering, senescence and abscission-Photoperiodism, phytochrome-vernalization. (10L)

Unit IV

General Ecology – Approaches to the study of Ecology, Autecology – Synecology, Plant environment – climatic, edaphic and Biotic factors (interference on Plant habitat by animals – Grazing and browsing, by humans – deforestation, Agriculture) Allelopathy. Ecosystem concept – components abiotic, autotrophic producers & heterotrophic consumers, biomass ecological pyramids, Productivity – primary, secondary & gross; food chain – food web & energy flow – pond ecosystem. (13L)

Unit IV

Vegetation – Units of vegetation – formation, association, consociation, society Development of vegetation: Migration – ecesis, colonization, Methods of study of vegetation (Quadrate & transect). Plant succession – Hydrosere & xerosere. Ecological classification of Plants; Morphological and anatomical features of plants and their correlation to the habitat factors. (13L)

REFERENCES:

PLANT PHYSIOLOGY

1. Steward. F.C. (1964) : Plants at Work (A summary of Plant Physiology) Addison-Wesley Publishing Co., Inc., Reading, Massachusetts, Palo alto, London.
2. Devlin, R.M. (1969) : Plant Physiology Holt, Rinehart & Winston & Affiliated East West Press (P) Ltd., New Delhi.
3. Noggle, R. & Fritz (1989) : Introductory Plant Physiology Prentice Hall of India.
4. Lawlor. D.W. (1989) : Photosynthesis, metabolism, Control & Physiology ELBS/Longmans-London.
5. Mayer Anderson & Bonning - (1965) : Introduction to plant Physiology D. Van Nostrand . Publishing Co., N.Y.
6. Saraswathy Rangamannar(1973) : Thaavaravalarchithaimartram (Metabolism & Biosynthesis) Tamilnadu Text Book society.
7. Periyasamy, K (1978) : “Cell iyakkaviyal” (cell Physiology) Tamilnadu text Book Society,
8. Hans Meidner (1984) : Class Experiments in Plant Physiology George Allen & Unwin, London, Boston, Sydney Srivastava, H.N. (1986) : Plant Physiology Pradeep Publications, Jalandhar, India.
9. Dulsy Fatima, R.P. et. al 1993 : Biochemistry Saras Publications, nagercoil, Tamilnadu.
10. Dulsy Fatima, R.P. et. al (1994) : Elements of Biochemistry Saras Publications, Nagercoil, Tamilnadu.
11. Jain, V.K. (1990) : Fundamentals of Plant Physiology S. Chand & Co., New Delhi.
12. Pandey, S.N. (1991) : Plant Physiology Vikas Publishing House (P) Ltd., New Delhi India.
13. Mukherjee, S. A.K. Ghosh (1998) : Plant Physiology Tata McGraw Hill Publishers(P) Ltd., New Delhi Verma, S.K. (1999) : Plant Physiology & Biochemistry S. Chand & Co., New Delh.
14. Verma, S.K. (1999) : A Text –Book of Plant Physiology S. Chand & Co., New Delhi 28.
15. Salisbury, F.B & C.W. Ross (1999) : Plant Physiology CBS Publishers and Printers, New Delhi.
16. Gill, P.S. (2000) : Plant Physiology S. Chand & Co., New Delhi.
17. Verma, V. (2001) : A Text Book of Plant Physiology Emkay Publications, New Delhi

18. Plant Ecology & Phytogeography Daubenmire, R.F. : Plants & Environment (2nd Edn.,)
19. John Wiley & Sons., N.Y. Puri, .G.S. (1960) : Indian Forest Ecology(Vol.I& II) Oxford Book Co., New Delhi& Calcutta.
20. Billings, W.B. (1965) : Plants and the Ecosystem Wadsworth Publishing Co., Inc., Belmont. 31.
21. Misra, R. (1968) : The Ecology work Book Oxford & INH Publishing Co., Calcutta Odum E.P. (1971) : Fundamentals of Ecology (2nd Edn.,) Saunders & Co., Philadelphia & Natraj Publishers, Dehradun –574pp.
22. Ambast, R.S. (1974) : Text book of Plant Ecology (3rd Edn.,) Students & Friends Co., Varanasi - pp.,
23. Odum E.P. (1975) : Ecology Holt, Rinehart & Winston- pp., Oosting, H.G. (1978) : Plants and Ecosystem
24. Wadsworth Belmont. Kochhar, P.L. (1975) : Plant Ecology(9th Edn.,) S.Nagi & Co., Jalandhar pp., Kormandy, E.J. (1978) : Concepts of ecology(2nd Edition) Prentice Hall of India (P) Ltd., New Delhi.
25. Agrawal, K.C. (1987) : Environmental Biology Agro Botanical Publisher, India.
26. Ananthakrishnan, T.N.(1978) : Bioresources Ecology(3rd Edn.,) Oxford & IBH Publishing Co, (P)Ltd., New Delhi, Bombay, Calcutta-226pp.,
27. Misra, K.C. () : Manual of plant Ecology(2nd Edition) Oxford & IBH Publishing Co., New Delhi.
28. Vashishta, P.C. (1989-90) : Plant Ecology Vishal Publications, Delhi, Jalandhar-284pp.
29. Kumar, H.D. (1992) : Modern Concepts of Ecology (7th Edn.,) Vikas Publishing Co., New Delhi-377pp.,
30. Dash, M.C. (1993) : Fundamentals of Ecology Tata McGraw Hill, New Delhi-373pp., Shukla, R.S. & P.S.
31. Chandel (1991) : Plant Ecology & Soil Science S.Chand & Co., New Delhi-305+97pp.,
32. Arumugam, N. (1994) : Concepts of Ecology (Environmental Biology) Saras Publications, Nagercoil, Tamilnadu-402pp.
33. Mackenzie, A. A.S. Ball & S.R. Vindee (1999) : Instant notes in Ecology Viva Books (P) Ltd., Delhi, Bombay, Chennai -321pp.
34. Kumar H.D. (2000) : Biodiversity & Sustainable Conservation Oxford & IBH Publishing Co., Ltd., New Delhi -420pp.
35. Sharma, P. D. () : Elements of Ecology Rastogi Publications, Meerut.
36. Newman, E.I. (2000) : Applied Ecology Blackwell Scientific Publisher, U.K-328pp.
37. Chapman, J.L. & M.J. Reiss (1992) : ecology (Principles & Applications) Cambridge University Press, U.K.-294pp.,
38. Verma, P.S. & Agarwal, V.K.(1999) : Concept of Ecology (Environmental Biology) S. Chand & Co., New Delhi-264pp.

39. Sharma, P.D. (2000) : Ecology & Environment Rastogi Publications, Meerut, India-7=653pp.
40. Sundaram, R. (1972) : Thaavara Chuyach Choozhnilaiyiyal. Tamilnadu Text Book Society-283pp.
41. Chandrasekaran, P. (1996) : Chutruchchoozhal Maasupadu (Environmental Pollution) T.K. Printers, Pudukkottai, Tamilnadu-417pp.,

First Year II Semester 1 Open Elective -
Practical # Credits 5

PRACTICAL IV (All - 2)

SUB CODE:

L T P C

0 0 5 5

PLANT PHYSIOLOGY

1. Determination of Osmotic Pressure of Rhoeo leaf/Onion leaf plasmolytic method.
2. Effect of temperature and chemicals on membrane permeability.
3. Effect of intensity of light on O₂ evolution during photosynthesis using Wilmott's bubbler. (DEMO)
4. Measurement of rate of respiration in germinating seeds/flower buds using simple Respiroscope.(DEMO)

List of practicals for the above subject should also be done along with the experiments connected with the core papers, if it is selected by a college as a open elective.

2017-18/MSU/46thSCAA/Affiliated coll./PG/M.Sc.(Microbiology)sem-1/Elective/Ppr-2

First Year II Semester 1 Open Elective - Credits 3
Theory

All -3 : CHORDATA

SUB CODE:

L T P C

3 0 0 3

Unit: I

General characters of Chordata and its outline classification **Prochordata:**
General characters and its outline classification. Detailed study : Amphioxus
and Ascidian. (12 L)

Unit: II

Vertebrata : General characters **Cyclostomata** : Petromyzon. Pisces : General
characters and classification upto orders with common examples. Detailed
study: Scoliodon
General Topics : Accessory respiratory organs in fishes,
Migration in fishes. (12 L)

Unit: III

Amphibia: General characters and classification upto orders. Detailed study :
Frog. Parental care in Amphibia
Neoteny in Salamanders
Gymnophiona and their affinities.

Reptilia: General characters and classification upto orders. Type study : Calotes.
General Topics: Identification of poisonous and non-poisonous snakes of South
India, Poison apparatus and biting mechanism, Nature of venom and antidotes.
(14 L)

Unit: IV

Aves : General characters and classification upto sub orders with examples.

Detailed Study : Pigeon General Topics : Flightless Birds and their distribution,
Migration in birds, Flight adaptations in birds. (12 L)

Unit: V

Mammalia : General characters and classification upto orders with examples.

Detailed Study : Rabbit. General Topic : Aquatic mammals. Brief study of
Monotremes and Marsupials. (10 L)

REFERENCE BOOKS:

1. Ekambaranatha Iyar, E.K.andT.N.Ananthakrishnan. 1992. A Manual of Zoology, Volume II Chordata. Viswanathan & Co.
2. Dhami. D.S.andJ.K.Dhami. 1978 Chordate Zoology. R.Chand& Co.
3. Jordon, E.L. and P.S.Verma 1995. Chordate Zoology and Elements of Animal Physiology..S.Chand& co.
4. Muthukumarasami, P. and K. Palanivel.1990. ThandudaiyaVilangugal. BARD.
5. Thangamani T and N. Arumugam 1992 A Text Book of Chordates. Saras Publications.

First Year II Semester 1 Open Elective -
Practical Credits 5

PRACTICAL IV (A II: 3)

SUB CODE:

L T P C

0 0 5 5

CHORDATA

Identification, classification, distinguishing characters and adaptive features of –

1. **Reptilia:** *Chameleon, Tortoise, Cobra & Krait,*
2. Russel's viper, Sea snake
3. **Birds :** Owl, Kite, Duck & Parrot
4. **Mammals :** Squirrel, Mongoose, Bat & Rabbit

List of practicals for the above subject should also be done along with the experiments connected with the core papers, if it is selected by a college as an open elective.

First Year II Semester 1 Open Elective - Theory Credits 3

AI -4 : BIOPHYSICS AND BIostatISTICS

SUB CODE:

L T P C

3 0 0 3

Unit: I

Colloids – description – types, properties: electrokinetic properties, Donnan equilibrium, Tyndall effect, surface tension, Brownian movement, filtration, osmosis, dialysis, adsorption. Components of light: Beer and Lambert’s law of light absorption. (13L)

Unit: II

Laws of thermodynamics, Biophysical principles in neuro muscular function and vision – Bioelectricity – electrical phenomena – membrane transport. (10L)

Unit: III

Biostatistics: Primary and secondary data. Type of sampling: Random and stratified random sampling. Tabulation of data: Histogram, polygon, pie diagram. Types of variables: Continuous and discontinuous variables, Qualitative and quantitative variables. (12L)

Unit: IV

Measures of Central tendency: Mean, Mode, Median - Uses and calculation of: Mean, SD, SE, variance and CV. (12L)

Unit: V

Common statistical tools: Chi-square, t test, Tests of significance – ANOVA – Correlation and Regression. (13L)

REFERENCES:

1. Daniel, M. 1992 – Basic Biophysics and Biologists, Wiley International, New Delhi.
 2. Das, D. 1996 – Biophysics and Biological Chemistry, Academic Publishers, Calcutta.
 3. Snedecor, G.W. and W.G. Cochran (1967) – Statistical Methods, Oxford & IBH Publishing, New Delhi.
 4. Zar, J.H. (1974) – Biostatistical analysis – Prentice Hall Inc., New Jersey, USA.
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2017-18/MSU/46thSCAA/Affiliated coll./PG/M.Sc.(Microbiology)sem-1/Elective/Ppr-2

First Year II Semester 1 Open Elective -
Practical # Credits 5

PRACTICAL IV (All - 4)	SUB CODE:
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L T P C

0 0 5 5

BIOPHYSICS & BIOSTATISTICS

1. pH meter, Spectrophotometer, Centrifuge, Electrophoretic apparatus.
2. Construction of graph and bar diagram.
3. Calculation of mean, median, mode, standard deviation and standard error
Chi-Square
test using plant leaves or molluscan shells.
4. Calculation of correlation between shell length and weight.

List of practicals for the above subject should also be done along with the experiments connected with the core papers, if it is selected by a college as a open elective.

2017-18/MSU/46thSCAA/Affiliated coll./PG/M.Sc.(Microbiology)sem-1/Elective/Ppr-2

First Year II Semester 1 Open Elective - Theory Credits 3

AII -5 : AQUACULTURE

SUB CODE:

L T P C

3 0 0 3

Unit: I

Importance of aquaculture – over - exploitation of wild fish stocks – advantages of aquaculture – production trends in the world and in India. Scope for aquaculture in India. Basic Fish farm design : selection of site, grow - out and nursery ponds. (12 L)

Unit: II

Cultivable species of fish, crustaceans, molluscs and algae. Selection of candidate species for aquaculture. Types of farming: extensive, intensive and semiintensive culture. Integrated farming. Advantages of polyculture, monosex and monoculture. (12L)

Unit: III

Culture of carp species –oyster culture: pearl oyster. Prawn culture: the problems in penaeid prawn culture due to socio-economic and environmental problems. Freshwater prawn culture. Potential for ornamental fish culture. Common species for ornamental fish farming. (13L)

Unit: IV

Fish disease management : Common bacterial, viral, fungal, protozoan and crustacean diseases, their symptoms and treatment. Water quality maintenance. Importance and composition of feeds; types of feed: wet and dry feeds. (12L)

Unit: V

Marketing the products: Marketing the fish to local markets and for export. Harvesting and transport. Quality control and norms of MPEDA for export of fishes. canning and freezing. (11L)

REFERENCES:

1. Arumugam.N. 2008. Aquaculture Saras Publications, Nagercoil.
2. Rath, R.K. (2000) Freshwater Aquaculture. Scientific Publishers, (India), PO. Box.91, Jodhpur.
2. Jhingran, AVG (1991) Fish and Fisheries of India. Hindustan Publishing Co.
3. Baradach, JE, JH Ryther and WO McLarney (1972) Aquaculture. The farming and Husbandry of Freshwater and Marine Organisms. Wiley Interscience, New York.



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2017-18/MSU/46thSCAA/Affiliated coll./PG/M.Sc.(Microbiology)sem-1/Elective/Ppr-2
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First Year

II Semester

**1 Open Elective -
Practical #**

Credits 5

PRACTICAL IV (All - 5)

SUB CODE:

L T P C

0 0 5 5

AQUACULTURE

1. Identification of larvae of cultivable fishes
2. Identification of larval stages of shrimps and prawns
3. Hatchery layout and identification of equipments
4. Field Visit to Fishing Harbour/Landing centre.

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List of practicals for the above subject should also be done along with the experiments connected with the core papers, if it is selected by a college as a open elective.
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2017-18/MSU/46thSCAA/Affiliated coll./PG/M.Sc.(Microbiology)sem-1/Elective/Ppr-2

First Year II Semester 1 Open Elective - Theory Credits 3

AII – 6 : BIODEGRADATION AND BIOREMEDIATION TECHNOLOGY

SUB CODE:

L T P C

3 0 0 3

Unit: I

Biodegradation and heterotrophic microbial population in aquatic, terrestrial and arid ecosystems – Degradation of natural polymers (Cellulose, lignin and hemicellulose). (10 L)

Unit: II

Microbial degradation of paper, paints, metals, concrete, textiles and leather goods – Biodegradation enhancement – Stimulation of Oil spills for degradation – Surface and subsurface degradation. (10L)

Unit: III

Bioleaching – Recovery of metals from ores – oxidation of minerals – testing for biodegradability – Biomagnifications – Removal of heavy metals and radionuclide from effluents – Preparation of metal sulfides. (12L)

Unit: IV

Bioremediation – Case histories – Constraints and priorities – Types of bioremediation – insitu bioremediation, exsitu bioremediation – Bioaugmentation – Bioreactors for bioremediation process – Biopackages for biodegradation.

(14L)

Unit: V

Biodegradation of xenobiotic compounds: organic contaminants Hydrocarbon, halogenated organic solvents, herbicides, pesticides – Treatment of solid and liquid wastes – Vermicomposting – Aiming for eco-friendly biodegradable products – Bioplastics.

(14L)

TEXTBOOKS RECOMMENDED:

1. Baker, W.C. and Herson, D. S. (1994). Bioremediation. McGraw Hill Inc., New York.
2. Rajendran, P. and Gunasekharan, P. (2000). Microbial bioremediation. MJP Publishers, Chennai.
3. Alexander, M. (1999). Biodegradation and Bioremediation. Academic Press.
4. Foster, C.F. and John Ware, D.A. (1987). Environmental biotechnology. Ellis Horwood Ltd.
5. Karrely, D., Chakrabarty, K. and Omen, G.S. (1989). Biotechnology and Biodegradation – Advances in Applied Biotechnology Series. Vol. IV, Gulf Publications Co. London.
6. Cookson, J.T. (1995). Bioremediation Engineering – Design and Application, McGraw Hill Inc.
7. Jogdand, S.N. (2007). Environmental Biotechnology. Himalaya Publishing Company Ltd.
8. Rittman, B. McCarty, p. (2000). Environmental Biotechnology; principles and Applications. McGraw Hill College.
9. Eweis, J.B. (Editor). Schroeder, E.D., Ergc; 1s-S.J., Chang, D.P.Y. (1998). Bioremediation principles. McGraw Hill College.
10. Alsopp, D., Seal, K. J. and Gaylarde, C. (2004). An introduction to Bioremediation. (2nd edition). Cambridge Univ. Press.
11. Glick, B.R. and Pasternak, J.J. (2003). Molecular Biotechnology. Pamima Publishers.
12. Prescott, L.M., Harley, J.P. and Klein, D.A. (2008). Microbiology (7th edition) McGraw Hill, New York

13. Larry Mc Kane and Judy Kandel (1996). Microbiology – Essentials and Applications. (2nd edition). McGraw Hill Inc., New York.
14. Madigan, M.T. Martinko, J.M. and Parker, J., Brock TO. (1997). Biology of Microorganisms. (8th edition). Prentice Hall International Inc, London.
15. Nester, E.W., Roberts, C.V. and Nester, M.T. (1995). Microbiology – A Human perspective. IWOA, USA.
16. Salle, A.J. (1996). Fundamental Principles of Bacteriology. (7th edition). Tata McGraw-Hill Publishing Company Ltd., New Delhi.
17. Pelczar Jr., M.J., Chan E.C.S. and Kreig, N.R. (1993). Microbiology. McGraw Hill Inc., New York.
18. Stainer, R.Y., Ingraham, J.L., Wheelis, M.L. and Painter, P.R. (1986). General Microbiology. MacMillan Education Ltd., London.
19. Subramanian, M.A. (2004). Toxicology (Principles and Methods). MJ Publishers, Chennai.
- 20.
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First Year

II Semester

1 Open Elective –
Practical[#]

Credits 5

PRACTICAL IV (A II - 6)

SUB CODE:

L T P C

0 0 5 5

BIODEGRADATION AND REMEDIATION

1. Isolation and purification of degradative plasmid of microbes growing in polluted environments.(DEMO)
2. Recovery of toxic metal ions of an industrial effluent by immobilized cells.
3. Utilization of biomass by SSF for the production of valuable products. (SSF- DEMO).
4. Mushroom production
5. Vermicomposting
6. Bioremediation – Treatment of dye by immobilization

List of practicals for the above subject should also be done along with the experiments connected with the core papers, if it is selected by a college as a open elective.